NUMBER: AWG-01 **VERSION DATE: 07/11/2005**

Regulations: 14CFR§135.411(a)(1) and 135.411(a)(2)
Source: Docket 2002-13923-53, 85, STE

ISSUE: Maintenance/Inspection Programs

Determine the maintenance/inspection program requirements appropriate for "large" airplanes currently operating in Part 135 such as intercontinental business jets and airplanes with modified payload capacity; as well as new airplane operations proposed by the 135ARC such as all-cargo airplanes with payload in excess of 7,500lbs and turbine-powered airplanes in commuter scheduled service.

SUMMARY OF FINDINGS & RECOMMENDATIONS

The AWG reviewed maintenance requirements, fleet composition and accident data for aircraft currently operating under Part 135 and made the following:

AWG Findings:

- Existing maintenance requirements use aircraft passenger seating configuration to differentiate between complex (10-or-more) and less complex (9-or-less) aircraft. At the time this rule was promulgated, there was a strong correlation between passenger seating configuration, aircraft size, and aircraft complexity.
- Airplane passenger seating configuration is no longer an appropriate method of differentiating between complex and less complex airplanes. Current business airplanes are <u>not</u> configured with the maximum passenger seating capacity resulting in airplanes of a relatively large size (i.e. complex) configured with 9-or-less passengers that had not been considered when the maintenance requirements of Part 135 were promulgated.
- Airplane size, as determined by certificated maximum takeoff weight (MTOW), correlates well with the relative airplane complexity of the existing fleet from a maintenance perspective. For example, airplanes with a MTOW of greater than 50,000lbs are all long-range airplanes that typically require specialized maintenance procedures (i.e. ETOPS).
- The correlation between aircraft size and aircraft complexity is <u>not</u> likely to hold true as new technologies and performance capabilities are introduced into a broader range of general aviation airplanes. Current trends in general aviation avionics and new airplane models demonstrate that the technologies and performance characteristics once found only on large, more-complex airplanes are now available on smaller general aviation airplanes.
- Part 135 accident data does not indicate that any safety issues exist for turbine-powered airplanes, regardless of whether these airplanes were maintained under a 135.411(a)(1) 9-or-less or 135.411(a)(2) 10-or-more maintenance program. The large "complex" airplanes operating in part 135 that were not envisioned when the maintenance requirements were promulgated are nearly ALL turbine-powered. However, 135 accident data raises a lot of questions regarding the adequacy of maintenance requirements for piston and turboprop airplanes which are nearly ALL small "less-complex" airplanes.

Aircraft Type	Part 135 Population	Part 135 Accidents
Piston Airplane	44%	59%
Turbo-Prop Airplane	16%	19%
Turbine Airplane	20%	2%
Helicopter	20%	19%

AWG Recommendations:

- From a strategic perspective that considers the entire Part 135 regulation and scope of current and future operations, the AWG recommends that a single flexible maintenance program standard for Part 135 be established which could address the multiple of levels and factors that comprise aircraft complexity as well as operational complexity.
  - The AWG recommends that FAA form a 135 Maintenance Aviation Rulemaking Committee (135MARC) with the appropriate membership required to develop a new 135 maintenance program standard. The membership of the 135ARC and AWG did not include operators of small piston and turboprop airplanes which would be a key stakeholder group for which new maintenance requirements would apply.

- From a tactical perspective that addresses the specific tasking to consider maintenance/inspection program requirements appropriate for "large" airplanes as well as new airplane operations proposed by the 135ARC, the AWG recommends the following:
  - Maintenance/inspection program requirements should be based on the "configured" passenger seating, not the "type-certificated" passenger seating
  - The following aircraft shall be maintained in accordance with a 135.411(a)(2) continuous airworthiness maintenance program (CAMP):
    - Large airplanes with MTOW of 50,000lbs or more
    - Turbine-powered airplanes with a payload capacity of greater than 7,500lbs
    - Turbojet-powered airplanes in commuter operation

DISCUSSION

Introduction:

The Airworthiness Working Group (AWG) primarily focused on the adequacy of §135.411(a)(1) and 135.411(a)(2) in response to the apparent industry trend of operating aircraft of a type, size and design in Part 135 service which had not been considered when Part 135 was promulgated. These new aircraft operating in 135 service include large part 25 intercontinental business jets, all-cargo aircraft with a payload in excess of 7,500lbs, and turbine-powered airplanes in scheduled commuter operations.

Current Regulatory Requirements:

Existing part 135 maintenance/inspection requirements use aircraft passenger seating configuration to differentiate between complex (10-or-more) and less complex (9-or-less) aircraft. At the time this rule was promulgated, there was a strong correlation between passenger seating configuration, aircraft size, and aircraft complexity.

> **Subpart J—Maintenance, Preventive Maintenance, and Alterations**
> **§ 135.411 Applicability.**
> (a) This subpart prescribes rules in addition to those in other parts of this chapter for the maintenance, preventive maintenance, and alterations for each certificate holder as follows:
>
> > (1) Aircraft that are type certificated for a passenger seating configuration, excluding any pilot seat, of nine seats or less, shall be maintained under parts 91 and 43 of this chapter and §§135.415, 135.416, 135.417, 135.421 and 135.422. An approved aircraft inspection program may be used under §135.419.

(2) Aircraft that are type certificated for a passenger seating configuration, excluding any pilot seat, of ten seats or more, shall be maintained under a maintenance program in §§135.415, 135.416, 135.417, and 135.423 through 135.443.

…

[Doc. No. 16097, 43 FR 46783, Oct. 10, 1978, as amended by Amdt. 135–70, 62 FR 42374, Aug. 6, 1997; Amdt. 135–78, 65 FR 60556, Oct. 11, 2000; Amdt. 135–92, 68 FR 69308, Dec. 12, 2003; Amdt. 135–81, 70 FR 5533, Feb. 2, 2005]

135.411(a)(1) Nine or Less	135.411(a)(2) Ten or More
Maintained under 91and 43	Maintained under 135 (135.425)
Inspection Program	Maintenance and Inspection Program
Mechanical Reliability Reports (135.415)	Mechanical Reliability Reports (135.415)
Mechanical Interruption Summary Report (135.417)	Mechanical Interruption Summary Report (135.417)
Aging Airplane (135.423)	Aging Airplane (135.422)
Additional Maintenance Requirements (135.421)	Organization (135.424)
	Manual Requirements (135.427)
	Required Inspection Personnel (135.429)
	Continuing Analysis and Surveillance (135.431)
	Maintenance Training Program (135.433)

Background:

When the maintenance rules for Part 135 were written the method to separate complex aircraft from less complex aircraft was the number of passenger seats. At the time that 135.411(a)(1) and 135.411(a)(2) were created the majority of aircraft flying in 135 service operated in a manner which maximized the number of seats on an aircraft to make each flight as efficient as possible. In this environment the number of passenger seats naturally correlated to the size and complexity of aircraft making this an accurate indicator upon which to assign a required maintenance program. It was not expected that operators would desire to fly large airplanes with less than the maximum seating capacity because this would significantly reduce the revenue potential of the airplane. The current Part 135 environment shows an increasing trend in the number of large “complex” airplanes configured with less than the maximum passenger capacity. These are primarily business airplanes with business cabin interior configurations.

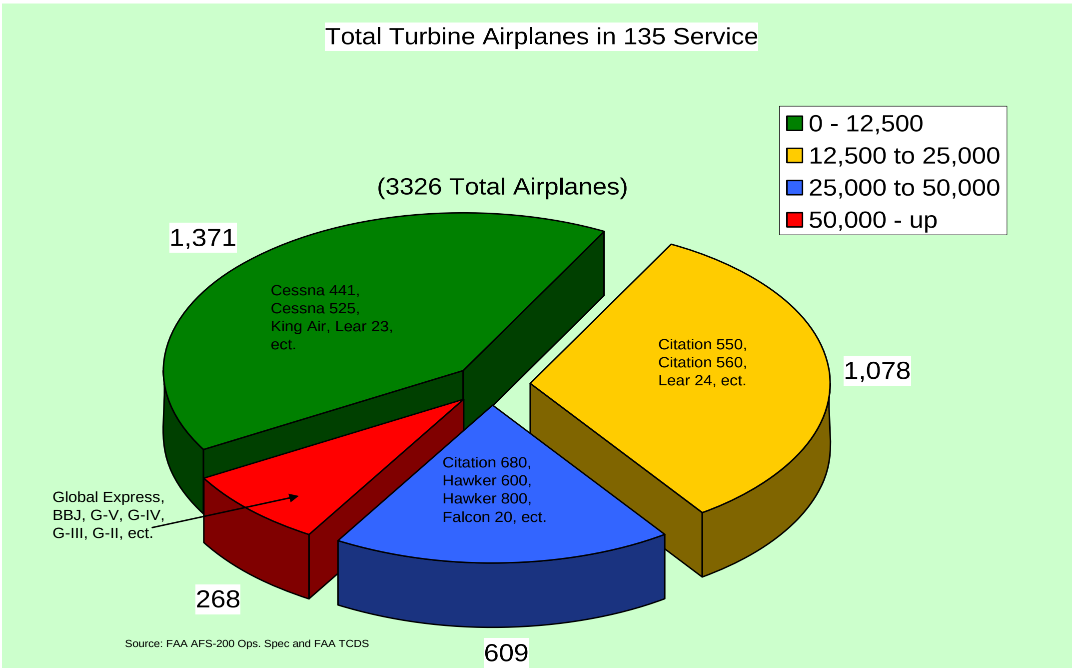
Airplane passenger seating configuration is no longer an appropriate method of differentiating between complex and less complex airplanes. Current business airplanes are not configured with the maximum passenger seating capacity resulting in airplanes of a relatively large size (i.e. complex) configured with 9-or-less passengers that had not been considered when the maintenance requirements of Part 135 were promulgated.

Current Situation:

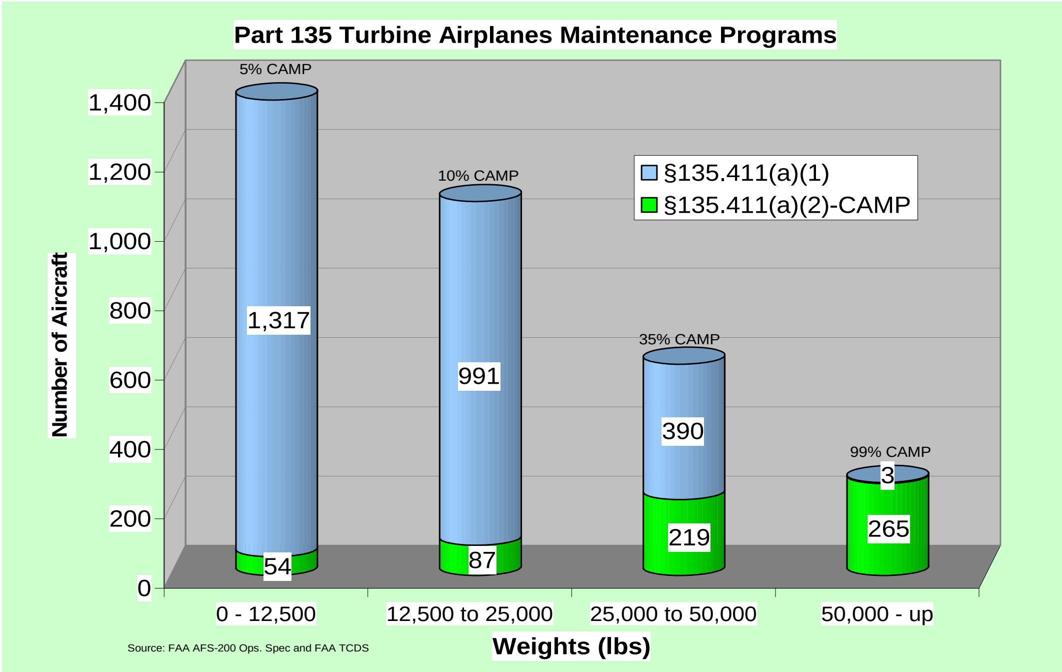
As discussed above, it is possible to operate large “complex” airplanes in Part 135 under the maintenance requirements intended for small “less complex” airplanes. This situation is due to the use of a discriminator which can be easily changed by a manufacturer or operator with no impact on airplane performance or cost. It is important to determine if this potential situation is prevalent within the existing 135 fleet and whether there are any indications of potential safety issues.

Review of 135 Fleet Data:

Current Part 135 operators include aircraft from single engine reciprocating aircraft to very complex intercontinental jet aircraft with hundreds of model of aircraft in between. In order to determine the number of complex aircraft operating in Part 135 service the subset of turbine aircraft was analyzed. The following chart represents all Part 135 turbine airplanes divided into weight categories as a measure of the population of complex aircraft.



It's clear from the chart above that the majority of aircraft in part 135 service are less complex with the truly complex aircraft such as intercontinental jets comprising the smallest segment of operators. These aircraft are maintained under the maintenance requirements of §135.411(a)(1) and 135.411(a)(2). As discussed previously the two standards were created to require less complex aircraft to be maintained under §135.411(a)(1) and to require more complex aircraft to be maintained under §135.411(a)(2). The following chart depicts the number of turbine airplanes maintained under an (a)(1) or (a)(2) requirement versus MTOW as an indication of whether the intent of the Part 135 maintenance rules is being met.

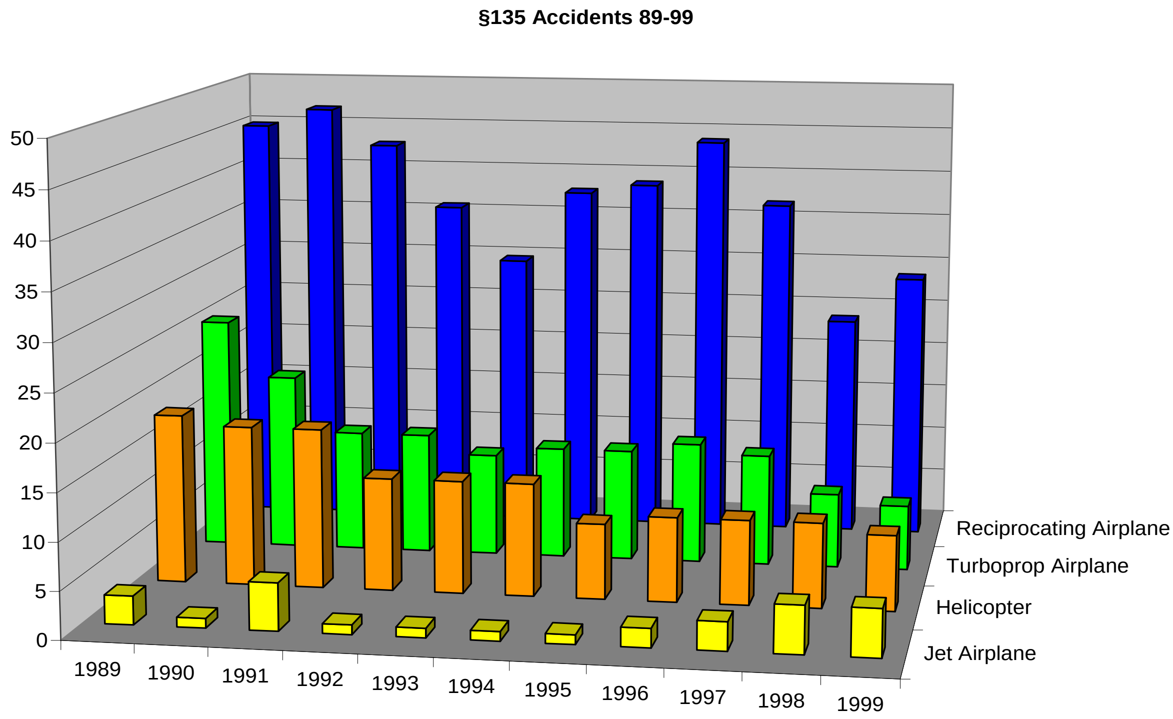


There is a correlation between the complexity of aircraft and the number of aircraft that follow the appropriate maintenance standards. Nearly all very complex intercontinental aircraft are maintained under the §135.411(a)(2) regulation also known as CAMP and the percentage of those in a CAMP decreases with MTOW. The data indicates there is currently not an issue with large complex aircraft following the maintenance programs intended for less complex aircraft though the possibility that this may occur in the future does exist.

Review of 135 Accident Data:
A review of average accident rates and accidents with maintenance related causes for aircraft operating in Part 135 was conducted to determine if there exists any indication that the regulations need to be improved for complex aircraft. When reviewing the data a clear division in overall accident rates could be seen based upon the following categories:

Reciprocating Engine Airplanes	Turbine Engine Airplanes
Turbo-Prop Engine Airplanes	Helicopters

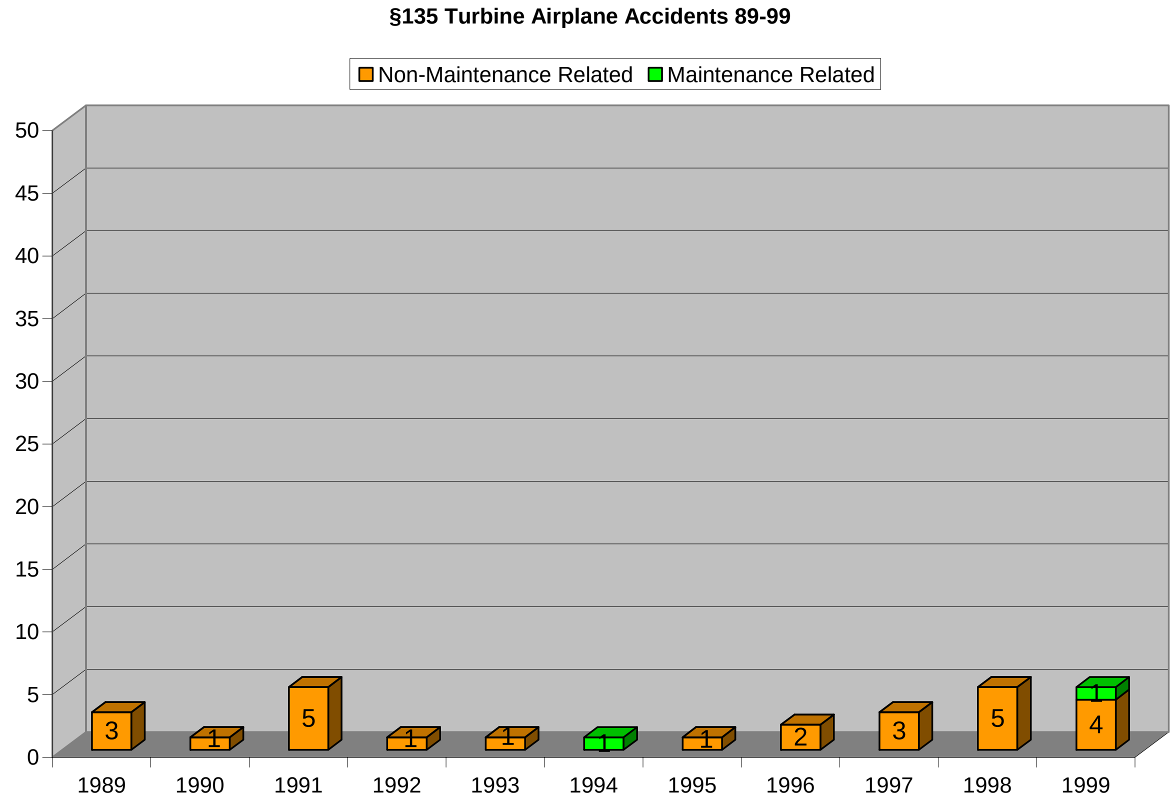
Information was obtained from the NTSB for accidents between 1989 and 1999 as the number of complete accident investigations was high and the data series was complete. Additionally accidents which occurred in Alaska have not been included in the analysis as there exists a unique operating environment which lends its self to individual scrutiny. The following chart depicts aircraft accidents based upon the categories above.



Aircraft Type	Part 135 Population	Accidents
Reciprocating Engine Airplane	44%	59%
Turbo-Prop Airplane	16%	19%
Turbine Airplane	20%	2%
Helicopter	20%	19%

The accident rate for all turbine aircraft is significantly lower their share of the total Part 135 operating population accounting for 20% of the Part 135 operators and only 2% of the accidents. Because complex aircraft are almost completely included in the Jet Airplane category the average accident data indicates that there is not currently a condition that results in a large number of complex airplane accidents. The data does suggest however that some other segments of Part 135 operations should be investigated further.

In addition to a review of the average accident rate for Part 135 aircraft causal data for those accidents was also investigated for the purpose of determining if maintenance is lacking. The chart below depicts the number of maintenance related accidents compared to the number of non-maintenance related accidents each year. The chart labeled §135 Turbine Airplane Accidents 89-99 indicates that of the of Part 135 turbine accidents from 1989 to 1999 an extremely small number of these accidents were said to have been caused by maintenance practices in the probable cause section of the NTSB accident reports.



It is noteworthy that maintenance related causes are more prevalent in Part 135 operating categories other than Turbine Airplanes. This data is presented in Appendix 1 and it is indicative that some of the categories of aircraft that had a higher rate of accidents also have a higher percentage of maintenance related causes.

Conclusion:
It's clear that the preambles of Parts 135, 23, and 25 identified aircraft complexity as the basis for differentiating which maintenance standard would be used when operating under Part 135. It is also clear that the item used to distinguish complexity, number of passenger seats, will not capture all operators of complex aircraft in the current operating environment. From the data it is also clear that the vast majority of current Part 135 operators are following the appropriate maintenance standards for the complexity of their aircraft regardless of the number of seats installed. Further average accident data supports the fact that these larger more complex aircraft have safety records that are much better than the average Part 135 operator. Detailed review of the few accidents in the complex aircraft category reveals an extremely small number of the accidents that do occur are related to maintenance issues. There is no accident or operational data to support a change in the regulations for complex aircraft in Part 135 service at this time.

It is expected that the number of large complex aircraft will grow in the coming years as will the number of smaller turbine operators possibly opening up currently unforeseen operating practices. As the complex aircraft become more commonplace the number of operators who would opt to default to the more simple maintenance requirements of §135.411(a)(1) may increase. In order to proactively deal with these possibilities it would be advisable to bolster the items that distinguish one maintenance program from another to assure the current operating trends continue and the extremely low accident rate and impeccable maintenance record remain.

Additionally recommendations should be made with respect to smaller turbine operators who will enter the market in the coming years as they will have unique operating practices.

It is evident that even less complex turbine aircraft which are maintained in accordance with the §135.411(a)(1) maintenance regulation exemplify the same fantastic safety record. This is likely due to a higher level of care given to these high-end of spectrum less complex aircraft. From this observation it would be advisable to consider a single maintenance standard which could be tailored to each operator as the division between (a)(1) and (a)(2) is not the most optimal way in which to divide the requirements and does not represent what operators are doing in today's §135 operating environment.

Accident data from the smaller Part 135 operators does indicate that changes to the requirements at this level might benefit the safety record of these aircraft. Consideration of a review of the entire Part 135 maintenance regulations would have merit however this is not the task assigned to this working group nor is the composition of the team appropriate to address all the issues involved. Assemblance of a team that is more representative of the range of Part 135 operators would be able to assess and recommend an appropriate solution. The data reviewed through this tasking indicates a single flexible maintenance standard would better fit the Part 135 environment as it exists today and into the future.

Current FAA Policy Change – HBAW 04-06D:

A general approach that was agreed upon by the AWG was to establish more appropriate criteria to differentiate small/simple airplanes from large/complex airplanes as the number of passenger seats does not match intent with today's types of Part 135 operation.

The number of seats with respect to §135.411(a)(1) and 135.411(a)(2) is defined as the certified passenger capacity. This capacity, originally defined on an FAA issued Type Certificate (TC) can be modified through Amended Type Certificate (ATC), Supplemental Type Certificate (STC) or field approval which can allow complex aircraft to qualify for the §135.411(a)(1) maintenance standards in place of the §135.411(a)(2) regulations that were intended for it.

The HBAW 04-06D bulletin explains FAA's intent to limit the ability for complex aircraft to operate under the maintenance standards of §135.411(a)(1) by requiring the number of passenger seats to be Type Certified (TC) or Supplemental Type Certified (STC). Such an interpretation does not prohibit such operation but simply requires the operator to purchase or design an STC designating a lower seating capacity. Upon reviewing the maintenance and safety data there appears on indication that issues exist in larger aircraft which would warrant the extra certification work needed to limit passenger seating capacity. There does not seem to be a method to force the number of seats to truly represent the complexity of an aircraft as all attempts can be met with other certification options to allow such operation. Such practice is a waste of FAA resources in a time when the commodity is critical and therefore a change should be made to the existing regulation. The words "type certified" in §135.411 should be changed to "configured" with 10-or-more seats for these reasons. Additionally this makes the terminology consistent with all other Part 135 safety standards (i.e. equipment) that are based upon the number of passengers. The term "configured" also makes the task of determining the required maintenance program simpler for FAA inspectors as one only needs to count the number of seats that can be occupied during taxi, takeoff, and landing.

Options Considered:
The AWG considered establishing a single flexible maintenance standard for all aircraft in Part 135 service which could address the multitude of levels of aircraft complexity and operational characteristics. As there is such a difference from one operator to the next such a task would need input from more stakeholders that were represented on the AWG. Additionally the task of the AWG is to assure the new types of aircraft and operations entering Part 135 service had adequate maintenance requirements and a single flexible maintenance standard would encompass the large numbers of existing operators. The date reviewed by the AWG does indicate that some existing Part 135 operators could benefit from a total review of Part 135 maintenance standards and the concept of a flexible single standard does have merit.

In keeping with the task of the AWG the group considered methods to aid the existing regulations. Though the data reviewed does not indicate there is currently an issue with complex aircraft operating outside of a §135.411(a)(2) maintenance program nor is there any safety concern with respect to maintenance on this type of aircraft benefit could be realized by implementing some additional constraints. To assure future complex aircraft are still maintained under the standards of §135.411(a)(2) it would be wise to use MTOW as a further discriminator in the determination of which maintenance standard needs to be followed. Such a recommendation would simply be a patch to the current process of two maintenance requirements where a single flexible standard would have more merit.

In order to group these aircraft by complexity an accurate indicator needed to be developed. In order to assure the indicator would accurately reflect the complexity of the aircraft and the indicator is not flexible enough to allow a very complex aircraft to indicate that it is a less complex aircraft. For the purpose of data analysis maximum take-off weight (MTOW) will be used as it accurately portrays aircraft complexity in today's environment. For future applications MTOW might be useful as well as any flexibility in this number comes at the expense of fuel. To make a notable change in an aircraft's MTOW the amount of fuel sacrificed will dramatically reduce the range of an aircraft.

In keeping with the original intent of the regulations (135, 23, and 25), i.e., using aircraft complexity to determine maintenance standards in 135, the AWG discussed the use of the aircraft certification basis, i.e., part 23 and part 25. Part 23 aircraft would fall under 135.411(a)(1) and Part 25 aircraft under 135.411(a)(2). However, consensus could not be reached on this proposal. Without any safety justification, it would be completely inappropriate and impracticable to require thousands of airplanes safely operating under 135.411(a)(1) inspection programs today to implement a 135.411(a)(2) continuous airworthiness maintenance program at significant cost and administrative burden.

How do you propose to change 135.411(a)(1) and 135.411(a)(2)?

The AWG recommends a review of the entire Part 135 maintenance program and the development of a single flexible maintenance standard.

In lieu of a re-write of the current 135 maintenance/inspection requirements, the following tactical recommendations to amend existing regulations are necessary to address aircraft operations not envisioned when the current regulations were promulgated:

<u>Passenger Seating – "type certificated" vs "configured" (HBAW 04-06D)</u>
The words "type certified" in §135.411 should be changed to "configured"

<u>Large "Complex" Airplanes</u>
Airplanes configured with 10-or-more passenger seats or a certificated MTOW of 50,000 pounds shall be maintained under a 135.411(a)(2) CAMP.

<u>Turbojet-Powered Airplanes in Commuter Operation</u>
The AWG believes that because turbojet engine powered aircraft were being considered in 135 scheduled commuter operation, it would be appropriate to require these aircraft to be maintained under the higher maintenance standard of 135.411(a)(2) CAMP which is consistent with the maintenance requirements of airplanes in scheduled Part 121 service.

<u>All-Cargo Airplanes with Payload in excess of 7,500lbs</u>
The AWG believes that turbine-powered all-cargo airplanes with payload in excess of 7,500lbs should be maintained under a 135.411(a)(2) CAMP. There is a very limited number of piston-powered all-cargo airplanes that will be required to transition to Part 135 from Part 125 as a result of 135ARC proposals.

RECOMMENDATION:

<u>From a strategic perspective</u> that considers the entire Part 135 regulation and scope of current and future operations, the AWG recommends that a single flexible maintenance program standard for Part 135 be established which could address the multiple of levels and factors that comprise aircraft complexity as well as operational complexity.

- The AWG recommends that FAA form a 135 Maintenance Aviation Rulemaking Committee (135MARC) with the appropriate membership required to develop a new 135 maintenance program standard. The membership of the 135ARC and AWG did not include operators of small piston and turboprop airplanes which would be a key stakeholder group for which new maintenance requirements would apply.

<u>From a tactical perspective</u> that addresses the specific tasking to consider maintenance/inspection program requirements appropriate for "large" airplanes as well as new airplane operations proposed by the 135ARC, the AWG recommends the following:

- Maintenance/inspection program requirements should be based on the "configured" passenger seating, not the "type-certificated" passenger seating
- The following aircraft shall be maintained in accordance with a 135.411(a)(2) continuous airworthiness maintenance program (CAMP):
  - Large airplanes with MTOW of 50,000lbs or more
  - Turbine-powered airplanes with a payload capacity of greater than 7,500lbs
  - Turbojet-powered airplanes in commuter operation
- The proposed rule language would be as follows:

§ 135.411 Applicability.
(a) This subpart prescribes rules in addition to those in other parts of this chapter for the maintenance, preventive maintenance, and alterations for each certificate holder as follows:

(1) Aircraft that are configured with nine or less passenger seats, excluding any pilot seat, shall be maintained under parts 91 and 43 of this chapter and §§135.415, 135.416, 135.417, 135.421 and 135.422. An approved aircraft inspection program may be used under §135.419.

(2)The following aircraft shall be maintained under a maintenance program in §§135.415, 135.416, 135.417, and 135.423 through 135.443:

(A) aircraft that are configured with ten or more passenger seats, excluding any pilot seat;

(B) aircraft with a **certificated maximum takeoff weight (MTOW) of 50,000 lbs or more;**

(C) turbine-powered airplanes with a payload capacity of greater than 7,500lbs; and

(D) turbojet-powered airplanes ***in commuter operation***

STEERING COMMITTEE REVIEW:

Summary of discussion with steering committee and recommended actions

FINAL ACTION:

Final recommended action by Steering Committee

NOTES:

AWG Concepts (2003):

- Develop maintenance/inspection program appropriate for type of operation (mission based)
  - Not based on payload or number of pax seats
  - Performance based requirements applicable to all aircraft types and operations
- Factors for consideration:
  - scheduled vs non-scheduled
  - Level of complexity (system and/or aircraft)
  - Additional requirements beyond OEM ICA
  - Tracking requirement
  - International (ICAO and JAA/EASA)

Existing requirements:

- CAMP 135.411(a)(2) (10+ pax)
- AAIP 135.419 (9 or less)

- OEM maintenance program
- 100-hour/annual 135.411(a)(1) /91.409 (9 or less)
- MSG 1/2/3

<u>Discussion:</u>
MSG approach very effective approach for developing maintenance program appropriate for a specific type of operation. 121 operators have the volume of operations to collect appropriate data/experience and the engineering capability to support the development of an MSG based maintenance program. However, GA (91/125/135) operations (in terms of volume of operations and engineering capability) do not typically support an MSG environment.

AAIP 135.419 program
- Does not require Ops Spec

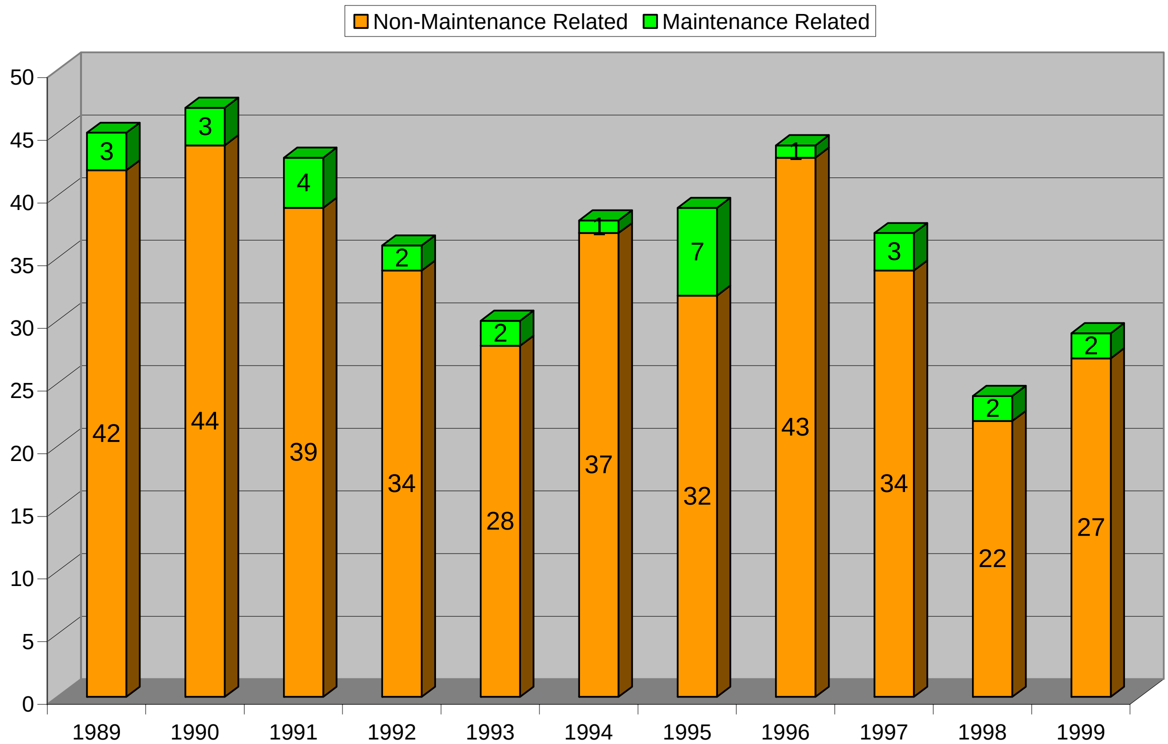
CAMP 135.411(a)(2)
- Benefit of CAMP for operator – ability to change (escalate/de-escalate) tasks if have data collection and engineering capability
- Benefit of CAMP for FAA – higher level of safety for common carriage operation
- Philosophy is based on assumption that operator program is a higher level of safety than the manufacturers minimum requirements. Operators update/modify their program based on operating experience.
- Reality for most 135 operators - simply adopt the manufacturers program and do not update/modify because they do not have enough data and/or engineering capability. Operator data/experience is typically sent to manufacturer to contribute toward fleet data and to determine changes/updates to manufacturer maintenance program
- Does not allow for automatic updates to CAMP program based on manufacturer revisions
- If operator does not have process to update CAMP based on continuous analysis, then maybe they should be required to follow manufacturers program.

Discussion - 135 maintenance program requirement should provide following options:
- Use of manufacturers maintenance program (complete adoption, including revisions)
- CAMP
- AAIP

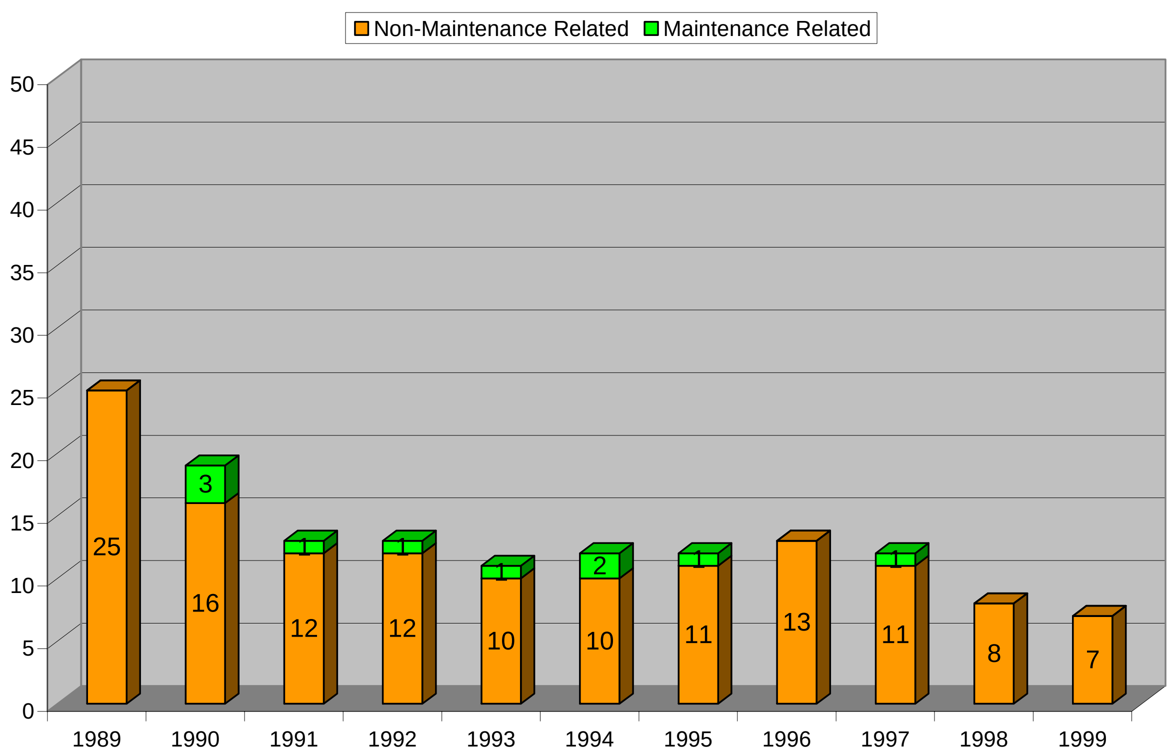
<u>11/19/2003 AWG Discussion</u>
- Incorporate AWG-15 Standard Inspection Programs; and AWG-18 Update CAMP and Reliability Maintenance Programs
- FAA current activity/effort to ensure that 135 and 121 CAMPs are standardized in terms of requirements and how they are treated by FAA inspectors. Particular emphasis on large aircraft because inspectors are not familiar with these airplanes.
    - Developing new guidance
    - Update Order
    - Update inspector training
    - Evaluating MSG-3 and RCM as tools to ensure effectiveness of maintenance program intervals

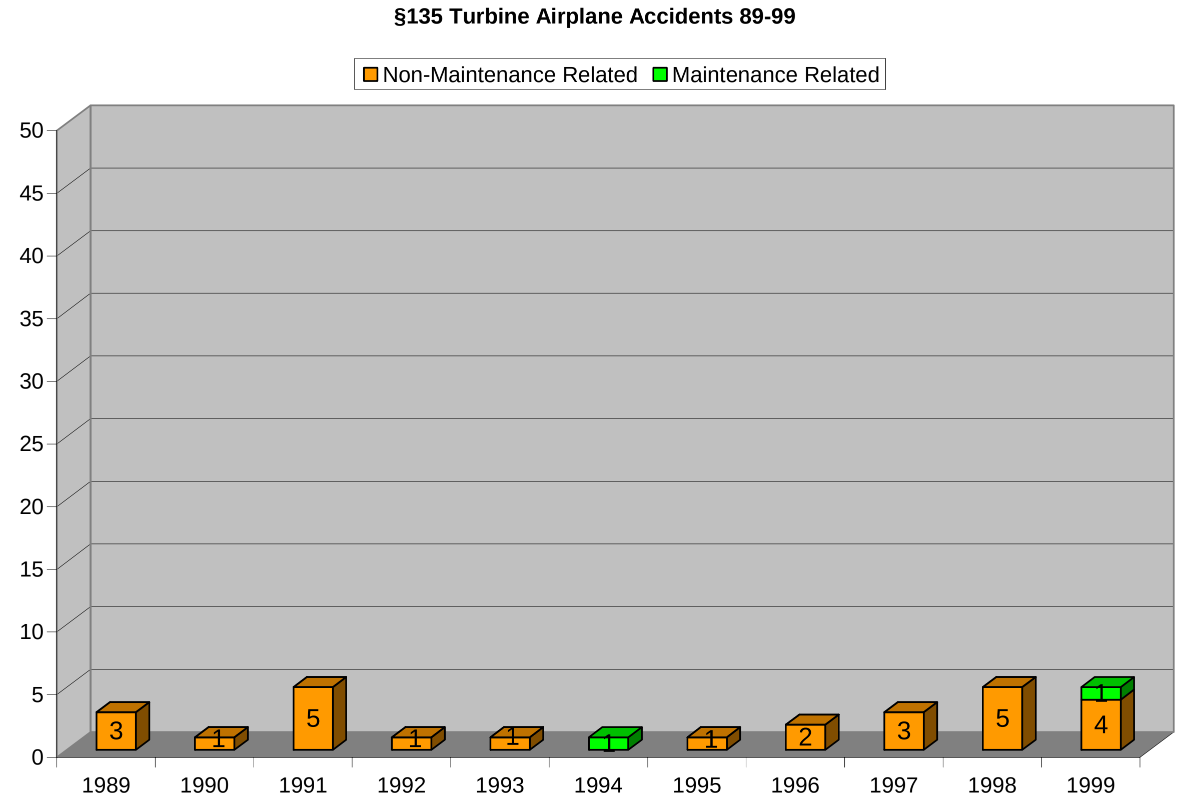
The AWG identified the following part 135 maintenance/inspection program issues and recommendations.
1. Large airplanes moving from Part 125 operations to Part 91 (private carriage).
    - Part 91 maintenance rules (91.409 (e)(f)) closely resemble rules under Part 135 and Part 125. This being said our consensus is these aircraft can be operated, from a maintenance standpoint, with an equivalent level of safety.
2. Existing Part 125 airplanes (private carriage for hire).
    - Part 125 has adequate provisions (125.247) to select a program appropriate to the type of airplane operated.
3. Turbojets (9 or less) operating in scheduled service.

§135 Reciprocating Airplane Accidents 89-99



§135 Turbo-Prop Airplane Accidents 89-99




§135 Turbine Airplane Accidents 89-99
Non-Maintenance Related
Maintenance Related
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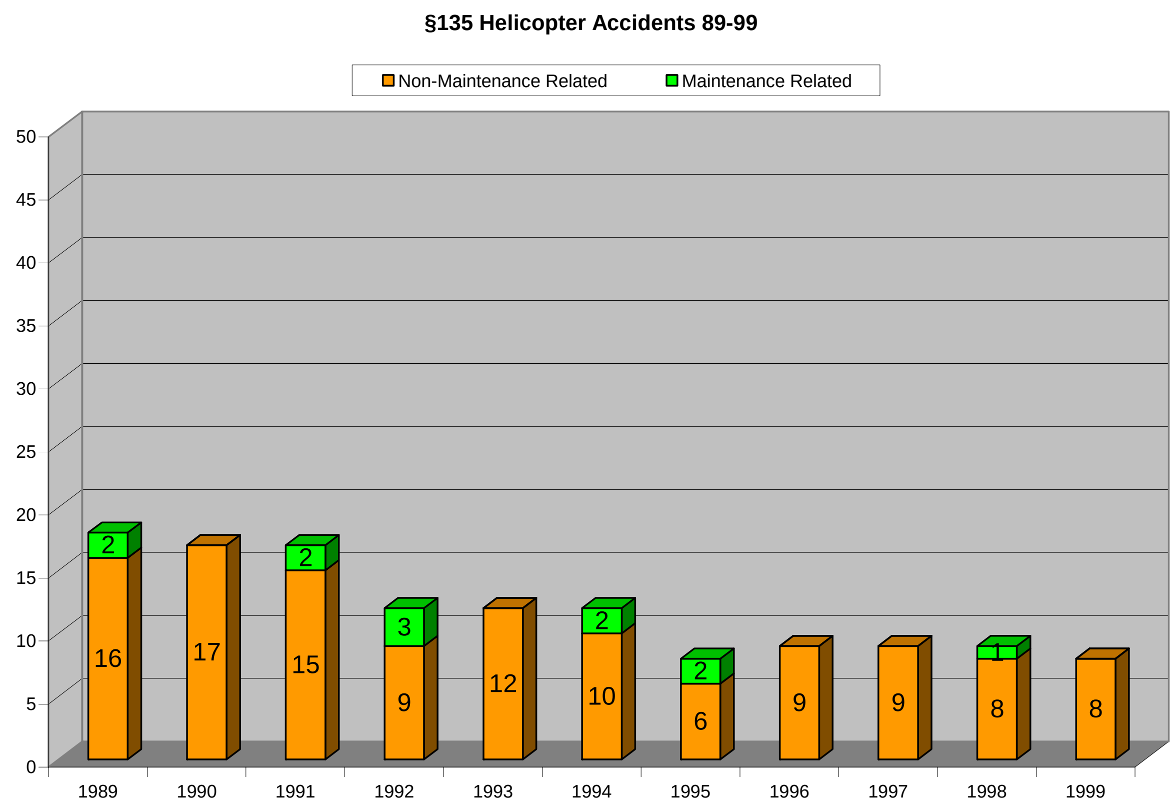
§135 Helicopter Accidents 89-99
Non-Maintenance Related
Maintenance Related
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1999

Part 135 Turbine Airplane Operators Listed by MTOW

Make	Model	(AKA)	Empty Weight (lbs)	MTOW (lbs)	Range (NM)	Maintenance Program CAMP	A1	% CAMP
Boeing	727	B-727-222	100,000	209,500	2,400	2		100.00%
Boeing	BBJ	B-737-700	126,000	171,000	6,116	4		100.00%
Lockheed	Hercules	L-382-G	77,736	155,000	4,830	1		100.00%
Douglas	DC-6	DC-6	52,567	97,200	4,100	3	1	75.00%
Bombardier	Global Express	BD-700-1A10/1A11	48,800	95,000	5,325	11		100.00%
Douglas	DC-9	DC-9	74,000	91,500	1,670	2		100.00%
Gulfstream	G-V	GA-V-V	46,800	90,500	6,420	21	1	95.45%
BAE	BAC-1-11	BAC-111-400	68,500	87,500	1,480	1		100.00%
Gulfstream	GIV/400	GA-1159-IV/400	49,000	73,200	4,000	99		100.00%
Fokker	F-28	F-28-MK4000	57,500	71,000	1,480	1		100.00%
Gulfstream	GIII	GA1159A/B/III	44,000	69,700	3,691	74	1	98.67%
Gulfstream	GII/IISP	GA-1159-1159/II	42,000	64,800	2,601	44		100.00%
Convair	CV-640	CV-640	33,166	63,000	1,695	1		100.00%
Bombardier	CRJ-200	CL-600-2B19	44,000	53,000	2,005	1		100.00%
50,000 LBS.								
Convair	CV-440	CV-440	33,314	49,700	1,677	2		100.00%
Embraer	EMB-135BJ	EMB-135BJ	35,274	49,604	3,038	2		100.00%
Bombardier	Challenger 604	CL-600-2A16	32,000	47,600	3,973	52	5	91.23%
Convair	CV-340	CV-340	29,486	47,000	505	1		100.00%
Dassault	Falcon 900/900EX	AMD-50-900, DA-50-900	28,200	45,500	3,869	23		100.00%
Fokker	F-27 Friendship	F-27-MK500	38,500	43,500	1,440	4		100.00%
Curtis-Wright	C-46 Commando	C-46	33,000	42,500	1,564	1		100.00%
Bombardier	Challenger 601	CL-600-2A12, CL-601-1A/3A	29,500	42,100	2,182	14	1	93.33%
Convair	CV-240	CV-240-27	27,600	41,790	1,565	2		100.00%
Lockheed	Jetstar II	L-1329-25	23,500	40,921	2,600		1	0.00%
Dassault	Falcon 50	AMD-50	25,570	38,800	3,280	10	14	41.67%
Bombardier	Challenger 300	BD100-1A10	26,100	38,500	3,254	1		100.00%
Bombardier	Challenger 600	CL-600-2B16/1A11	25,800	36,500	3,211	19	5	79.17%
Cessna	Citation 750	CE-750-750	24,400	36,100	3,070	4	81	4.71%
Gulfstream	GI	GA-159-159	27,303	36,000	2,206	3		100.00%
Dassault	Falcon 2000/EX	AMD-2000 s/n 217	28,660	35,800	3,090	28	1	96.55%
ATR	ATR-42	ATR-42-300	32,625	35,605	2,420	4		100.00%
Gulfstream	G-200	G-200	24,000	35,450	3,432	12	14	46.15%
De Havilland	Dash 8	DHC-8	22,600	34,500	1,100	1		100.00%
Dassault	Falcon 20	AMD-20-(D,E,F,20)	22,500	32,000	2,000	3	55	5.17%

Appendix 2

CASA	CN-235	CN-235-235	21,605	31,752	430	1		100.00%
Raytheon	Hawker 1000/A	BAE-125-1000A	17,200	31,000	2,708		18	0.00%
Dornier	DO-328	DO-328-300/100	19,665	30,842	1,000	2		100.00%
Cessna	Citation 680	CE-680	20,300	30,000	2,381		3	0.00%
Raytheon	Hawker 700	HS-125-700A	14,120	28,000	2,540	2	27	6.90%
Raytheon	Hawker 800/800XP	BAE-125-800A/800XP	14,120	27,400	2,449	9	80	10.11%
SAAB	340	SAAB / 340-A	25,200	27,275	2,145	5	1	83.33%
Shorts	SD-360	SD-3-60	16,600	26,000	636	5	31	13.89%
Raytheon	Hawker 600	HS-125-600A	13,100	25,500	1,630		5	0.00%
Embraer	EMB-120	EMB-120-ER/FC/RT	23,148	25,353	810	5	7	41.67%
Douglas	DC-3	DC-3	17,720	25,200	1,307	4	41	8.89%
25,000 LBS.								
Gulfstream	G-100	G-100/IA-1125-1125	17,000	24,650	2,700		7	0.00%
Sabreliner	Sabreliner 65	NA-265-65	16,250	24,000	2,407		6	0.00%
Bombardier	Lear-60	LR-60	16,500	23,500	2,289	3	52	5.45%
IAI	Westwind IAI-1124	IA-1124-1124	16,500	23,500	2,550	1	22	4.35%
Sabreliner	Sabreliner 80	NA-265-80	15,620	23,300			5	0.00%
Cessna	Citation 650	CE-650-650	16,500	23,000	1,726	3	50	5.66%
Shorts	SD-330	SD-3-30	14,500	22,000	915	2	18	10.00%
Bombardier	Lear-55	LR-55	15,000	21,000	1,975	2	44	4.35%
Bombardier	Lear-45	LR-45	16,000	20,500	1,885	3	11	21.43%
Cessna	Citation 560XL	CE-500-560XL	15,100	20,200	1,796	3	78	3.70%
Sabreliner	Sabreliner 60	NA-265-60	13,250	20,172			6	0.00%
Bombardier	Lear-35/A	LR-35	13,500	18,300	1,924	10	177	5.35%
Bombardier	Lear-36/A	LR-36	13,500	18,300	2,543	3	7	30.00%
Dassault	Falcon 10	AMD-10-10	12,360	18,300	2,040	1	16	5.88%
Raytheon	1900	BE 1900C/D	15,165	17,120	1,498	16	29	35.56%
CASA	Aviocar C-212	C-212-CC/CD	15,653	16,976	950	4	7	36.36%
Cessna	Citation 560	CE-500-560	12,600	16,630	1,778	2	140	1.41%
Raytheon	Beechjet	BE-400-400/MU-300	12,470	15,780	1,693	6	74	7.50%
Bombardier	Lear-31/A	LR-31	13,000	15,500	1,202	2	29	6.45%
British Aerospace	Jetstream 3101/3201	BA-JETSTM/3101/3201/4101	13,668	15,212	1,150	17		100.00%
Bombardier	Lear-25	LR-25	10,000	15,000	1,437	1	69	1.43%
Cessna	Citation 550	CE-500-550	11,300	14,800	1,614	6	106	5.36%
Dornier	DO-228	DO-228-202	8,243	14,110	1,320	1	3	25.00%
Bombardier	Lear-24	LR-24	9,000	13,000	1,440	1	35	2.78%
12,500 LBS.								
Bombardier	Lear-23	L-23	9,000	12,500	1,436		5	0.00%

Appendix 2

De Havilland	Twin-Otter	DHC-6	7,415	12,500	920	6		100.00%
Fairchild	SA-227	SA-227-DC	8,150	12,500	1,938	23	58	28.40%
Raytheon	King Air	BE-200-200/300/65/90/99/100	11,000	12,500	1,759	13	533	2.38%
Raytheon	Premier	RA-390-390	10,000	12,500	1,500		2	0.00%
Shorts	Skyvan SC-7	SC-7 SERIES 3	7,344	12,300	600		10	0.00%
Piper	Cheyenne III PA-42	PA-42	7,522	12,050	1,630		2	0.00%
Cessna	500/501	CE-500	8,400	11,850	1,328		33	0.00%
Piaggio	Avanti	P-180-180	9,000	10,810	1,400		2	0.00%
Cessna	Citation 525/525A	CE-525-525	8,400	10,600	1,248	2	3	40.00%
Fairchild	Merlin SA-226	SA-226-AT	6,452	10,000	1,550	7	20	25.93%
Cessna	441	CE-441	8,500	9,850			18	0.00%
Piper	Cheyenne PA-31T	PA-31T	5,680	9,540	1,478		39	0.00%
Reims	Reims F406	REIMS-F406-F046	8,500	9,435			3	0.00%
Mitsubishi	MU-2	Mitsubishi MU-2B-20	5,343	9,350	1,395		46	0.00%
Pilatus	Pilatus PC-12/45	PC-12/45	5,732	9,039	1,600		23	0.00%
Cessna	C-208	C-208B	4,965	8,750	1,080	1	505	0.20%
Pilatus Brittan Norman	Trilander MKIII-2	BN-2 A MK III-2	6,600	7,000	868	2	14	12.50%
Piper	Malibu PA-46	PA-46-310P	3,243	5,092	1,018		1	0.00%
						625	2,701	18.79%

Source: FAA AFS-200 Ops. Spec. Query (Mar. 4, 2005) and FAA TCDS

NUMBER: AWG 02 Rev 4 **VERSION DATE: 10-29-04**

Source: Docket 2002-13923-69 and 2002-13923-76

ISSUE: Maintenance Technician Training Program

Regulation: FAR Part 135.433, 135.411, 135.420, AC 120-16D

Strengthen/enhance existing 135.433 requirements for maintenance training program to promote consistent application and compliance. Consider training appropriate for type of operation and new requirement for an "approved" training program and documented training history. Examine training program requirements for aircraft operated under 135.411(a)(2).

DISCUSSION:

The Airworthiness Working Group has reviewed the submitted docket comments related to AWG-02 and offers the following recommendations.

Current State for Ten or More Aircraft:
Part 135.433 is the current rule with regards to maintenance training programs for Part 135 Air Carriers. Part 135.433 is however, only applicable to aircraft maintained under 135.411 (a)(2), a Continuous Airworthiness Maintenance Program (10 or more passenger aircraft). In reviewing the current rule, Part 135.433, we find that the rule states that "Each certificate holder or a person performing maintenance or preventative maintenance functions for it shall have a training program to ensure that each person (including inspection personnel) who determines the adequacy of work done is fully informed about procedures and techniques and new equipment in use and is competent to perform that person's duties." Part 135.433 does not require a training program to be approved; therefore, by default such training programs are merely accepted by the FAA. The rule also does not specify criteria for the type of training required or the frequency for such training to be conducted.

Part 135.429 "Required Inspection Personnel", which only applies to aircraft operated under 135.411(a)(2), does state that "(a) No person may use any person to perform required inspections unless the person performing the inspection is appropriately certificated, properly trained, qualified, and authorized to do so." It should be noted that 135.429 is only applicable when performing return to service on Required Inspection Items.

Similarly Part 121.375 states the requirements for training programs under Part 121 and is worded verbatim to Part 135.433.

Current State for Nine or Less Aircraft:
Aircraft maintained under Part 135.411 (a)(1) (9 or less) are not subject to the requirements of Part 135.433 and virtually have no regulatory requirements for technician training other than the very broad scope requirements of Part 65.81 "General Privileges and Limitations". Part 65.81 applies to all certified maintenance personnel and generically states that "…he may not supervise the maintenance, preventive maintenance, or alteration of, or approve and return to service, any aircraft or appliance, or part thereof, for which he is rated unless he has satisfactorily performed the work concerned at an earlier date."

Current FAA Guidance for Ten or More Aircraft:
In reviewing current guidance material related to maintenance training programs, the AWG reviewed AC 120-16D. AC 120-16D titled “Continuous Airworthiness Maintenance Programs” provides guidance for certificate holders operating aircraft under Part 135.411 (a)(2)(10 or more). More specifically, Chapter 10 of the Advisory Circular is dedicated to “Personnel Training”. Chapter 10 provides information regarding training programs including: Basic Requirements, Types of Training, Definition of Initial and Recurrent Training, Definitions of: Specialized, Maintenance Provider, and Competence Based Training. AC120-16D does not however, make a recommendation for the frequency of recurrent training. In reviewing other guidance material regarding Part 135 training programs it was found that AC 120-16D is virtually the only guidance material available. Because AC120-16D is guidance material for aircraft operated under Continuous Airworthiness Maintenance Programs, it is not intended for aircraft operated under 135.411(a)(1) (9 or less).

The Airworthiness Inspectors Handbook 8300.10 Chapter 70 provides guidance for “…evaluating and accepting an operator/applicant's maintenance/inspection training program.” Although the guidance material describes different elements of training and also initial and recurrent training, the guidance is generally only used when initially accepting an Air Carriers training program.

Current FAA Guidance for Nine or Less Aircraft:
Because there is no regulatory requirement for a 9 or less aircraft to have a training program, there is no applicable guidance material for this category of aircraft with regards to Air Carrier training programs. The responsibility for technician qualification falls on the technician under the requirements of Part 65, and not the Air Carrier.

Other Training Guidance:
The “International Standard for Business Aircraft Operations 9.0” (ISBAO) states under “Aircraft Maintenance Requirements” in section 9.5 “Maintenance Personnel Training”, that “The training programs shall include initial and recurrent training related to aircraft maintenance and may include other subjects such as: …d. human factors or crew resource management”

The NBAA Management Guide in section 4.10 Maintenance Technician Training states: “The training program should consist of initial and recurrent courses in each type of aircraft operated and maintained by the company.” NBAA further recommends that “…aircraft-specific recurrent training be conducted annually at a reputable training facility.”

AC’s 120-28D and AC 120-67, “Criteria for Cat III Weather Minima…” and “Criteria for Operational Approval of Auto Flight Guidance Systems” respectively, detail maintenance training requirements for very specific aircraft navigational systems. In this guidance, very specific Initial and Recurrent Training Programs are described with AC120-28D recommending recurrent training “...at least annually.”

Current Problem for Ten or More Aircraft:
The current regulation as it exists is broad scope in nature and is subject to varying levels of interpretation. The current regulations do not require training programs to be approved by the FAA. Because of the lower level of scrutiny imposed on Part 135 training programs, there is a

wide range of training program implementation able to achieve compliance throughout the Part 135 industry. An informal polling conducted of Part 135 Air Carriers revealed not only varying levels of training within 135.433, there is also uneven enforcement of the current regulations by the FAA, and inconsistent use of the available guidance material. This lack of training program definition has manifested itself in several recent air carrier accidents where maintenance training program deficiencies were specifically cited. The NTSB has issued reports, based on recent aviation accidents, recommending that Part 121 Air Carrier Maintenance Training programs be approved by the FAA. Other recent rule changes have focused on maintenance training programs and have specifically further defined the requirements for such programs.

The current rule does not uniformly apply to all Part 135 operations. Aircraft being manufactured today are more sophisticated than ever. Avionics systems, digital data bus technology and new construction techniques have put an increased demand on today's technician to stay current with technology. Human factors have proven to be an ever-increasing area of attention and contributors to aviation accidents and incidents. The regulations that govern the training of the air carrier maintenance technician are clearly in need of revision.

Current Problem for Nine or Less Aircraft:
Those operations that are maintained under 135.411(a)(1) do not require any such training program to be in place. Many of the aircraft operating under this rule, as 9 or less aircraft, are just as, or even more complex than those that operate as 10 or more. The expected growth in the light jet market will introduce ever increasing new technologies into the nine or less category of aircraft. Often thought of as a "simpler" category of aircraft, the smaller jets and piston powered aircraft are now employing high tech composites, advanced avionics and computer technologies that will test the capabilities of today's aircraft technician. The responsibility to ensure that these technicians are properly trained to maintain these aircraft should lie not only with the technician but also with the Air Carrier.

Nine or Less aircraft have the same opportunity to suffer from insufficient maintenance training as do the Ten or More. A recent NTSB report involving an Air Sunshine Cessna 402C that crashed in the Bahamas cited maintenance deficiencies. A contributing factor to the crash was the improper torquing of the right engine #2 cylinder hold down nuts. Although the report's recommendation focused on the pilots' actions and not maintenance training specifically, the conclusions drawn are quite obvious.

Other Related Rulemaking
The FAA recently released a new set of rules specific to Fractional Operations. The intention of this rulemaking effort was to "level the playing the field" between Part 135 and Fractional Operations that were being conducted under Part 91. In releasing the rules under "91K" the fractional operators were given a set of regulations that would incorporate many of the parameters of Part 135 yet accounted for the unique operation of Fractional Operations. Part 91.1111 titled "Maintenance Training" which applies to all fractional operations, states, "The program manager must ensure that all employees who are responsible for maintenance related to program aircraft undergo appropriate initial and annual recurrent training and are competent to perform those duties." The rule specifically points out the requirement for initial and annual recurrent training. In reviewing the preamble of 91K, it is discovered that a commenter questioned the use of the terms "appropriate initial and annual recurrent training," even

suggesting that more generic language be used. The FAA however chose to use the more defined language in the final rule.

In another rulemaking effort, the FAA has recently revised the standards of FAR Part 145. Their issuance of Part 145.163 "Training Requirements" defines the requirements for technician training operating under the authority of Part 145 Repair Stations. The requirements are very specific in stating "(a) A certificated repair station must have an employee training program approved by the FAA that consists of initial and recurrent training." Furthermore, Part 145.51 "Application for Certificate" states in 145.51(7) that the applicant must submit "A training program for approval by the FAA in accordance with § 145.163." In support of the new regulation the FAA has been developing associated guidance material. A report was prepared for the FAA by the F.J. Leonelli Group in October 2004. The report points out the need for more defined training programs for Part 145 Repair Stations. In this report, parallels are easily drawn between Parts 145 and 135 as the report describes; changes in the quality and background of mechanics, changes in industry, changing technology, inconsistency in FAA oversight and influence from other regulatory agencies. The report makes a recommendation for 8-16 hours of initial and recurrent training for Repair Station employees. The FAA has also drafted an Advisory Circular and Inspector Handbook material regarding approval of Part 145 Training Programs. Draft AC 145RSTP dated October 13, 2004 clearly states the flexibility in program approval. The AC states that it is an "acceptable means, but not the only means for developing a training program." A Repair Station may choose not to follow either one of the 2 sample programs provided and a process is provided to tailor the program to the particular operation. As an important note, the FAA choose not to set minimum hours for technician training but merely provided guidelines in subject area and content. The AC also describes a process for determining individual technician training needs based on background and experience. Similar to the Leonelli Report, the FAA points out the need and justification for such training, based on changing hiring practices, ICAO and JAA guidelines, and new technologies. It should be noted that the requirement for a Part 145 Training Program does not differentiate by seating capacity, aircraft size or complexity. The flexibility is built in to the development and application of such programs.

Cost/Benefit

It will be argued that the U.S. aviation safety record is the finest in the world and that further regulation with regard to maintenance training is unnecessary and costly. For a large part of the aviation industry, this may be true. In fact, the majority of U.S. operators will find they already comply with whatever maintenance training requirement might be implemented by FAA and the only additional costs may be in assuring accurate recordkeeping.

However, regulations are not written for the high-end performer. The never have been. They are written as a minimum standard for the lowest acceptable performance for a participant in an industry. Compliance is a litmus test for acceptable ability to perform safely in this community. If you can't perform to the minimum level, you can't participate in our industry. The regulations also represent an outer ring of performance that even historically safe operations could breech if their safety culture should somehow lag or if financial burdens place them in positions of having to save money on programs that the operator might deem unnecessary or are otherwise not required by regulation.

Following an aviation accident, it is not just the affected operator, his employees, the passengers and their families and friends that suffer. It is all of aviation. Granted, the larger the aircraft, that larger the impact on society, the flying public and our industry. But the crash of just one passenger aircraft jangles the nerves of our entire industry and is an opportunity for all of us to closely examine our own operations. To employ a time honored maxim, “Can we afford not to?” with regard to assuring the quality of aviation maintenance through assuring the implementation of comprehensive, FAA-approved technician training programs.

The FAA has well understood the value and importance of approved training for pilots, flight attendants and dispatchers and has backed up that recognition with appropriate regulation. FAA also understands the commensurate role that quality maintenance with properly trained technicians plays in assuring and improving aviation safety.

Well written regulation does not have to result in unnecessary expense. Not all training has to be accomplished at remote based factory training centers. Air Carriers can, and should develop their own maintenance training programs, recognize On-The Job training, and take advantage of low cost industry seminars and professional organizations. By developing proper regulatory guidance that focus’s on training standards, those operators that are currently operating to solid safety practices should experience minimal cost impact.

In similar rulemaking process for Part 145, the Leonelli Report previously mentioned in this document address’s potential training program cost. The report states “Many repair stations already have training programs in place and may only require revisions to their programs to comply with the new requirements.” Very similar conclusions could be drawn concerning Part 135. With the FAA not taking a position on minimum training hours in the Part 145 guidance, similar flexibility could be built in to Part 135 training program guidance.

RECOMMENDATION:

Recommendation for Rulemaking for Ten or More Aircraft:
The AWG recommends with full consensus that 135.433 be revised to require that maintenance training programs be "approved" by the FAA for air carriers maintaining aircraft under 135.411(a)(2).

The AWG recommends that the guidance material within 120-16D be revised to more clearly identify the need for initial and recurrent training intervals and more emphasis be placed on describing procedures for conducting "in-house" or "On the Job Training (OJT)". Furthermore, FAA guidance material should be enhanced to stress the flexibility that must be in place to tailor a training program to an air carrier's operation.

AWG feels strongly that any training program guidance must be flexible enough and appropriate to fit the type of aircraft being operated and responsive to individual 135 operations. No single program should be developed as a requirement for all operations.

Recommended Rulemaking Language for Ten or More Aircraft:

FAR Part 135:

(regulation to be effective 18 months from effective date of rule)
§ 135.433 Approved Maintenance and preventive maintenance training program.
Each certificate holder or a person performing maintenance or preventive maintenance functions for it must have an approved training program that includes initial and recurrent training to ensure that each person (including inspection personnel) who determines the adequacy of work done is fully informed about procedures and techniques and new equipment in use and is competent to perform that person's duties.

AC 120-16D:

1000. (2nd sentence) "These regulations state, in part, that air carriers must "have an approved training program that includes initial and recurrent training to ensure that each person (including inspection personnel) who determines the adequacy of work done is fully informed about procedures and techniques and new equipment in use and is competent to perform that person's duties.""

1001. "Some of the types of training that can be included in an air carrier training program are: initial training, recurrent training, on the job training (OJT), specialized training, maintenance provider training, and competence-based training.

1002. What is initial training and what does it include? Initial training is provided right after a person is hired, or when personnel begin to work on new equipment or a new assignment. Your initial training program may include subjects such as employee indoctrination or orientation, maintenance department policies and procedures, maintenance recordkeeping and documentation, aircraft systems or ground equipment, specific skills (avionics, composite repair, aircraft run-up and taxi, etc.), skills upgrade, human factors, task-specific training, hazardous materials, or Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) regulations familiarization. Your initial program may also include a competence-based assessment of employees. This evaluates an employee's previous training and experience and helps identify their specific individual training needs. Each air carrier's initial training program will be unique and based on its individual operation and needs. When developing its initial training requirement, each air carrier should consider its size, location, the type of employees it uses (full-time, part-time, contract,), and its employees' experience and skill levels.

1003. What is recurrent training and what does it include? Recurrent training is education occurring on a repetitive basis. It provides maintenance personnel with the information and skills necessary to maintain the required level of competence. This training also accommodates the introduction of new aircraft, aircraft modifications, new or different ground equipment, new procedures, techniques, and methods, or other new information. Recurrent training, although occurring on a repetitive basis, may not adhere to a defined schedule. This training should not provide repetitive information unless it is to maintain the desired degree of competence. Recurrent training may include:

a. Continuing competency training designed to maintain regulatory and certificate currency requirements;

b. Refresher training on a seldom accomplished task or seldom used skill;

c. Update training for particular tasks or skills. Update training can include training bulletins, bulletin-board items, self-study tasks, and computer-based instruction;

d. Specific training designed to correct deficiencies identified through the air carrier's CASS; and

e. Any other continuing education or training that may not be provided on a defined schedule

Each air carrier's recurrent training program will be unique and based on its individual operation and needs. When developing its recurrent training requirement, each air carrier should consider its size, location, the type of employees it uses (full-time, part-time, contract,), and its employees' experience and skill levels.

1005. What is maintenance provider training and what does it include? Your training program must provide appropriate information to each employee of a maintenance provider about your specific program. The training should include function-specific training appropriate to each person's job assignment or area of responsibility. You do not need to provide training to maintenance provider personnel in areas that do not concern them. For example, training on aircraft log procedures and minimum equipment list procedures would not be required for aircraft interior cleaners, but would be required for maintenance personnel assigned to on-call maintenance for you. Maintenance training programs approved under **§145.163** may meet an air carrier's technical training requirements, however, the air carrier shall remain responsible to provide appropriate information about their specific program to maintenance providers

NOTE:

If a maintenance provider has specific types of training for its personnel, you do not need to duplicate that training for those individuals, but you must ensure the maintenance provider has indeed provided the training and that the training meets your own needs and training standards.

Recommendation for Rulemaking for Nine or Less Aircraft:

The AWG recommends with general consensus that aircraft maintained under Part 135.411(a)(1) be required to have in place a training program. However, that the training program not require specific approval from the FAA.

The AWG recommends that the FAA develop guidance material for the establishment of maintenance training programs that would be required for aircraft maintained under 135.411(a)(1). This guidance material should include elements to be included in an operators Nine or Less training program. These elements should consist of, but not be limited to:

- Types of training that can be used (initial, recurrent, OJT, competence based training, computer based training, distance learning, etc)
- Definitions of initial, recurrent, and other types of training
- Recommendations for frequency of training
- Documentation of training

Recommended Rulemaking Language for Nine or Less Aircraft:

(regulation to be effective 18 months from effective date of rule)
§ 135.411 Applicability.

(b) This subpart prescribes rules in addition to those in other parts of this chapter for the maintenance, preventive maintenance, and alterations for each certificate holder as follows:

(1) Aircraft that are type certificated for a passenger seating configuration, excluding any pilot seat, of nine seats or less, shall be maintained under parts 91 and 43 of this chapter and §135.415, 135.416, 135.417, 135.420, 135.421 and 135.423. An approved aircraft inspection program may be used under §135.419.

(regulation to be effective 18 months from effective date of rule)
§135.420 Maintenance and preventive maintenance training program.
Each certificate holder or a person performing maintenance or preventive maintenance functions for it shall have a training program to ensure that each person who determines the adequacy of work done is fully informed about procedures and techniques and new equipment in use and is competent to perform that person's duties.

STEERING COMMITTEE REVIEW:

On August 26, 2004 the AWG presented Rec Doc AWG-02 to the Steering Committee. It was stated that AWG was in Full Consensus regarding the proposed requirement for 135.433 maintenance training programs (10 or more) to be approved by the FAA. It was also stated that the AWG was in General Consensus regarding the requirement for 135.411(a)(1) aircraft (9 or less) to have in place a maintenance training program. AWG further stated that:

•No single maintenance training program should be developed as a requirement for all operations.

•That any training program guidance must be flexible enough and appropriate to fit the type of aircraft being operated and responsive to individual 135 operations.

The Steering Committee posed several questions regarding the recommendation and requested:

- More definition regarding implementation timeline
- More definition of initial and recurrent training
- Proposed guidance material to support new regulation

DISCUSSION AT STEERING COMMITTEE: Does the FAA have the staffing to handle the approved training program requirement? There is concern in the group that the FAA does not have the required resources to handle this.

It is our understanding that the FAA is considering maintenance training for all air carriers (135/121) and it would be appropriate that this recommendation go forward with that package instead of the 135/125 ARC recommendation. The FAA will take this under consideration.

Group recommends that the Steering Committee vote on this recommendation, but leave it up to the FAA to consider how to move this recommendation forward as part of this NPRM or other rulemaking effort.

FINAL ACTION:

APPROVED

NOTES:

- Gathering background information: existing regulations, guidance, and industry best practices from NBAA and operators
    - Operators report significant inconsistencies regarding FAA application/expectations of training program requirements

  - Order 8300.10 Chapter 70 and AC 120-16D Chapter 10 address maintenance training program elements. However, many operators and FAA inspectors are not familiar with these guidance documents.
- Philosophy on Maintenance Training is evolving:
  - New 145 repair station rules require FAA Approved training programs for maintenance technicians by April 6, 2005.
  - Part 91 K for Fractional Operations requires maintenance personnel to undergo "appropriate initial and annual recurrent training" specific to the aircraft type, this language is much more specific and prescriptive than in FAR Parts 121 or 135.
  - Expect NTSB recommendations on maintenance training.
    Follow-up:
    - NTSB issued a number of maintenance-related recommendations in their final report on the crash of Air Midwest Flight 5681, Beechcraft 1900 in Charlotte, N.C. Among those recommendations was that FAA require all FAR Part 121 maintenance training programs be "Approved."
    - FAA is currently scrutinizing the role of the "Non-Certificated Repair Facility" in the performance of maintenance on FAR Part 121 Air Carriers. The so-called "Non-Certificated Repair Facility" is defined a one or more aircraft mechanics working under the authority granted as Airframe and Powerplant rated Mechanics. The DOT-OIG is currently conducting a survey at the request of Congressman Oberstar on the impact of A&P mechanics working solely under the authority of their certificates, but without specific training oversight by the air carrier. FAA is clearly moving in a direction that strictly quantifies and documents maintenance training for all technicians performing maintenance on Part 121 air carriers.
    - With respect to the ARC Steering Group's concern about 135 being more prescriptive than 121, FAA acceptance of NTSB's recommendation and eventual requirement for "Approved" maintenance training programs will specifically address that concern. In addition, with the Part 145 and Part 91.1111 maintenance training requirements already more prescriptive than either Part 121 or Part 135, the concern is rendered moot.
    - The preamble to Part 135 specifically identifies that FAA intends is to have the maintenance training requirements in Parts 121 and 135 be identical.
- Issues to be addressed by AWG
  - Expand/refine guidance (AC 120-16D Chapter 10) for maint. training program to include some additional information from 8300.10 Chapter 70 and industry best practices
  - Consider benefits of requiring an "approved" or "accepted" 135.433 training program (i.e. similar to NPRM on hazmat training)
  - Consider expanding 135.433 training program to be applicable to ALL 135 operations (not just under CAMP for aircraft with 10+ pax)
  - Consider requirement to document training history/experience for transferability (i.e. records/logbook)

NUMBER: AWG-08 **VERSION DATE: 08/25/2004**

Source: Docket Number 2002-13923-13

ISSUE: **Part 135 Third Artificial Horizon Requirement**

Regulation: 14 CFR Part 135 §135.149(c)

Part 135 has a tendency to treat small jets as having to meet transport level standards. These higher standards are completely independent of passenger capacity, airplane performance, airplane weight, flight crew requirements, but rather is only driven by the means of propulsion. A particular economic burden is the requirement for a third artificial horizon for all jets and transport category airplanes, not recognizing updated Type Design regulations for instruments.

DISCUSSION:

There are a number of manufacturers developing light business jets intended to replace the current fleet of small, propeller driven airplanes that meet older Type Design certification standards. These airplanes are have design features that enhance safety, such as lower stall speeds providing enhanced pilot handling at critical operating conditions, and allowing operation in the small airfields currently only serviced by small, propeller driven airplanes. In addition, these new aircraft provide significant advancements in safety by meeting current FAA design Standards (i.e., current Part 23 standards); thereby, providing more reliable and redundant systems. Also, they have much more reliable propulsion systems (modern turbofans) and cockpits often designed to provide enhanced safety by reducing pilot workload while efficiently providing essential safety information.

However, operational requirements often tend to try and "force" small jets to higher standards that equivalent capability, propeller driven airplanes with older certification basis. Specific example that causes economic burden is §135.149, which requires the installation of a third independent, artificial horizon for all turbojet powered airplane; however, there are high performance turboprops operated under Part 135 not requiring the extra expense of installing the additional equipment. Also, the fact that all turbojet pilots are required to have Type Ratings, as opposed to pilots of small propeller driven airplanes which do not require Type Ratings brings more into question the requirement to install the third indicator in small jets. The only other aircraft required to install the third indicator are those aircraft operated under Part 121.

Of note, JAR-OPS 1, which is a more conservative set of operational requirements, does not have either of these requirements for business jets. This is likely that JAR requirements were developed around more current versions of FAR requirements.

Options evaluated:

- Revise Part 135 to provide appropriate standards based upon airplane use, vice means of propulsion.
- Do nothing – problem still exists and precludes safety enhancements of small jets in the European market.

Airworthiness Working Group Discussions:

It was agreed that type/means of propulsion should not dictate equipment requirements, rather the FAR Type Design standards should. It was agreed to remove type/means of propulsion entirely from the regulations and leave the requirements to the design specifics. It was also agreed that a qualifier be added for certification basis that requires evaluation of systems safety requirements for complex systems and determine point at which third independent artificial horizon does not need to be specifically required (was determined to be Am 23-41 and Am 25-23 for Parts 23 and 25, respectively).

There was much discussion of the broader issue that the regulations eliminate qualifiers and differentiate by mission (scheduled, unscheduled, common carriage, cargo, on demand, etc.).

RECOMMENDATION:

Proposed Regulation
"§135.149 (c) For large turbojet airplanes with a certification basis prior to Am 25-23 (effective May 8, 1970) and small turbojet airplanes with a certification basis prior to Am 23-41 (effective Nov 26, 1990), in addition to two gyroscopic bank-and-pitch indicators (artificial horizons) for use at the pilot stations, a third indicator that is installed in accordance with the instrument requirements prescribed in 121.305(j) of this chapter."

Impacts:

This change will be a cost positive by not requiring small jet manufacturer's only to install third artificial horizons. This also results in greater ability for small jets with enhanced safety (as compared to older, propeller-powered airplanes) to enter the market place. Due to current negative cost impacts on small jet manufacturer's of requiring a third artificial horizon, recommend this change be made as soon as feasible.

STEERING COMMITTEE REVIEW:

The STE agrees that in light of 23/25.1309 the need for a third artificial horizon would make this regulation outdated. A third artificial horizon would only be required if .1309 shows that there Is a need.

FINAL ACTION:

APPROVED, August 2004

NOTES:

NUMBER: AWG-09-STE **VERSION DATE: 05/25/2004**

Source: Docket 2002-13923-16

ISSUE: **Certification for Flight in Icing**

Regulation: 25.1419, Part 25 Appendix C, 135.227, Training…

Comment to docket raises numerous observations/issues pertaining to certification and operation of aircraft for flight into known icing.

SUMMARY OF ISSUES:

1) Certification to the parameters of part 25 appendix C does not approve an aircraft for flight into severe icing

Section 135.227(e) allows transport category airplanes to fly into severe icing conditions. This seems to be inconsistent with Part 25 ice protection certification standards in Section 25.1419 and Appendix C because it only considers certain types of icing conditions and does not necessarily address all potential severe icing conditions.

It is important to recognize that Part 25 certification does not approve an aircraft for flight into severe icing. The purpose of Appendix C is to provide a standard set of conditions in which to demonstrate aircraft performance in icing conditions. The Aviation Rulemaking Advisory Committee (ARAC) Ice Protection Harmonization Working Group (IPHWG) has submitted recommendations to FAA and JAA which contemplating adding Supercooled Large Droplets (SLD) to the meteorological conditions of part 25 appendix C. Therefore, the AWG recommends no action be taken by the 135ARC.

2) Training for Flight in Icing

- **Pilots should train recovery from ice induced stalls techniques -** AWG recommends that this observation be forwarded to the training work group.
- **Pilots should exit severe icing immediately -** AWG recommends that this observation regarding the need for training to identify and exit severe icing be forwarded to the training work group.

3) The desirability of thorough Pilot reports

PIREPS: The AWG agrees that complete and thorough PIREPS are of considerable value. Icing terminology is being standardized by the ARAC Ice Protection Harmonization Work Group (IPHWG) for use in the AIM. As part of this effort, the PIREP's will be reformatted to improve meteorological reporting. As this PIREP activity is being addressed by outside activities, the AWG recommends no action be taken by the 135ARC.

RECOMMENDATIONS:

1) **Certification for Flight in Icing** - The ARAC Ice Protection Harmonization Working Group (IPHWG) has submitted recommendations to FAA and JAA which address this issue.

Therefore, the AWG recommends no action be taken by the 135ARC.

2) **Training for Flight in Icing** - AWG recommends that these observations be forwarded to the training work group.

3) **Thorough PIREPS for Flight in Icing –** The ARAC IPHWG is addressing PIREP formatting and standardization of icing terminology. Therefore, the AWG recommends no action be taken by the 135ARC.

STEERING COMMITTEE REVIEW:

Recommends no action

FINAL ACTION:

Approved, no action needed.

NOTES:

The is the literal text of the comments submitted to the docket
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AIRFRAME ICING

As we joined the ranks of commercial pilots, we were introduced to airplanes that are certified for "flight into icing conditions." For many of us, that has been the entry to innocent ignorance, or what I call flying "Fat, dumb, and happy." I know that I – and perhaps most of us – have escaped danger unscathed without knowing we were exposed.

Part 25 Certification

What does Part 25 Appendix C certification assure? Is it a 100% guarantee of the ability to continue in icing conditions? No! Depending on temperature and Liquid Water Content, an airplane certified for flight into icing conditions may only be able to deal with ice for as little as 17 ½ nm. in "Continuous Icing" –in stratus clouds, or 3 ½ nm in "Intermittent" –ice in cumulous type clouds. So much for slogging along for an hour in ice at 10,000 to avoid even greater headwinds at 14,000. I, and others like me, have been lucky. Part 25 certification standards protect for droplets as large as 50 microns Mean Volumetric Diameter (MVD) –the size of a sharp point on a pencil. In other words, these are tiny droplets that we are hardly able to see that could cause significant ice on an aircraft.. Although modern aircraft enjoy much better performance enabling faster climbs through icing conditions, we should realize that the certification standards could lead to unwarranted complacency about performance.

Anything larger than 100 - 150 microns – existing at temperatures of 0° C. or less – is called SLD (Supercooled Large Droplet). By the time you can see a droplet – like drizzle – you can be sure that it is significantly larger than 50 microns. NASA has found that when droplets get to 175 microns, because they have the energy required to penetrate the boundary layer and strike aft of the protected areas, there is almost 100% collection efficiency. . That is, if there is SLD of 175 microns or larger, we can anticipate severe icing if we stay in those conditions.

Furthermore, we had operated under the common misconception that if we blew the boots too soon, we would build a bridge to be followed by certain death as the airplane plummeted to the ground with an unbreakable sheet of ice out in front of the airfoil.
Well, Virginia, there may be a Santa, but there is no bridging. NASA has been trying to build a "bridge" for more than 10 years, and they could not produce one on an airplane or in a tunnel. If you see any ice, turn the boots on "continuous." (By the way, there is an AD for airplanes with boots to do just that.) I know that we may see a nice clean boot if we wait for a solid half inch or more, but the scraps left behind from "early" boot activation will be insignificant in cruise flight. Nonetheless, small amounts of ice may be a factor as one nears stall speed. Furthermore, that tail that we cannot see will probably accumulate sooner and more efficiently than the wing. If you see ice on the wiper, please, turn on the boots: the tail you save may be your own! If you are using heat, it should have been on a while ago. Heated wings have a protected area similar to a boot, but the heat actually evaporates the droplets on contact. If the ice only melts, the water may refreeze aft of the protected area – not a good thing. Late application of heat can cause runback, where the water refreezes aft of the protected area. Similarly, nacelle heat needs to be on at 10°C and less when in visible moisture. Remember that expansion within the nacelle inlet can cause a temperature decrease resulting in ice formation while none is present on the airframe. This sort of ice can cause serious disruptions in engine airflow.

Up until recently, the government required airlines only to publish Holdover times, and procedures for deicing/anti-icing on the ground. At least one fatal accident has prompted the government to tell carriers to address severe icing – *in flight*, which is where we can get into serious trouble. Severe icing is a subjective observation: if there is more ice than the system can handle, or if ice is accreting aft of the protected surfaces, it is severe. *No airplane is certified for flight in severe icing.*

Severe Icing is an Experience.

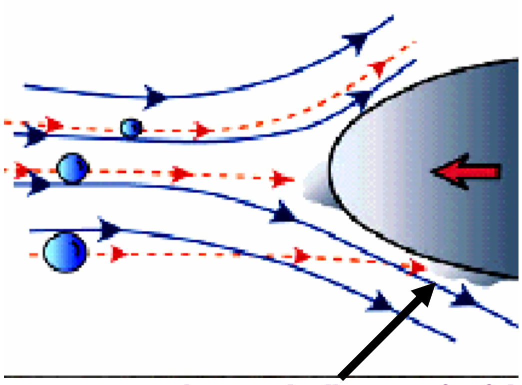
Severe icing does not exist in and of itself. It is a subjective observation. A C-172 with ¼" of rime is experiencing severe icing. A Saab is experiencing severe icing when it begins to accrete aft of the boots, or if it simply cannot keep up with the accretion. If a B-757 is experiencing moderate icing, one should expect a more serious accumulation in aircraft with less climb performance and different ice protection systems. In other words, with valid information, we can anticipate conditions that may cause severe icing. If we do, there are ways to avoid the *experience*. The most important tool for making plans – in the absence of a crystal ball – is PIREPS. Without PIREPS we can make an educated guess sometimes, or just hope for the best.

Holdover Times Anticipated for SAE Type IV Fluid 100% Mixture

Approximate Holdover Times under Various Weather Conditions
(hours: minutes)

OAT	**Freezing Drizzle	Light Freezing Rain
Above 0°	0:40 – 1:10	0:25 – 0:40
0 to -3	0:40 – 1:10	0:25 – 0:40
Below -3 to -14	0:20 – 0:45*	0:10 – 0:25*

A look at the Holdover table for Type IV fluid shows that we should be protected at -3°C. from 25 to 40 minutes in light Freezing Rain. Just to the left, we can see 40 minutes to an hour and 10 minutes in Freezing Drizzle. As long as we are on the ground, we can anticipate that protection, but almost all the fluid will be left on the runway as we takeoff.
Should we anticipate conditions that produce severe icing? Well, light Freezing Rain droplets are larger than 200 microns (remember the 175 mentioned above). If we should *fly* in light Freezing Rain for enough time, we can be sure to accrete aft of the protected surfaces.



Note SLD striking and adhering aft of the boot.

The much longer Holdover times for Freezing Drizzle would lead one to believe that there is much less risk in flying in Freezing Drizzle. Once again, is Freezing Drizzle SLD? The first clue is we can see the droplets. Freezing Drizzle droplets run 150 – 200 microns. Note that the average size is 175, which will impinge on the surface aft of our protected areas. If we fly in those conditions, we *will* experience severe icing.

Freezing Drizzle areas have another interesting characteristic: they have enormous Liquid Water Content (LWC). In fact, NASA has found that a cubic meter of Freezing Drizzle contains *2 to 3 times* the mass of water found in a cubic meter of Freezing Rain! Therefore- with 100% collection efficiency thanks to the size of the droplets - when we fly through Freezing Drizzle, we should expect a great deal more ice to accumulate on the airplane than we would in Freezing

Rain. As long as we stay on the ground, the Freezing Drizzle will not wash away Type IV fluid as quickly as Light Freezing Rain will, but don't let that lead you into a false sense of security regarding *flight* in those conditions.

So, when is it safe to takeoff in conditions of Light Freezing Rain or Freezing Drizzle? If we know that we will be out of the SLD conditions within a thousand feet or so, might we be comfortable? How do we know? Obviously adiabatic rate will not help: there is probably an inversion. As with other icing situations, the best information is from PIREPS. If there is Light Freezing Rain on the surface, there will usually be an inversion less than 2,500 AGL. It may be as low as a few hundred feet, in which case we would not *experience* the severe icing since we would not be in the conditions long enough to accrete significant amounts aft of the protected areas (unless you plan to cruise at two hundred feet!).

We all know that we must not fly in severe icing conditions. If we can fly through the conditions that would produce severe icing quickly enough, we will not experience the severe icing. Most situations that have the potential to cause severe icing are relatively small in terms of geography, thickness, and time. The conditions are seldom more than 3,000' thick: therefore, the best escape is normally a change in altitude. This can be critically important during holding or extensive vectoring. If you find yourself in severe icing conditions during such events, get a new altitude *without delay*. ATC has become quite sensitive to these situations, and you can expect their immediate cooperation. If you stay in severe icing conditions, you are inviting an emergency, the consequences of which you may not be able to control. A certain airline's pilots have numerous stories of severe icing encounters that have resulted in control problems. Fortunately, none has resulted in an accident. While we are on the subject, airplanes with unboosted controls should be flown manually – at least periodically – when in moderate ice. If you leave the airplane on autopilot, you will not feel control feedback that may warn you of impending problems.

We all need to be making more PIREPS. Without PIREPS, we do not know if there is ice, or if there is *negative* icing! Remember, if no one says anything, there is no information for others to make decisions. If you are experiencing ice, report the temp., type, and altitude. If you do not accrete ice in conditions where one might expect ice, report negative icing.

Arrivals.

The requirements to study Holdover times and the obligatory crew actions take no account of arrivals. What do you think about arriving in Light Freezing Rain or Freezing Drizzle? As with departure, the threat is measured by the time you may spend in the SLD conditions. If the inversion is a few hundred AGL, you may not accrete a significant amount prior to landing. On the other hand, if you find yourself in the SLD at - or prior to - the OM, the nature of the situation is different indeed. One pilot described entering SLD at about 1,000 AGL (well inside the FAF), and on post-flight inspection, he found the lower surface of the wing and his side windows covered with ice! If he had needed to go around, the success of the maneuver would have been doubtful. Another crew described entering a cloud during a procedure turn. In about 30 seconds, the aircraft suffered such an accumulation that the stall shaker activated, and they finally recovered in VFR about 1200 AGL!

What can we do to determine if we are accreting aft of the protected areas? Generally, the windshield wipers are the first to accrete because of their small leading edge. If there is an unusually large accretion, that is cause for suspicion – if not concern. If there is ice on the side windows (especially the aft portion), chances are excellent there is accretion on other unprotected areas. Therefore, one might consider turning OFF the Side Window heat in order to get a better idea of the icing conditions that we cannot see – but may be accumulating - aft of the protected areas.

If you are faced with a severe accumulation on short final, anything other than a landing will be an adventure not-to–be-enjoyed. As you slow down, angle of attack increases even if the wing is clean. Now add ice to the equation, and the wing sees an even higher angle of attack.. The margin above stall – if any - has decreased to an unknown point. We have distorted the airfoil, changed the critical angle of attack, and if confronted with a go-around situation, we will be in uncharted territory. The chances of trouble are great and success slim. It may be necessary to exercise emergency authority and land on an occupied runway, or a vacant taxiway – alternatives preferable to stalls close to the ground. Last year, a turboprop crew had such a sudden accumulation, and they declared an emergency. They warned the tower that they would not be able to go around and to plan accordingly: Good thinking.

Several people have asked about practicing ice-encumbered stalls in the simulator. Simulators accurately reproduce events that have been charted in the airplane with sophisticated sensors. The simulators we use simply add gross weight to the equation. The NASA research has shown that distortion of the airfoil is the most significant concern in icing, and the weight increase is of comparatively little consequence. There is no program that demonstrates the violent rolling motions that a few have experienced in some aircraft, and there are no simulators that emulate tail stalls.

Is there any good news?

Yes. As a general rule, airframe icing is experienced in about 40% of encounters where we have visible moisture at temperatures below freezing. As we get into temperatures of -20° C. and less, the chances decrease to about 14%, and they decrease to 0% at -40 °. There must be at least *some liquid* water before any ice accretion is possible. If there is only snow, icing is unlikely since the cloud is completely glaciated – there is no liquid water. (The colder the air mass the less likely is airframe icing.) Severe icing conditions seldom continue laterally more than 50 nm, nor more than 3,000' vertically. The conditions are usually short-lived too. If conditions are dangerous for landing at your destination, they may not last long, and you can probably find a safe alternate within 100 miles.

At the risk of being repetitive, please note that this information makes PIREPS that much more important. Dispatch and ATC (not to mention pilots!) cannot know of actual changes without our reports. Recently, an flight was ready to divert because of reports of severe icing by a 737 departing a field. Shortly, ATC passed along a PIREP from an arriving Dash-8 – on the opposite side of the airport. The Dash had experienced light ice on the arrival a few miles and minutes behind the Boeing. The flight was able to make the planned arrival thanks to timely PIREPS.

Acknowledgment

I am indebted to Bill Rieke of NASA for the wisdom and guidance that he has shared with me. For more than five years he has been generous with his time, and patient with my pestering. He has been especially kind to verify the contents of this paper.

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AWG RECOMMENDATIONS:

1. **Certification for Flight in Icing** - The ARAC Ice Protection Harmonization Working Group (IPHWG) has submitted recommendations to FAA and JAA which address this issue. Therefore, the AWG recommends no action be taken by the 135ARC.
2. **Training for Flight in Icing** - AWG recommends that these observations be forwarded to the training work group.
3. **Thorough PIREPS for Flight in Icing –** The ARAC IPHWG is addressing PIREP formatting and standardization of icing terminology. Therefore, the AWG recommends no action be taken by the 135ARC.

RECOMMENDATION DOCUMENT

NUMBER: AWG-10-STE **VERSION DATE: 5/25/2004**

Source: Docket 2002-13923-17(9) and 2002-13923-68(7)

ISSUE: Transponder Maintenance Checks

Regulation: 91.413, 135.411, Order 8300.10

Consider performance of transponder test/checks under an approved Part 135 maintenance program as opposed to Part 91.413(c) (1) requirement that it can only be accomplished by a properly certificated repair station that is equipped to do the work.

DISCUSSION:

Section 91.413(c)(2) only allows operators that hold a 121 or 135.411(a)(2) continued airworthiness maintenance program (CAMP) to conduct ATC transponder tests and inspections. Part 135 operators of airplanes with 9 or less passengers that have adopted the manufacturers recommended maintenance program or an FAA approved maintenance inspection program under 135.411(a)(1) are not able to perform required ATC transponder tests and inspections. These operators must remove their airplanes from service and bring them to a properly certificated repair station or the aircraft manufacturer for the required ATC transponder tests and inspections. This imposes significant cost and burden upon these operators.

Many of these operators already have authorization to conduct ATC transponder tests and inspections under their existing CAMP procedures which are used to support other aircraft in their fleet. Nevertheless, 91.413 does not allow these operators to conduct the same tests on smaller aircraft that happened to be maintained under a 135.411(a)(1) maintenance program.

The AWG recommends that a certificate holder that utilizes a maintenance program under 135.411(a)(1) be able to conduct ATC transponder tests and inspections in accordance with FAA approved procedures contained within the maintenance section of their manual. This would ensure that the appropriate procedures are used to conduct ATC transponder tests and inspections and that persons performing the work would be required to have the appropriate calibrated and certified equipment, and be properly trained/qualified.

Many operators already utilizing CAMP under 135.411(a)(2) who also maintain aircraft under 135.411(a)(1) could simply reference the appropriate procedures. Operators who do not hold an approved CAMP would be required to put in its manual procedures for an ATC transponder test and inspection program for approval by the administrator.

The AWG recommends an amendment to 91.413(c) and the applicable guidance document, Order 8300.10, to allow the holder of a maintenance program under 135.411(a)(1) to conduct ATC transponder tests and inspections in accordance with an FAA approved procedure.

<u>Current regulation:</u>

§ 91.413 ATC transponder tests and inspections.

(a) No persons may use an ATC transponder that is specified in 91.215(a), 121.345(c), or § 135.143(c) of this chapter unless, within the preceding 24 calendar months, the ATC transponder has been tested and inspected and found to comply with appendix F of part 43 of this chapter; and

(b) Following any installation or maintenance on an ATC transponder where data correspondence error could be introduced, the integrated system has been tested, inspected, and found to comply with paragraph (c), appendix E, of part 43 of this chapter.

(c) The tests and inspections specified in this section must be conducted by -

(1) A certificated repair station properly equipped to perform those functions and holding -

(i) A radio rating, Class III;

(ii) A limited radio rating appropriate to the make and model transponder to be tested;

(iii) A limited rating appropriate to the test to be performed;

(iv) A limited rating for a manufacturer issued for the transponder in accordance with §145.101(b)(4) of this chapter; or

(2) A holder of a continuous airworthiness maintenance program as provided in part 121 or §135.411(a)(2) of this chapter; or

(3) The manufacturer of the aircraft on which the transponder to be tested is installed, if the transponder was installed by that manufacturer**.; or**

[NEW](4) A holder of a maintenance program as provided in §135.411(a)(1) of this chapter with an approved inspection procedure in its manual to perform those functions.

Current Guidance:

Order 8300.10 Volume 2 Chapter 83 for the *Evaluation of part 135 (nine or less) Approved Aircraft inspection Program*

Cost Benefit

Cost benefit can be quantified by multiplying aircraft revenue by available annual flight hours. You would then need to determine what additional time the aircraft would be out of service due to scheduling with outside avionics shops. This number is then subtracted from the annual available number. You would then factor in the cost of supporting a technician and equipment for these inspections.

Example:

Flight Hours Per Day	Revenue Per Hour	Gross Revenue Per Day	Gross Revenue 200 Days/Year
4	2000	8000	1600000

Depending on scheduling of flights and repair station availability revenue can be adversely affected. In this model a one day delay, in returning an aircraft to service, reduces revenue by $8,000.00.

A delay over a weekend or holiday could be increase the loss by a factor of 4 or 5.

The benefit will be increased aircraft availability. This will allows operators to factor their fixed costs over a larger revenue base.

RECOMMENDATION:

The AWG recommends that a certificate holder that utilizes a maintenance program under 135.411(a)(1) be able to conduct ATC transponder tests and inspections in accordance with FAA approved procedures:

Amend 91.413(c) by adding a new subparagraph (4) which reads as follows:

> **(4) A holder of a maintenance program as provided in §135.411(a)(1) of this chapter with an approved inspection procedure in its manual to perform those functions.**

Amend Order 8300.10 Volume 2 Chapter 83 to include minimum criteria for maintenance program procedures to conduct ATC transponder tests and inspections.

STEERING COMMITTEE REVIEW:

Several committee members see this as an important rule to get through on a fast track.

FINAL ACTION:

Approved.

NOTES:

Additional notes.

NUMBER: AWG-11 **VERSION DATE: 10/24/2004**

Source: STE-09 to AWG (formerly OPS-7)
FAA-2002-13923-17 (7) Regional Air Cargo Carriers Assoc.
FAA-2002-13923-17 (10) Regional Air Cargo Carriers Assoc.
FAA-2002-13923-24 (10) Bankair, Inc.
FAA-2002-13923-66 (3) West Air, Inc.
FAA-2002-13923-68 (5) Mountain Air Cargo, Inc.
FAA-2002-13923-71 Cape Air/Nantucket Airlines)

ISSUE: Self-issued Ferry Permits

Regulation: 21.197(c)(2), 135.419, 135.179(c).

Part 135 only allows certain air carriers with a CAMP to establish approved procedures for the self-issuance of ferry permits. Propose change so that a 135 operator with an appropriate maintenance program can self-issue ferry permits in accordance with their FAA approved ops spec procedures.

DISCUSSION:

Problem Statement: *(What is wrong with the old rule)*
Part 135 only allows certain air carriers to establish approved procedures for the self-issuance of ferry permits. Part 135 operators maintaining their aircraft with an AAIP are not eligible for self-issue ferry permits [21.197(c)]. This imposes an economic burden on certain operators because ferry permits are only available during "FAA business hours". Additionally, current rules prohibit carriage of revenue cargo on ferry flights.

- AWG to recommend that any 135 can issue ferry permits IAW approved Ops Spec procedure
- AWG does NOT support ability to carry cargo/passengers on ferry flight

Background: *(Why do you think this change is justified)*
Special Flight Permits (Ferry Permits) are governed by FAR 21:197 and the Air Carriers Operations Specifications D084-1 for those aircraft on a Continuous Airworthiness Maintenance Program as prescribed by FAR 135.411 (a)(2) or (b). Special Flight Permits may also be issued directly from the FAA or Designed Airworthiness Representative under FAR 21.199. The 135 Regulations treat aircraft with seating configurations of ten or more differently then aircraft with nine or less seating configurations. Although the operator has the option of placing nine or less aircraft onto a CAMP program (135.411(b)), this seems unnecessarily burdensome for the operator with no apparent improvement to safety or process. Both nine or less and ten or more aircraft configurations operating under a 135 certificate, more then likely, have maintenance and/or inspection programs in place that follow the manufacturers Chapter Five program. In the case of an operator that operates both nine or less and ten or more aircraft types, they have an acceptable process in place to ferry their aircraft and an operations specification, D084-1, that authorizes them to self ferry. The operator would need only to develop an acceptable program and submit that program to the FAA for approval for the nine or less aircraft the same as for the CAMP aircraft. The operator desires to have his aircraft repaired and returned to service as quickly as possible. In the case of a nine or less operator, he must contact the FAA or a DAR, feed them the information and then wait for a response. If the request happens after hours, week-

ends, or holidays, then the permit may not be issued for days. The increased costs of keeping an aircraft that may be away and incurring parking costs or hangar rent, as well as the operator may have to charter or find other accommodations for his clients. These additional out of service costs while awaiting a ferry permit, could be very high.

The largest burden of the FAR 135 regulations is categorizing aircraft by size, weight, and seating configurations. These categories no longer apply or identify an aircraft as belonging to a certain size or use groupings. Operators that operate both nine or less and ten or more category aircraft and have D084-1 Operations specifications in place have acceptable means in place to self ferry ten or more aircraft. It would stand to reason that these processes would also apply to the nine or less aircraft with the same level of safety.

The recommendation would be to use the regulations to maintain the safety which they were designed to uphold regardless of aircraft size, weight, or seating configuration. The process used by operators to prove to the FAA that they have an adequate program in place to meet the intent and purpose of the regulations to use Operations Specification D084-1 should apply to all aircraft that fall under that program.

(When does this need to be done)
This appears to be accomplishable by merely changing/adding wording to 21.197(c)(2). Considering that the change is not complex, in most cases where operators will desire this Operational Specification, the process is either in place or could be in place easily. The guidance for the Operational Specification already exists.

(Who will be affected and how)
This will affect the fleet operator whose business depends on the ability to return his aircraft to service as quickly as possible. It will also "unburden" the FAA FSDO in needing to issue special flight permits to these operators. It will level the playing field for those operators who have placed their aircraft onto CAMP programs merely to be able to access this Operational Specification.

(What will be the "spill over effect"?)
This change will reduce paperwork and effort within the FAA. No other agencies should be affected. Fleet operators will be better able to return their aircraft to service by placing them where they may be repaired faster. This will translate to improved operating efficiencies. No FAA documentation will need to be rewritten other then the operators procedures (GMM, etc.) Operator or FAA Inspector training will be basically unaffected.

<u>11/17/2003 AWG DISCUSSION</u>

- ACTION: *(How do you propose to change the rule)*
    - Propose reg change to 21.197(c)(2) to add allow holder of 135.411(a)(1) or 135.419 inspection program with an FAA approved Ops Spec procedure for self-issue of a special flight permit
    - Propose change to Order 8300.10 Volume 2 Chapter 89 to reflect this change

<u>2/24/2002 AWG DISCUSSION</u>

- What vehicle used for "accepted/approved procedures" for issuance of ferry permit?

- Operators that have a GMM (i.e. 135.411(a)(2)) can simply add procedures to their GMM for self-issuance of special flight permits for aircraft with less than 9 seats.
- 135 Operations manual could have appendix with self-issuance of special flight permit
- Why was self-issuance of special flight permit limited to 135 with CAMP? Need to review preamble for rationale.
- These privileges would still be recognized under Ops Spec D84. Requires change to Order 8300.10

RECOMMENDATION:

Change FAR 21.197 (c)(2) to read as follows:

Certificate holders authorized to conduct operations under Part 135 for those aircraft they operate and maintain under a continuous airworthiness maintenance program prescribed by §135.411 (a)(2) or (b) of that part, **or an Approved Aircraft Inspection Program prescribed by §135.411 (a)(1) and §135.419 provided procedures acceptable to the Administrator governing issuance of Special Flight Permits and safety standards for flights conducted in accordance with those permits, are incorporated in the operator's manual required by §135.21.**

STEERING COMMITTEE REVIEW:

Summary of discussion with steering committee and recommended actions

FINAL ACTION:

APPROVED

NOTES:

Additional notes.

NUMBER: **AWG-12-STE** **VERSION DATE:** **05/25/2004**

Source: Docket FAA 2002-13923-23

ISSUE: **Seat Removal and Installation**

Regulation: Part 21

Is an STC required to remove seats from an aircraft in order to haul cargo?

DISCUSSION:

Submittal to the Docket

Is an STC required to remove seats from an aircraft in order to haul cargo, when no other changes are made to the design and operation of the aircraft, in airplanes with a continuous cockpit and fuselage cargo bay, which were obviously intended by their manufacturers to be used for mixed or cargo only operation, but not designated as cargo aircraft at certification. Many such aircraft are being utilized on-demand for both passenger operations and for all cargo operations.

The Alaska Air Carriers Association believes that it is not necessary to have and STC or 337 to remove some or all seats from an aircraft to haul cargo. Since seat removal is not a major alteration under Part 43, then seats should be able to be removed as needed so long as there is a method for the flightcrew to determine the weight and balance in all seating configurations.

AWG Discussion

Unless specifically provided for in the Aircraft Flight Manual, the removal of seats is a change in the type design of an aircraft. In accordance with Part 21 certification procedures, a FAA design approval is required, such as a 337 Field Approval or STC

Paragraphs § 135.3(a)(1) and § 135.25(a)(2) require that the aircraft comply with the applicable rules and airworthiness requirements of chapter I, 14 CFR, this requirement is explicit in that the aircraft must meet its certification basis, (whether CAR 4b, CAR 3, part 25 or part 23) to be operated under part 135. Therefore, the aircraft must first meet its certification basis/type design before it is eligible for operation. This means that it would not be possible to simply incorporate a procedure in the operators manual to perform seat removal/installation because the aircraft would not meet its type design. The operating rules do not and can not override the certification basis for the aircraft.

Operators requiring the flexibility to change the configuration of the aircraft by removing/installing seats when needed can obtain a conversion STC, which is design to permit swapping back and forth. The STC covers installation configurations and the conversion procedures

RECOMMENDATION:

Unless specifically provided for in the Aircraft Flight Manual, the removal/installation of seats is a change in the type design of an aircraft and would require a design approval (TC/STC/337). Since existing requirements and guidance are adequate, the AWG recommends no action be taken by the 135ARC.

STEERING COMMITTEE REVIEW:

Agreed, no action needed.

FINAL ACTION:

Approved.

NOTES:

Additional notes.

NUMBER: **AWG-16-STE** **VERSION DATE:** **06/24/2004**

Source: Docket 2002-13923-54(2)

ISSUE: **Oxygen Capacity Requirements**

Regulation: 135.157, 121.333

Inconsistencies in the oxygen capacity requirements of Part 135 (i.e. 1-hour/30-minutes) and Part 121 (10-minutes) have significant economic impact on aircraft design/construction with no apparent safety benefit.

DISCUSSION:

Docket Submittal

FAR 135.157 contains oxygen capacity requirements for pressurized airplanes, including the requirements of FAR 135.157(b)(ii) that, in the event of cabin decompression, that one hour of passenger oxygen be provided, unless the aircraft can descend below 15,000 feet in less than four minutes, in which case only 30 minutes is necessary.

Even for jet aircraft operating over non-mountainous terrain that can descend quickly and easily to lower altitudes where ambient pressure is sufficient to prevent hypoxia, a minimum of 30 minutes of passenger oxygen is required.

This requirement is contrasted with that in FAR 121.333(e)(2) which has similar requirements, except that the minimum oxygen supply requirement is ten minutes.

It is not clear why there are two different oxygen capacity requirements when the exposure to high cabin altitude in the event of a cabin depressurization is the same. Both requirements are objectively structured around cruise altitude (both before and after the pressurization failure) and descent capability, but the FAR 135 requirement requires a much higher minimum capacity for the same passenger exposure.

This difference in requirements has required operators of Embraer aircraft that have moved into FAR 135 operation to modify their airplanes to replace the oxygen canister systems that have sufficient endurance to meet the FAR 121.333 requirement, with a higher capacity gaseous system that meets FAR 135.157(b). Since there is no design or operational reason apparent to Embraer for the difference, we request that the committee review the development of these two requirements and revise FAR 135.157 to more closely match that of FAR 121.333 unless the committee determines that safety considerations justify otherwise."

AWG Discussion

The oxygen requirements of Part 121 and 135 have been developed to take into account the differences in the operations between Domestic, Flag, and Supplemental Air Carriers and Commercial Operators of Large Aircraft (Part 121) and Air Taxi Operators and Commercial Operators (Part 135). Individual sections of Part 121 may be less stringent than the corresponding section 135.157(b)(ii), with regard to oxygen requirements. However, when all related oxygen requirements of Part 121 are taken as a whole it provides a comprehensive and stringent standard which assures the highest level of safety appropriate to the type of operation. Revising Section 135.157 to more closely match a single Section 121.333 would not provide a level of safety equivalent to that established by the existing regulations.

Regulations

Sec. 121.333 Supplemental oxygen for emergency descent and for first aid; turbine engine powered airplanes with pressurized cabins.

…

(e) Passenger cabin occupants. When the airplane is operating at flight altitudes above 10,000 feet, the following supply of oxygen must be provided for the use of passenger cabin occupants:

(1) When an airplane certificated to operate at flight altitudes up to and including flight level 250, can at any point along the route to be flown, descend safely to a flight altitude of 14,000 feet or less within four minutes, oxygen must be available at the rate prescribed by this part for a 30-minute period for at least 10 percent of the passenger cabin occupants.

(2) When an airplane is operated at flight altitudes up to and including flight level 250 and cannot descend safely to a flight altitude of 14,000 feet within four minutes, or when an airplane is operated at flight altitudes above flight level 250, oxygen must be available at the rate prescribed by this part for not less than 10 percent of the passenger cabin occupants for the entire flight after cabin depressurization, at cabin pressure altitudes above 10,000 feet up to and including 14,000 feet and, as applicable, to allow compliance with Sec. 121.329(c) (2) and (3), except that there must be not less than a 10-minute supply for the passenger cabin occupants.

Sec. 135.157 Oxygen equipment requirements.

…

(b) Pressurized aircraft. No person may operate a pressurized aircraft--

(1) At altitudes above 25,000 feet MSL, unless at least a 10-minute supply of supplemental oxygen is available for each occupant of the aircraft, other than the pilots, for use when a descent is necessary due to loss of cabin pressurization; and

(2) Unless it is equipped with enough oxygen dispensers and oxygen to comply with paragraph (a) of this section whenever the cabin pressure altitude exceeds 10,000 feet MSL and, if the cabin pressurization fails, to comply with Sec. 135.89 (a) or to provide a 2-hour supply for each pilot, whichever is greater, and to supply when flying--

(i)At altitudes above 10,000 feet through 15,000 feet MSL, oxygen to at least 10 percent of the occupants of the aircraft, other than the pilots, for that part of the flight at those altitudes that is of more than 30 minutes duration; and

(ii)Above 15,000 feet MSL, oxygen to each occupant of the aircraft, other than the pilots, for one hour unless, at all times during flight above that altitude, the aircraft can safely descend to 15,000 feet MSL within four minutes, in which case only a 30-minute supply is required

Comparison of Oxygen Requirements

The following excerpt from Exemption No. 5192, FAA Docket No. 26106 provides FAA's analysis of a request for an exemption from Section 135.157(b)(2)(ii) 30-minute oxygen supply.

> There are three major purposes for oxygen on an aircraft operated under Part 121 or 135. The first purpose is to

provide oxygen to each person on the aircraft if a loss of cabin pressurization should occur. This oxygen is used while the aircraft descends, in the fastest manner possible, and is referred to as get-down oxygen. The percentage of oxygen in the atmosphere is relatively constant as altitude is increased above the surface of the earth. However, as altitude is increased, density, the pressure that forces the oxygen into the lungs and blood stream, is decreased. Therefore, the percentage of oxygen in the respiration cycle must be increased to compensate and maintain an adequate level of oxygen. Thus, a supplemental supply of oxygen to each person, following decompression must be provided until the aircraft has descended to an altitude at which the density or pressure in the atmosphere has increased to the point that supplemental oxygen is not necessary.

The second reason for oxygen on an aircraft is for sustenance, to provide a means of sustaining life. This supply of oxygen must be supplied whenever the aircraft is operated at an altitude at which the pressure inside the cabin of the aircraft is not sufficient to force the oxygen in the atmosphere into the lungs and the blood stream. This high cabin pressure altitude would exist in (1) a nonpressurized aircraft, (2) an aircraft which had been pressurized but in which the pressurization system has failed, or (3) a pressurized aircraft, but one in which the pressurization system is not capable of providing enough cabin pressure to force the oxygen in the atmosphere into the lungs and blood stream. Operations conducted under these circumstances are governed by sections of the FAR which specify the duration and percentage of the entire number of occupants on the aircraft that supplemental oxygen must be provided for during flight at these altitudes, depending on the actual cabin altitude.

The third reason that oxygen is required on aircraft is for use in first-aid.

In Part 135, all operational oxygen regulations, based on the three reasons to provide oxygen, are contained in Section 135.157. However, in Part 121, the 3 reasons to provide passengers with oxygen are prescribed in separate sections. These separate sections, when taken together, provide the total set of oxygen requirements for Part 121, that for Part 135 are found in Section 135.157. For example, Section 121.329 prescribes supplemental oxygen for sustenance in turbine-engine powered airplanes. Section 121.333 prescribes supplemental oxygen for emergency descent and for first aid in turbine-powered airplanes with pressurized cabins. Section 121.327 prescribes supplemental oxygen requirements for reciprocating engine-powered airplanes. Section 121.331 prescribes supplemental oxygen requirements for pressurized cabin airplanes that are powered by reciprocating engines. Section 121.335 prescribes equipment standards for both reciprocating and turbine engine-powered airplanes.

In Exemption No. 4701 dated August 21, 1986, FAA denied a request to substitute the oxygen supply requirements contained in Section 121.333 (e) (1) and (2) in place of the passenger oxygen dispensing requirements contained in Section 135.157 (b) (2) (ii) because the petitioner failed to show how it would provide a level of safety equivalent to that provided by the regulation. The FAA's denial of this exemption request found that picking and choosing selected sections of Part 121 and Part 135 for oxygen requirements was unacceptable. An equivalent level of safety is only provided when all oxygen requirements of the respective Part are taken together as a whole.

In Exemption No. 5192 dated June 13, 1990, FAA granted an exemption from Section 135.157(b)(2)(ii) to a Part 135 operator because they agreed to comply with the similar complete set of Part 121 oxygen requirements in Sections 121.329, 121.333, 121.335, and 121.391 of the FAR. This grant of exemption accepted an air carrier's proposal to comply with the Part 121 oxygen requirements taken as a whole in lieu of the Part 135 oxygen requirements.

The AWG agrees with FAA's analysis and discussion within Exemption Nos 4701 and 5192 and the conclusion that existing oxygen requirements for Parts 121 and 135 are appropriate for their respective types of operations and that when all related requirements are taken as a whole, the oxygen requirements of parts 121 and 135 establish an equivalent level of safety.

In general, the Part 121 requirement to provide a 10-minute supply of oxygen to passengers accounts for the fact that all flight routes must be approved in advance in accordance with Part 121, Subpart E and that a flight attendant is available on each flight. Route approval takes into consideration availability and adequacy of airports, communication, navigation, and airplane radio facilities, and the ability of the personnel to be used in the operation (121.93). The ability to descend to a safe altitude within the oxygen supply limits in the event of depressurization is one of the considerations reviewed during route approval. In addition, flight attendants trained in emergency procedures are available on Part 121 operations to administer the use of supplemental (portable) oxygen supplies and first-aid oxygen use in the event an emergency requires.

These two exemptions provide sufficient guidance to allow the working group to recommend that the existing oxygen requirements for Parts 121 and 135 are appropriate for their respective types of operations and that when all related requirements are taken as a whole, the oxygen requirements of parts 121 and 135 establish an equivalent level of safety.

Problem With Existing Rule
Aircraft designed and manufactured for airline customers who operate under part 121 must undergo costly modification to the oxygen equipment and capacity system in order to operate under part 135. The level of safety established by part 121 oxygen requirements should also be acceptable for part 135. FAA exemptions have been granted which allow the complete set of Part 121 oxygen capacity requirements to be used in lieu of part 135 requirements.

RECOMMENDATION:

The oxygen requirements of Part 121 and 135 have been developed to take into account the differences in the types of operations under each part. The minimum oxygen quantity requirement of part 121 takes into account related safety requirements which, when taken together, establish an equivalent level of safety to part 135 oxygen requirements (121 is 10 minutes whereas 135 is 30 minutes). The AWG recommends a change to oxygen capacity requirements of 135.157(b)(2)(ii) to allow airplanes which meet the complete set of Part 121 oxygen equipment and quantities of oxygen requirements to operate in Part 135.

<u>Proposed Rule Language</u>

Sec. 135.157 Oxygen equipment requirements.

…

(b) Pressurized aircraft. No person may operate a pressurized aircraft--

(1) At altitudes above 25,000 feet MSL, unless at least a 10-minute supply of supplemental oxygen is available for each occupant of the aircraft, other than the pilots, for use when a descent is necessary due to loss of cabin pressurization; and

(2) Unless it is equipped with enough oxygen dispensers and oxygen to comply with paragraph (a) of this section whenever the cabin pressure altitude exceeds 10,000 feet MSL and, if the cabin pressurization fails, to comply with Sec. 135.89 (a) or to provide a 2-hour supply for each pilot, whichever is greater, and to supply when flying--

- (i)At altitudes above 10,000 feet through 15,000 feet MSL, oxygen to at least 10 percent of the occupants of the aircraft, other than the pilots, for that part of the flight at those altitudes that is of more than 30 minutes duration; and
- (ii)Above 15,000 feet MSL,
  - (A) oxygen to each occupant of the aircraft, other than the pilots, for one hour unless, at all times during flight above that altitude, the aircraft can safely descend to 15,000 feet MSL within four minutes, in which case only a 30-minute supply is required or
  - (B) oxygen equipment and quantities prescribed in 121.329(c) (1), (2), and (3); 121.333(d); 121.333(e) (1), (2), and (3); 121.335(b); and 121.391(a)(1).

NOTE: a summary of the part 121 oxygen requirements that can be used in lieu of 135.157(b)(2)(ii) oxygen capacity requirement is available in the attached Exemption #5192.

Exemption-5192.txt

STEERING COMMITTEE REVIEW:

Summary of discussion with steering committee and recommended actions

FINAL ACTION:

Final recommended action by Steering Committee

NOTES:

Additional notes.

NUMBER: AWG-17-STE **VERSION DATE: 05/25/2004**

Source: Docket 2002-13923-69, -72(8), and -76

ISSUE: Type Ratings for Maintenance Technicians

Regulation: FAR Part 65 Subpart D

Consider establishing maintenance technician "type ratings" for aircraft at or above a defined level of complexity. (i.e. type-rating by product, systems, privileges, etc)

Comments provided at the end of this document!

DISCUSSION:

Issue submitted to the docket:
Establish a higher certification option for mechanics. Transport Canada's system requires maintenance technicians to be type-certified for transport category airplanes in order to have any sign-off privileges.

The FARs already recognize that the differences in operating characteristics between different types of high-performance aircraft are substantial enough to require pilots have specialized training and exhibit proficiency in that type. Those skills must also be regularly demonstrated through proficiency checks. The increasing complexity of modern aircraft also requires different and specialized maintenance skills dependent on the type of aircraft. To assure continued airworthiness and safety of these aircraft, maintenance technicians should be able to quantify their abilities through type ratings.

RAA Comments:
The AMT/AMT(T) mechanics and repairmen NPRM (docket no. 27863) was withdrawn because most in the aviation industry thought it was a bad idea. It remains a bad idea. RAA sees no reason for it to be resurrected; we particularly oppose the concept because our members operate both type of airplanes, transport and non-transport. The proposal therefore conflicted with the "one level of safety" policy implemented by the Commuter Rule. The AMT(T) curriculum added 573 classroom hours. Total classroom hours was approaching that of a BS degree and was suggested at a time when it was difficult to encourage young people to enter the technician trade. Those days (of shortages of mechanics) will return. Adding more classroom time to the Part 147 curriculum is not the answer. Updating the curriculum is something everyone can agree on. All aircraft produced today are "high performance "aircraft. I doubt that any student enters a Part 147 school with aspirations of learning "dope and fabric" techniques. The GAO recently issued a report recommending changes to the current curriculum (GAO-03-317). All agree that a curriculum update, not a new certificate is what is needed.

AWG Discussion:
The Airworthiness Working Group (AWG) discussed the issue of "Type Ratings" for Maintenance Technicians at length. The subject of ratings for mechanics is already identified in FAR Part 65.73 explaining that ratings are issued as (a)(1) Airframe and (a)(2) Powerplant. The

limitations of such ratings are further identified in FAR Part 65.81 General Privileges and Limitations. FAR Part 65.81 explains that "A certified mechanic may perform or supervise the maintenance, preventative maintenance, or alteration of an aircraft…for which he is rated…" "However, he may not supervise the maintenance, preventative maintenance or alteration of, or approve and return to service, any aircraft…for which he is rated unless he has satisfactorily performed the work concerned at an earlier date." The AWG believes that although FAR Part 65.81 is vague, any revisions would best be served in the area of *how* a mechanic maintains his rating and not the addition of aircraft "type specific ratings". Furthermore, a "higher level" of certification already exists through Inspection Authorization. FAR's Part 65.91, 65.92, 65.93 and 65.95 detail the requirements and privileges of Inspection Authorization.

There are three (3) submitted comments to Docket 202-13923 which reference type-ratings for maintenance technicians. Document 202-13923-72 (8) asks for "Higher certification options for mechanics". Document 202-13923-76 states that "Training programs for maintenance personnel should be approved rather than merely accepted. In addition rest and duty limits for maintenance personnel should be tightened up in Part 121 and added to Part 135". In reviewing these comments and the existing regulations, the AWG makes the following recommendation:

1. The industry will not be better served by establishing specific "Type Ratings" for Maintenance Technicians. The cost and administrative complexity of specialized type ratings is not necessary because the desired safety benefits can actually be achieved through appropriate training standards for Maintenance Technicians.

2. No action be taken with regard to AWG-17 to consider establishing matintenance technician type-ratings. The commenter's concerns are valid but will be more accurately addressed in AWG-02 regarding enhancements to Maintenance Technician Training Programs, and AWG-03 Maintenance Technician Duty/Rest Time.

I agree completely with the recommendation of the AWG for the reasons given, as well as noting that a high percentage of maintenance technician's work for small repair stations or small operators who do not have the funds or time available for sending their technician(s) to school for acquiring government mandated type ratings. Additionally, I am not aware of any safety statistic that indicates poorly trained technicians have been a reoccurring cause of aircraft accidents. I would be in favor of developing higher rankings of maintenance technicians as a voluntary option (i.e. "master technician"). PAMA may be currently investigating this option.

RECOMMENDATION:

After reviewing the referenced materials, AWG decided NOT to pursue a type rating for maintenance technicians because the desired safety benefits are actually achieved through appropriate training, not a new system of certification/type rating. AWG-02 will make recommendations to strengthen/enhance Part 135 maintenance technician training programs.

STEERING COMMITTEE REVIEW:

Agreed.

FINAL ACTION:

Approved

NOTES:

Additional notes.

Background

Order 1110.135 established the part 135/125 Aviation Rulemaking Committee (ARC). Aviation industry dynamics, new technology, new aircraft types and configurations, and current operating issues and environment mandate a comprehensive review and rewrite of parts 135 and 125. The general objectives and scope of the committee's work are to complete a comprehensive review and rewrite of parts 135 and 125 and related regulations to:

a. Resolve current issues affecting this part of the industry.
b. Enable new aircraft types, size and design and new technologies in air transportation operations.
c. Provide safety and applicability standards that reflect the current industry, industry trends and emerging technologies and operations.
d. Address international harmonization and ICAO standards.
e. Potentially, rescind part 125 from 14 Code of Federal Regulations.

The part 135/125 ARC tasked a working group to review part 23 for small jets and high performance airplanes expected to operate in part 135. The working group determined that in general, for small jets under 12,500 pounds, the current amendment (23-51) of part 23 is an acceptable minimum standard after incorporating the recommended changes of this rulemaking proposal. Most of the recommended changes are based on the current special conditions being levied against part 23 jets.

The working group recommended that the FAA immediately adopt the new standards outlined in this proposal as special conditions for use on new part 23 turbine projects. They also recommended that the FAA proceed with concurrent rulemaking action to incorporate these rulemaking recommendations as soon as practical. Commuter category was included in the working group's review. They determined that the existing requirements including the proposed requirements provided an appropriate level of safety for jets between 12,500 pounds and 19,000 pounds. This determination was based on a comparison to existing business jets and commuter category turboprops.

The recommendations are based on a review of the existing part 23 requirements. These requirements were compared to the current set of special conditions used for all previous part 23 jet certification programs. The existing and proposed requirements were also compared with an extensive review of all business jet, turboprop, and popular high-performance piston twin accidents for the past 10 (12 for jets) years.

The working group reviewed the following group of accidents:

- 251 business jet accidents (from the May 2004 Flight Safety Digest),
- 145 part 23 turboprop, and
- 254 popular high-performance light twins weighing under 6000 pounds

The working group based its recommendations on the following philosophy; given that all requirements are equal, a near-centerline-thrust jet will offer more safety than a wing-mounted, turboprop or recip. There are numerous safety reasons for supporting this philosophy. Primarily the safety benefits come from a reduced pilot workload and guaranteed performance required of all turbine airplanes following an engine failure. Engine reliability for turbines was also considered a significant factor.

The current special conditions drive the certification standards to higher performance levels that serve as an economic impediment to the development of technically safer airplanes. The working group considered the FAA's goal to reduce accidents and believes that, in the interest of safety, the working group should promote this new class of smaller jets to gradually replace the propeller driven twins.

Numerous manufacturers are developing light jets to replace small reciprocating engine and turboprop airplanes so our efforts also included trying to level the playing field between reciprocating, turboprop, and jet requirements. Where possible, our recommended rule changes are phrased to include all turbines because part 23 requirements should not differentiate between propulsion types unless there is a technical limit forcing this situation. Passengers on a part 23 turboprop or reciprocating engine airplane should have the same safety as those in similar sized jets.

The working group used the following considerations or assumptions relating to the certification of small part 23 jets. Any high performance part 23 airplane applying for certification with performance, flight characteristics, and/or features beyond those considered in this study should expect an FAA evaluation for special conditions.

- Lower wing loadings than are typical for transports or bizjets - results in lower stall speeds that are more comparable to high performance reciprocating and turboprop airplanes. The stall speeds relate directly to takeoff and landing distances and therefore the criticality of those phases of flight.
- Turbine engine reliability. This is an important safety consideration because piston engine twins have a high percentage of accidents originating from the loss of one engine. Moreover, many of these are fatal. The percentage of engine failures for turboprop and turbojets is lower.
- New, small turbofan engines with faster spool-up times than older turbojet engines. This is important because historically there have been landing and go-around accidents where pilots may have failed to account for the spool-up time of their engines resulting in impact with the ground.
- Disking drag from turboprops verses very little drag from the jet. This is consideration for landing and rejected takeoff. While there were runway overrun accidents during takeoff and landing for turboprops, these accidents dominated the non-fatal category for jets.
- This class of small jet will not incorporate complex features more typical in large jets. For example, the working group expect this class of airplane to use trimmable elevators, plain flaps or simple fowler flaps, reversible flight controls, independent spoilers not integrated into flight control systems. In other words, the working group expects the level of complexity to be equivalent to the current fleet of small turboprop airplanes. Our assumption relates directly to the need for a takeoff configuration warning system. Airplanes with a trimmable horizontal tail may be critical for rotation and therefore takeoff distance. This configuration should have a takeoff configuration warning system as required in the commuter category.

These recommendations do not include accelerate/stop and takeoff path requirements for small jets under 12,500 pounds. Takeoff performance will be based on two-engine operation and not single-engine performance as done with jets today. Additionally, normal category doesn't require engine compartment fire extinguishers for the piston and turboprop engines and therefore they aren't proposed here. All existing part 23 jets currently are TC'd with engine compartment fire extinguishers, but the accident study doesn't support the need for fire extinguishers in turbine aircraft.

Preamble

General Discussion of the Proposals and Changes to the Aircraft Regulations

23.3 Airplane categories - The FAA has already granted exemptions for certifying business jets weighing more than 12,500 pounds in part 23. These exemptions restricted the operational use to part 91 and 135 only. The working group didn't see any reason to limit operations if a manufacturer wanted to introduce a 19-seat commuter jet. The only condition is that the manufacturer would need to comply with certain additional part 121 requirements.

The working group also recommends that the FAA delete the term "commuter" in part 23 to eliminate the confusion of the term with commuter operations. Commuter is also an inaccurate term considering the current regulations because there aren't any markets today for commuter category airplanes because all scheduled operations with 10 or more passengers requires a part 25 airplane. The working group proposes that all references to "commuter" category be replaced with the term "normal over 12,500 lbs."

23.49 Stalling Speed – The working group recommended adding language to clarify that V_{SO} relates to maximum landing flap position for stall speed determination. Current part 23 needs amending to clarify the traditional small airplane definition of landing configuration stall speed, V_{SO}. The current FAR and JAR standards read the same and have been amended to look more like the part 25 language. Consequently, this requirement is being interpreted by certification personnel similar to what part 25 has done for the past 5 decades.

23.67 Climb: One Engine Inoperative – The part 23 jets have had special conditions applied that increase the climb gradient above that required by the current regulations. The working group discussed One Engine Inoperative (OEI) performance and reached consensus that improved performance was desirable for all airplanes weighing more than 6000 pounds, not just jets. The accidents studies clearly support better single engine performance for all propulsion types. Because the accidents supported improved OEI performance, the working group recommends that the FAA improve OEI requirements. The working group strongly believed that all airplanes should meet the same climb gradients, not just jets. Consequently, the discussion centered on what would be acceptable for all airplanes. The working group recommended a requirement halfway between current requirements and the commuter category. The working group thinks that 1 percent will offer a significant safety benefit for all turbines and reciprocating powered airplanes over 6000 pounds without having a negative market impact. The third segment climb may also need to be increased accordingly, so the working group recommended that the FAA ask for comments from the manufacturers addressing not only the second, but the third segment climb requirements.

23.73 Reference Landing approach speed – The working group recommended that a V-speed reference mistake be corrected. Reference to V_{SO} should be reference to $V_{S1.}$ The standards need amending to address airplanes being certified under 14 CFR 23 that may have more than one landing flap setting. The V_{REF} speed should be based on 1.3 times the stall speed in the appropriate landing flap configuration, V_{S1}. V_{SO} is by definition the stall speed in the maximum landing flap configuration and is not applicable to other flap configurations.

23.177 Static directional and lateral stability – The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from part 25. part 23 needs to add specific criteria to flight test high-speed flight characteristics that are conservative for high-speed airplane operations. The working group recommended adding specific criteria to subparagraphs (a) and (b) ("V_{FE}, V_{LE}, or V_{FC}/M_{FC} as appropriate") to define original paragraph's "maximum allowable speed" from the special conditions.

23.181 Dynamic stability – The working group recommended that the FAA add current special conditions for jets to 23.181. This section was originally developed for small airplanes without yaw dampers and isn't appropriate for larger airplanes that do typically use yaw dampers.

23.201 Wings level stall – The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from part 25. part 23 needs to amend the current requirements to incorporate additional configurations for all airplanes and a different trim speed for turbines.

23.203 Turning flight and accelerated turning stalls - The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from part 25. part 23 needs to amend the current requirements to incorporate additional configurations for all airplanes and a different trim speed for turbines. The current requirements were written around lower performance reciprocating powered aircraft that typically do not reach the altitudes of the current high performance turbine powered aircraft. The proposed change brings the requirement more in line with the current part 25 requirements and accommodates the differences between the part 23 reciprocating powered aircraft and the turbine powered aircraft.

23.251 Vibration and buffeting - The working group discussed how this rule relates to part 25 and how it was weight driven. Also pointed out that there is a JAR OPS factor associated with this issue. part 25 only requires this for above 25K and M_D>.6 Mach. The working group proposed that the FAA add part 25.251(d) and (e) but limit the requirements to airplanes that fly over 25K and have an M_d faster than 0.6. The working group recommended that the FAA include the reference to V_{DF}/M_{DF}. The proposed additional requirements add paragraphs to 23.251 and 23.253 that should be met if the airplane is faster and higher than 0.6 M and 25,000ft

23.253 High speed characteristics – Same as for 23.251.

23.255 Out of Trim Characteristics – The working group recommended that the FAA add new requirements to consider potential high-speed Mach effects for airplanes with M_{MO} greater than M 0.6 and that incorporate a trimmable horizontal stabilizer.

23.571 Metallic pressurized cabin structures - The working group recommends the FAA amend current part 23 to provide additional pressurized fuselage damage tolerance requirements for high performance aircraft certified for operations above 41,000 feet

23.573 Damage tolerance and fatigue evaluation of structure - The working group recommends the FAA amend current part 23 to provide additional fuselage pressurization damage tolerance requirements for high performance aircraft operating above 41,000 feet

23.574 Metallic damage tolerance and fatigue evaluation of commuter category airplanes - The working group recommends the FAA amend current part 23 to provide additional fuselage pressurization damage tolerance requirements for high performance aircraft operating above 41,000 feet

23.629 Flutter – This standard needs amending to reflect FAA and industry interpretation of the regulation for high speed aircraft. Include in V_{DF}/M_{DF} language from special conditions.

23.703 Takeoff Warning System – The working group recommended that the FAA amends 23.703 to address a new class of airplane that up until now has been addressed using special conditions from part 25. The current part 23 requirements need to be amended to make takeoff warning systems applicable to all part 23 airplanes over 6000 pounds. Airplanes targeted incorporate a trimmable horizontal stabilizer or other features that could affect lift generation in a way that could cause an unsafe condition if not set in a manner approved for takeoff.

23.777 Powerplant controls – The current requirement provides specific cockpit powerplant controls location and height requirements. The last amendment to 23.777 was incorporated to standardize these controls due to operational problems with using the wrong controls on propeller driven aircraft. This requirement, however, didn’t envision single power levers or controls that do not have the separate, distinct controls located in the same areas (such as typical turbojet installations). The FAA currently issues an equivalent level of safety (ELOS) for each single power lever project not withstanding the jet engine operation issues. The working group proposed to amend section 23.777 so that ELOS documents are not needed for future projects.

23.807 Emergency exits –Amend part 23 to provide an alternate means for meeting the requirement for an emergency exit on both sides of multi-engine airplanes that would be above the waterline in the event of a water ditching. For most of the small part 23 jets this creates significant cost and weight impact to add a second emergency exit either in the side of the aircraft or overhead in addition to the main door. The proposed alternative will allow the use of a water barrier to be placed in the door opening prior to opening the door to slow the inflow of water in a manner that would be similar to what would be accomplished with the emergency exit. This has already been approved by means of an Equivalent Level of Safety on several airplanes and the proposal would be to include that option in the rule so that an ELOS is not required for new small airplanes.

23.831 Ventilation – The working group proposed § 23.831(c) and (d) to ensure that in the event of ventilation system failure in turbine powered pressurized airplanes, the temperature and humidity within the airplane shall not exceed values hazardous to the occupants or that affect crew performance

Existing special conditions that have been levied on part 23 jets are equivalent to the requirements in 25.831(g), Amendment 25-87. The special condition requires that any failure or combination of failures that could lead to temperature exposures that would cause undue discomfort must be shown to be improbable. Minor corrective actions (e.g., selection of alternate equipment or procedures) would be allowed if necessary for probable failures. The special condition also requires that any failure or combination of failures that could lead to intolerable temperature exposures must be extremely improbable. Major corrective actions (e.g., emergency descent, configuration changes) would be allowed for an improbable failure condition.

The part 23 special conditions have a time-temperature relationship containing a single-point humidity requirement. It is difficult or impossible to comply with this humidity limit under the assumption of loss of all conditioned airflow for flight following failure, including descent and landing, because this humidity level is often exceeded at lower altitudes at and near sea level for airport ambient conditions. Thus, this requirement would prohibit the use of outside air to ventilate the aircraft during high humidity conditions above 27 mBar.

This proposal is to use different language in the regulation that will specify a more performance-based criteria in that failures cannot hazardously affect crew performance or result in permanent physiological damage to passengers (note that it is a different standard for the crew than the passengers). Associated guidance material would have an acceptable means of compliance that would consider a combination of temperature, humidity, time exposure, and activity level. This standard is a closer approximation of human tolerance to adverse environments than the single point humidity requirement in the existing special conditions.

23.841 Pressurized Cabins – To provide adequate standards for safe operation of part 23 aircraft up to 51,000 feet, the standards need amending to address a new class of airplane that, until now, has been addressed using Special Conditions and grants of Equivalent Level of Safety based on 14 CFR part 25 aircraft Special Conditions and Equivalent Levels of Safety.

The intent of 14 CFR 23.841 is to prevent exposure of the occupants to cabin pressure altitudes that could prevent the flight crew from safely flying and landing the aircraft, or cause permanent physiological injury to the occupants. The intent of the proposed changes to § 23.841 is to provide airworthiness standards that allow subsonic turbine powered pressurized airplanes to operate at their maximum achievable altitudes. This is the highest altitude an applicant chooses to demonstrate that, after decompression: (1) the flight crew will remain alert and be able to fly the airplane; (2) the cabin occupants will be protected from the effects of hypoxia; and (3) in the event some occupants do not receive supplemental oxygen, they will be protected against permanent physiological harm.

Existing rules require the cabin pressure control system to be able to maintain a cabin altitude of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system. Cabin pressure control systems on 14 CFR part 23 airplanes frequently exhibit a slight and brief overshoot above 15,000 feet cabin altitude before stabilizing below 15,000 feet. Existing technology for cabin pressure control systems on 14 CFR part 23 cannot prevent this momentary exceedance, which prevents strict compliance with the rule. Findings of Equivalent Level of Safety have been previously granted for this characteristic, because physiological data shows the brief duration of the overshoot will have no significant effect on the airplane occupants.

Existing Special Conditions that have been levied on 14 CFR part 23 jets are similar and, for operating altitudes above 45,000 feet, equivalent to the requirements in § 25.841, Amendment 25-87. The Special Conditions required consideration of specific failures. Subsequent to the issuance of the Special Conditions, reliability, probability, and damage tolerance concepts addressing other failures and methods of analysis were incorporated into 14 CFR 25. This proposal recommends the use of these additional methods of analysis.

This proposal is to use language in the regulation that will specify a more performance-based criterion such that failures cannot hazardously affect crew performance or result in permanent physiological harm to passengers (note that it is a different standard for the crew than the passengers). Associated guidance material based on prior special conditions would provide an acceptable means of compliance for showing compliance to the amended standards.

Existing part 23 and part 25 regulations require warning of excessive cabin altitude at 10,000 Ft and do not adequately address airfield operation above 10,000 Ft. Rather than disable the cabin altitude warning to prevent nuisance annunciations, grants of Equivalent Level of Safety have been issued that allow the warning altitude setting to be shifted above the maximum approved field elevation, not exceeding 15,000 Ft. This proposal incorporates language from existing Equivalent Levels of Safety into the regulation.

23.853 Passenger and crew compartment interiors – The working group recommended that the FAA delete the requirement for lettering size of “No Smoking” or “No Smoking in Lavatory” placards. Currently, 23.853(d)(2) specifies that placards are required to have red letters at least ½ inch high on a white background at least 1 inch high. The letter size is currently not a requirement for part 23 normal category nor for part 25 transport category aircraft. This requirement for lettering size is unique to part 23 commuter category. “No Smoking” lettering size in part 25 was deleted at amendment 25-72 when the requirements where moved from part 25.853 to part 25.791, effective Aug 20, 1990.

23.1141 Powerplant controls – The language in this section is difficult to define in (e) because it came from the part 33 rules but isn’t complete. The working group noted that there aren’t any of the single engine manufacturer’s really analyzing the criticality of their control system to the limit that could be applied from this rule? Therefore, the working group recommended a fundamental change that will make the “engine control system” come under 1309. The recommended rule change is mainly so the applicant will consider environmental effects of integration of the control design scheme into the airplane. The working group was very clear that this recommended requirement is not intended to invalidate or overrule the part 33 certification but to consider the airframe/engine interface.

23.1165 Engine ignition systems – Propose to eliminate the term “turboprop.”

23.1301 Function and installation - The purpose of this particular rulemaking effort is to update this regulation to what is considered a more reasonable approach to certification of equipment standards. The proposed change would require certificating only the equipment required for type certification and/or operations rules to “perform their intended function”. The proposed change is deleting to § 23.1301(d) “ Function properly when installed”. Paragraph (d) of the current § 23.1301 (“Function and installation”) states that each item of installed equipment must “function properly when installed.” This rule applies to all equipment installed in the airplane whether if required or not required. The new rule would reduce the burden since it would be required only on equipment required for type certification or operating rules. The

FAA proposes to delete this paragraph, because it would be redundant to the proposed revision to § 23.1309(a).

23.1305 Powerplant instruments – Currently the FAA grants an ELOS to applicants for direct-reading, digital powerplant instruments. The working group recommended that the FAA codify requirements based on these ELOS grants. The language should be similar to that provided in AC 23-1311-1A for direct-reading, digital powerplants.

Regulation requires that powerplant displays referred to as "indicators" in 23.1305 provide trend or rate-of-change information. AC 23.1311-1A provides basis for Equivalent Safety Finding when the indicators don't have trend information. The items in the AC should be codified into part 23 because this has become a "generic" Equivalent Safety Finding for many electronic display systems.

23.1309 Equipment, Systems, and installations - The working group recommended that this rulemaking effort update section 23.1309 to what is currently being accomplished for this class of airplane. Some of the major issues being addressed and are summarized as follows:

- Applying clarification to 23.1309 that is currently cited in Advisory Circular (AC) 23.1309-1C.
- Adding electronic engine controls to be applicable in section 23.1309 to eliminate the requirement for special conditions.
- Deleting unnecessary and redundant requirements.
- Incorporating probability values and software and hardware assurance levels for the four classes of airplanes that are currently in AC 23.1309-1C.
- Replacing outdated failure conditions terminology with the updated/current terminology.
- Warning for unsafe conditions would not have to be provided if the airplane has adequate inherent characteristics
- Moving the power source capacity and distribution requirements from section 23.1309 to a new section.

The introduction provides a clarification of applicability: The FAA's historical policy in applying the requirements of § 23.1309 has been to consider that the rule is one of general applicability. This change is reducing the burden by applying § 23.1309 of the current rule to only certain sections. This means that the requirements of the § 23.1309 are not applicable to any specific requirements contained in another section of part 23. Since software or hardware development assurance levels are not addressed elsewhere in part 23, the development assurance criteria by the use of this section with AC 23.1309-1C or later version are applicable. Subpart E, powerplant systems are added for electronic engine control (EEC) systems for only their installation effects. The evaluation should be limited to only the interfaces of the engine control system and verify the installation does not invalidate any of the assumptions made for part 33 certification of the engine. The analysis should not extend into data submitted and approved as part of the engine certification program. Currently, special conditions have been applied to electronic engine controls. The functions of the EEC may be considered critical. Additionally, the EEC system may be susceptible to disruption of both command/response/engine health-monitoring signals as a result of electrical and magnetic interference. This disruption of signals could result in the loss of critical engine functions, flight displays and annunciations, or present misleading information, including the health of the engine, to the pilot.

DELETE;
(a) Each item of equipment, each system, and each installation:
(1) When performing its intended function, may not adversely affect the response, operation, or accuracy of any--
(i) Equipment essential to safe operation; or
(ii) Other equipment unless there is a means to inform the pilot of the effect.
(2) In a single-engine airplane, must be designed to minimize hazards to the airplane in the event of a probable malfunction or failure.
(3) In a multiengine airplane, must be designed to prevent hazards to the airplane in the event of a probable malfunction or failure.
(4) In a commuter category airplane, must be designed to safeguard against hazards to the airplane in the event of their malfunction or failure.

Explanation: Delete 23.1309(a). This section is not needed with the new 23.1309(a) and current 23.1309(b) and AC 23.1309-1C/D that developed four classes of airplanes and with various probability ranges. It is a duplication of requirements with paragraphs (a) and (b). AC 23.1309-1C/D allows a much better approach to safety assessment when qualitative analysis and engineering judgment are encouraged. Originally most of 23.1309 (a) requirements were for older airplanes that were developed by amendment 23-14. These airplanes can use the older certification basis when applicable. Also, with 23.1309 (b) an evaluation is required even on airplanes without complex systems. If the systems are not complex, the AC 23.1309-1C/D does not require a quantitative assessment.

ADD.
(a) The airplane equipment and systems must be designed and installed so that:

(1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the airplane operating and environmental conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes.

(2) Other equipment and systems do not adversely affect the safety of the airplane or its occupants, or the proper functioning of those covered by sub-paragraph (a)(1) of this paragraph.

Explanation: The FAA proposes to revise § 23.1309(a) to specify that, with certain exceptions, the airplane equipment and systems must be designed and installed so that they "perform as intended" under the airplane's operating and environmental conditions. The proposed change broadens the scope of existing paragraph 23.1309(a) to all installed airplane equipment and systems whose improper functioning would reduce safety regardless of whether required by type certification rules, operating rules, or not required. The phrase "improper functioning" is intended to identify equipment and system failures that have an effect on airplane safety and are therefore failure conditions. Any installed equipment or system, the failure or malfunction of which results in a minor or more severe failure, that is, catastrophic, hazardous, and major. (I'm not clear on this use of the term "minor or more severe". It seems to me that people could interpret the "more severe differently. Is there some way we can clarify this? If you change it you need to change the next page also.) condition is considered to have an effect on the safe operation of the airplane.

Paragraph 23.1309(a) would have requirements for two different classes of equipment and systems installed in the airplane. Paragraph 23.1309(a)(1) covers the equipment and systems that have a safety effect, or are installed in order to meet regulatory requirement. This class of equipment and systems are required to "perform as intended under the airplane operating and environmental conditions." Paragraph 23.1309(a)(2) requires all other equipment and systems to not have an effect on the safe operation of the airplane. Consequently these equipment and systems are not required to "perform as intended."

Clarification of "Perform as Intended":

The FAA sometimes finds type designs subject to such failures acceptable if these failures are judged to not significantly contribute to the risks already accepted under § 23.1309(b). For example, some degradation in functionality and capability are routinely allowed during some environmental qualifications, such as HIRF and lightning testing. In fact, paragraph (d) of § 23.1309 (System lightning protection") specifically allows the functionality and capabilities of some electrical/electronic systems to be lost when the airplane is exposed to lightning, provided that "these functions can be recovered in a timely manner."

Clarification of "Under the Airplane Operating and Environmental Conditions":

With this proposed revision to § 23.1309(a), the conditional qualifiers of "when installed" and "under any foreseeable operating condition," contained in the current §§ 23.1301(d) and 23.1309(b)(1), would be replaced by:

"... under the airplane operating and environmental conditions ..."

The proposed phrase is intended to mean:

- throughout the full normal operating envelope of the airplane, as defined by the Airplane Flight Manual, together with any modification to that envelope associated with abnormal or emergency procedures and any anticipated crew action; and
- under the anticipated external and internal airplane environmental conditions, as well as any additional conditions where equipment and systems are assumed to "perform as intended".

This change was made in response to the observation that although certain operating conditions are foreseeable, achieving normal performance when they exist is not always possible. For example, ash clouds from volcanic eruptions are foreseeable, but airplanes with current technology cannot safely fly in such clouds.

Provisions for Equipment and Systems with No Safety Effect on the Operation of the Airplane:

Modern airplanes contain equipment that is not intended to have an effect on the safe operation of the airplane. Typically, this equipment is associated with amenities for the passengers and includes such items as:

- entertainment displays,
- audio systems,
- in-flight telephones,
- non-emergency lighting, and
- equipment for food storage and preparation.

A problem for airplane manufacturers arises when certification authorities have questioned installations of this type when the equipment does not perform in accordance with its system specifications and, therefore, is "not functioning properly when installed." This poses a non-compliance issue because the regulations require that all equipment, systems, and installations function properly when installed.

However, the proper functioning of "amenities," such as those items listed above, is not necessary for the safe operation of the airplane. The only safety issues associated with this type of equipment and systems are the possibility that, as a result of its normal operation or in the event of its failure, it could directly injure someone or adversely affect the functioning of the crew or other equipment and systems. Accordingly, the provision for exceptions in the proposed § 23.1309(a)(2) allows these types of "amenities" to be approved even if they frequently do not perform as intended.

Under proposed § 23.1309(a)(2), any frequent failure of amenities to "perform as intended" must not adversely affect the safety of the airplane or its occupants, or the proper functioning of the equipment and systems that do have a safety impact. That is, they must not directly injure persons or adversely affect the crew or other equipment and systems. The intent of this accommodation is to reduce the cost of certification to airplane and equipment manufacturers without reducing the level of safety provided by part 23. No safety benefit is derived from demonstrating that equipment performs as intended, if failing to perform as intended would not result in a "minor" or more severe failure condition that is, catastrophic, hazardous, and major. Instead, as a minimum, the FAA would require that a qualitative evaluation of the design and installation of such equipment and systems as installed in the airplane be performed to determine that neither their normal operation nor their failure will adversely affect crew workload, the operation of other systems, or the safety of persons.

The FAA expects that, in most cases, normal installation practices will result in sufficiently obvious isolation of the impacts of such equipment on safety that substantiation can be based on a relatively simple qualitative installation evaluation. If the possible impacts, including failure modes or effects, are questionable or isolation between systems is provided by complex means, more formal structured evaluation methods or a design change may be necessary.

Environmental Qualification of "Amenities": In accordance with the proposed revision to § 23.1309, the environmental qualification requirements for certification of the airplane equipment and systems that are not associated with any functional hazard would be reduced to those tests necessary only to verify that their presence, operation, or failure does not:

- interfere with the proper operation of other equipment,
- directly injure anyone, or
- increase the flightcrew's workload unreasonably.

Although these types of equipment and systems are not required to function properly when installed, they would be required to be functioning when they are tested to verify that they do not interfere with the operation of other airplane equipment and systems and do not pose a hazard in and of themselves. Other environmental testing for this type of equipment is no longer required.

DELETE:

(b) The design of each item of equipment, each system, and each installation must be examined separately and in relationship to other airplane systems and installations to determine if the airplane is dependent upon its function for continued safe flight and landing and, for airplanes not limited to VFR conditions, if failure of a system would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions. Each item of equipment, each system, and each installation identified by this examination as one upon which the airplane is dependent for proper functioning to ensure continued safe flight and landing, or whose failure would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions, must be designed to comply with the following additional requirements:

(1) It must perform its intended function under any foreseeable operating condition.

(2) When systems and associated components are considered separately and in relation to other systems--

(i) The occurrence of any failure condition that would prevent the continued safe flight and landing of the airplane must be extremely improbable; and

(ii) The occurrence of any other failure condition that would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions must be improbable.

(4) Compliance with the requirements of paragraph (b)(2) of this section may be shown by analysis and, where necessary, by appropriate ground, flight, or simulator test. The analysis must consider--

(i) Possible modes of failure, including malfunctions and damage from external sources;

(ii) The probability of multiple failures and the probability or undetected faults;

ADD:

(b) The airplane systems and associated components for the appropriate classes of airplane, considered separately and in relation to other systems, must be designed and installed so that:

(1) Each catastrophic failure condition

(i) is extremely improbable; and

(ii) does not result from a single failure; and

(2) Each hazardous failure condition is extremely remote; and

(3) Each major failure condition is remote.

Explanation. The FAA proposes to revise § 23.1309(b) to reduce the certification burden by dividing the small airplanes into four classes of airplanes, to require that the airplane systems and associated components considered separately and in relation to other systems must be designed and installed so that the requirements would be the same as AC 23.1309-1C/D. It updates the terminology and adds the classes airplanes as defined in AC 23.1309-1C/D, uses the later terms, and makes it read much easier to determine compliance.

Since their adoption by the FAA, these probability guidelines and their role in demonstrating and finding compliance with §23.1309(b) have been a source of misinterpretation, confusion, and controversy. The FAA intends the numerical values in AC 23.1309-1C/D associated with the probabilistic terms in §23.1309(b) to be used as acceptable risk guidelines in those cases where the effect of system failures are examined by quantitative probability methods of analysis. The use of numerical probability analysis and these guidelines is simply intended to supplement, but not replace, qualitative methods based on engineering and operational judgments. Whether a design meets these guidelines simply provides some evidence to support an informed finding by the FAA as to whether or not the design complies with the intent of the rule.

The Intent of the Term "Extremely Improbable":

The objective of using this term in the regulations has been to describe a condition (usually a failure condition) that has a probability of occurrence so remote that it is not anticipated to occur in service on any commuter category airplane to which the standard applies. For other classes of airplanes, likelihood of occurrence may be greater. However, while a rule sets a minimum standard for all the airplanes to which it applies, compliance determinations are limited to individual type designs. Experience indicates that the level of conservatism traditionally provided in proper safety assessments more than compensates for the cumulative risk effects across airplane types.

The means of demonstrating that the occurrence of an event is “extremely improbable” varies widely, depending on the type of system, component, or situation that must be assessed. Failure conditions arising from a single failure are not considered “extremely improbable;” thus, probability assessments normally involve failure conditions arising from multiple failures. Both qualitative and quantitative assessments are used in practice, and both are often necessary to some degree to support a conclusion that an event is “extremely improbable.” Generally, performing only a quantitative analysis to demonstrate that a failure condition is extremely improbable is insufficient due to the variability and uncertainty in the analytical process. Any analysis used as evidence that a failure condition is extremely improbable should include justification of any assumptions made, data sources and analytical techniques to account for the variability and uncertainty in the analytical process. Refer to AC23.1309-1C/D, or later revision, for acceptable means of compliance. In short, wherever part 23 requires that a condition be “extremely improbable,” the compliance method -- whether qualitative, quantitative, or a combination of the two -- along with engineering judgment, must provide convincing evidence that the condition should not occur in service.

Inclusion of Specific Failure Condition Categories and Probabilities:

The proposed § 23.1309(b) would include specific terms to describe failure condition categories and probabilities that are in current usage within the aviation industry. It is recognized that some of these terms may be used elsewhere within 14 CFR with different meanings. The FAA may consider issuing a miscellaneous regulatory amendment in the future to standardize the use of these terms to classify failure conditions. However, for the purposes of this proposed regulation, these terms are defined in AC 23.1309-1C/D.

Although the terminology in § 23.1309(b) would be changed from the current regulation, the intent would not be changed. The new text of the rule would serve to “document” and formally institute the current interpretation and application of these terms.

Prohibiting Catastrophic Single Failures:

The proposed text of § 23.1309(b) would explicitly include a fail-safe design requirement that single failures must not result in catastrophic failure conditions, regardless of their probability. This has been the FAA’s practice and, in fact, was the only requirement of this sort under the FAA’s early Civil Air Regulations (CAR) and the earliest version of part 23. Further guidance concerning § 23.1309(b) has been made part of the new proposed Advisory Circular (AC) 25.1309-1C/D.

Additional Explanation taken from AC 23.1309-1C. The safety objective is to ensure an acceptable safety level for equipment and systems installed on the airplane. A logical and acceptable inverse relationship should exist between the Average Probability Per Flight Hour and the severity of Failure Conditions effects (as shown in the Figure 2 of AC 23.1309-1C/D). This figure defines the appropriate airplane systems probability standards for four certification classes of airplanes designed to 14 CFR part 23 standards. The relationship between probability and severity of Failure Condition Effects is as follows:

- Failure Conditions with No Safety Effect have no probability requirement.
- Minor Failure Conditions may be Probable.
- Major Failure Conditions must be no more frequent than Remote.
- Hazardous Failure Conditions must be no more frequent than Extremely Remote.
- Catastrophic Failure Conditions must be Extremely Improbable.

(1) The four certification classes of airplanes in Figure 2 are as follows: Class I (Typically SRE under 6,000 pounds (#)), Class II (Typically MRE and STE under 6,000 pounds), Class III (Typically SRE, STE, MRE, and MTE equal or over 6,000 pounds), and Class IV (Typically Commuter Category). The acronyms for these airplanes in the four classes of part 23 airplanes are Single Reciprocating Engine (SRE), Multiple Reciprocating Engine (MRE), Single Turbine Engine (STE), and Multiple Turbine Engine (MTE).

(2) Numerical values are assigned for use in those cases where the impact of system failures is examined by quantitative methods of analysis. Also, the related new Software Development Assurance Levels for the various Failure Conditions are part of the matrix. The new probability standards are based on historical accident data, systems analyses, and engineering judgment for each class of airplane.

(3) In assessing the acceptability of a design, the FAA recognized the need to establish rational probability values. Historically, failures in GA airplanes that might result in Catastrophic Failure Conditions are predominately associated with the primary flight instruments in Instrument Meteorological Conditions (IMC). Historical evidence indicates that the probability of a fatal accident in restricted visibility due to operational and airframe-related causes is approximately one per ten thousand hours of flight for single-engine airplanes under 6,000 pounds. Furthermore, from accident data bases, it appears that about 10 percent of the total were attributed to Failure Conditions caused by the airplane's systems. It is reasonable to expect that the probability of a fatal accident from all such Failure Conditions would not be greater than one per one hundred thousand flight hours or 1×10^{-5} per flight hour for a newly designed airplane. It is also assumed, arbitrarily, that there are about ten potential Failure Conditions in an airplane that could be catastrophic. The allowable target Average Probability Per Flight Hour of 1×10^{-5} was thus apportioned equally among these Failure Conditions, which resulted in an allocation of not greater than 1×10^{-6} to each. The upper limit for the Average Probability per Flight Hour for Catastrophic Failure Conditions would be 1×10^{-6}, which establishes an approximate probability value for the term "Extremely Improbable." Failure Conditions having less severe effects could be relatively more likely to occur. Similarly, airplanes over 6,000 pounds have a lower fatal accident rate; therefore, they have a lower probability value for Catastrophic Failure Conditions.

c. Acceptable criteria for Software and Hardware Development Assurance Levels of part 23 airplanes are shown in Figure 2.

(1) The criteria shown in Figure 2 directly reflect the historical accident and equipment probability of failure data in the Civil Air Regulations (CAR) 3 and 14 CFR part 23 airplane fleet. Characteristics of the airplane, such as stall speed, handling characteristics, cruise altitude, ease of recognizing system failures, recognition of entry into stall, pilot workload, and other factors (which include pilot training and experience) affect the ability of the pilot to safely handle various types of system failures in small airplanes. The criteria considered over all airplanes' Failure Conditions is based on service experience, operational exposure rates, and total airplane system reliability. The values for individual system probability of failure could be higher than probability values shown in Figure 2 for specific Failure Conditions since it considers the installed airplane systems, events, and factors.

(2) These classes were defined based on the way accident and safety statistics are currently collected. Generally, the classes deal with airplanes of historically equivalent levels of system complexity, type of use, system reliability, and historical divisions of airplanes according to these characteristics. However, these classes could change because of new technologies and the placement of a specific airplane in a class must be done in reference to all the airplane's missions and performance characteristics. The applicant should have the cognizant certification authority concurrence on the applicable airplane class early in the program. When unusual situations develop, consult the Small Airplane Directorate to obtain specific policy guidance or approval.

(3) For example, multi-turbine-engine airplanes traditionally have been subject to more stringent requirements than a single-engine reciprocating airplane, with the fuel consumption of a reciprocating engine, which permits a wider stall-cruise speed ratio than traditional turbine-engine airplanes. Such an airplane with a stall speed under 61 knots with simple systems, and with otherwise similar characteristics to a traditional single-engine reciprocating airplane (except for a higher cruise speed and a more reliable engine that is simpler to operate), can be treated as a Class I airplane under this analysis. Conversely, if a single-engine reciprocating airplane has the performance, mission capability, and system complexity of a higher class (such as cabin pressurization, high cruise altitude, and extended range), then that type of airplane design may align itself with the safety requirements of a higher class (for example, Class II airplane). These determinations should be made during the development of the certification basis.

DELETE:
(b) (3) Warning information must be provided to alert the crew to unsafe system operating conditions and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed to minimize crew errors that could create additional hazards.

ADD:
(c) Information concerning unsafe system operating conditions must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimize crew errors which could create additional hazards.

Explanation:
Description of the Specific Changes:

The FAA proposes to revise the text of § 23.1309(b)(3) to continue to require that:

- information concerning unsafe system operating conditions be provided to the crew to enable them to take appropriate corrective action, and
- systems and controls, including indications and annunciation, be designed to minimize crew errors that could create additional hazards.
- The proposed revised paragraph § 23.1309(c) would also require that a warning indication be provided if immediate corrective action is required.

Categorization of Required Flightcrew Information:

Proposed § 23.1309(c) would be compatible with the requirements of the current § 23.1322 ("Warning, caution, and advisory lights"), which distinguishes between caution, warning, and advisory lights installed on the flight deck. Rather than only providing a warning to the flightcrew, which is required by the current rule, the proposed § 23.1309(c) would require that information concerning unsafe system operating conditions be provided to the flightcrew.

A warning indication would still be required if immediate action by a flightcrew member were required. However, the particular method of indication would depend on the urgency and need for flightcrew awareness or action that is necessary for the particular failure. Inherent airplane characteristics may be used in lieu of dedicated indications and annunciations if they can be shown to be timely and effective. However, the use of periodic maintenance or flightcrew checks to detect significant latent failures when they occur is undesirable and should not be used in lieu of practical and reliable failure monitoring and indications.

Minimization of Crew Errors:

The proposed wording of § 23.1309(c) is intended to clarify the current rule by specifying that the design of systems and controls, including indications and annunciations, must minimize crew errors that could create additional hazards. The additional hazards to be minimized are those that could occur after a failure and are caused by inappropriate actions made by a crew member in response to the failure. Unless they are accepted as part of normal aviation abilities, any procedures for the flightcrew to follow after the occurrence of a failure indication or annunciation should be described in the approved Airplane Flight Manual (AFM), AFM revision, or AFM supplement.

Interpretation of Unsafe System Operating Conditions:

The following interpretive material provides guidance to aid in making determinations as to whether a given system operating condition is "unsafe". It is not intended to be the only way to define an unsafe condition.

Any system operating condition which, if not detected and properly accommodated by crew action, would significantly contribute to or cause one or more serious injuries is an "unsafe system operating condition" for the purposes of this regulation. Even if airplane operation or performance is unaffected or insignificantly affected at the time of a failure, information to the flightcrew is required if it is considered necessary for the flightcrew to take any action or observe any precautions. If operation or performance is unaffected or insignificantly affected, information and alerting indications may be inhibited during specific phases of flight where informing the flightcrew is considered more hazardous than not informing them.

DELETE:

(c) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:

(1) Loads connected to the power distribution system with the system functioning normally.

(2) Essential loads after failure of--

(i) Any one engine on two-engine airplanes; or

(ii) Any two engines on an airplane with three or more engines; or

(iii) Any power converter or energy storage device.

(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.

(d) In determining compliance with paragraph (c)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

Explanation: The FAA proposes to remove the current paragraphs (c) and (d) from § 23.1309 and include them as a new § 23.1310. These requirements are not directly related to the other safety and analysis requirements of § 23.1309, and the FAA considers it appropriate to state them separately for the purpose of clarity. There would be no change to these requirements, other than their new section number. The addition of proposed § 23.1310 would entail no significant change to the current requirements, and there would be no increase in costs associated with it.

DELETE AND CHANGE

(e) In showing compliance with this section with regard to the electrical power system and to equipment design and installation, critical environmental and atmospheric conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered. For electrical generation, distribution, and utilization equipment required by or used in complying with this chapter, the ability to provide continuous, safe service under foreseeable to the airplane operating and environmental conditions may be shown by environmental tests, design analysis, or reference to previous comparable service experience on other airplanes.

Explanation: Current paragraph (e) is being deleted since it is redundant to proposed paragraph (a). Except the words “including radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered” are being retained and moved to propose paragraph (a) with the environmental conditions.

CHANGE and DELETE

(d) As used in this section, "systems" refers to all pneumatic systems, fluid systems, electrical systems, mechanical systems, and powerplant systems. Included in the airplane design, except for the following:

(1) Powerplant systems provided as part of the certificated engine.

(2) The flight structure (such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments) whose requirements are specific in subparts C and D of this part.

Explanation: Paragraph identification is changed from (f) to (d). Deleted the exceptions. The exceptions and applicability were added to the introductory paragraphs. The words “The flight structure such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments” are being retained and moved to the introductory paragraphs.

23.1310 Power Source capacity and distribution - The working group proposes to remove the current paragraphs (c) and (d) from § 23.1309 and include them as a new § 23.1310. These requirements are not directly related to the other safety and analysis requirements of § 23.1309, and the working group considers it appropriate to state them separately for the purpose of clarity. There would be no change to these requirements, other than their new section number. The addition of proposed § 23.1310 would entail no significant change to the current requirements, and there would be no increase in costs associated with it.

23.1311 Electronic display instrument systems - The working group recommended that this rulemaking effort update section 23.1311 to what is currently being accomplished for this class of airplane.

In paragraph (a) (5), replace “individual electronic display indicators” with “electronic display parameters” for clarification that has caused confusion. These electronic display parameters could be integrated on one electronic display that is independent from the primary flight display. In paragraph (a) (6), after the word cues add ”that provides a quick glance sense of rate and when appropriate trend information” for clarification of sensory cue that has caused confusion.

In paragraph (a) (7), the word equivalent was added after incorporate to allow instrument markings on electronic displays that are equivalent to those instrument markings on conventional mechanical and electromechanical instruments.
In paragraph (b), After the word will replace “remain available to the crew without need for immediate action” with “be available within one second to the crew with a single pilot action or by automatic means.”

These changes would allow reversionary flight displays as additional displays such as secondary primary flight display (PFD) or a Multifunction Display (MFD) that can provide a secondary means to provide primary flight information (PFI). The function of a MFD system is to provide the crew access to a variety of data, or combinations of data, used to fly the aircraft, to navigate, to communicate, and to manage aircraft systems. MFD"s may also display PFI as needed to ensure continuity of operations. MFD's are designed to depict PFI, navigation, communication, aircraft state, aircraft system management, terrain, weather, traffic, and/or other information used by the flight crew for command and control of the aircraft. Display of PFI on reversionary (secondary) displays should be arranged in the basic T-configuration. However, the displays should be legible and usable from the pilot's position with minimal head movement. The reversionary (secondary) guidance display, if required, may be outside the pilot's primary field-of-view, if it is usable from the pilot's position with minimum head movement. There would be three acceptable methods.

1. Reversionary flight information should be presented by an independent source and display to prevent complete loss of PFI due to a single failure. Reversionary flight information need not be continuously displayed as long as the information is available without crewmember action for any single failure or probable combination of failures.

2. Primary information displayed continuously on the reversionary displays could be available during critical phases of flight (e.g., takeoff, landing, and missed or final approach) is acceptable. Manual activation of reversionary displays through single action by the pilot is acceptable when procedures to activate them are accomplished prior to entering critical phases of flight.

3. Another acceptable method is automatic selection and with a single pilot action to restore information essential for continued safe flight and landing via duplicate displays on the PFD and MFD. Most all detectable faults involving display of essential information (attitude, altitude, and airspeed) should result in an automatic selection of secondary information or reversion of the PFD to the MFD.

The electronic display system for this configuration should have a two-display system that incorporates dual, independently powered Attitude Heading Reference (AHRS) and dual Air Data Computer (ADC) sub-systems that provide primary flight parameters. This configuration is significantly more reliable than presently certified mechanical systems, and the skills required while flying in reversionary mode are identical to those used when flying in primary mode.

The configuration provides backup information essential to continued safe flight and landing by the use of an intuitive control that allows instant, simultaneous access to reversionary mode on both the PFD and MFD displays. The single pilot action would force both the PFD and MFD displays into reversionary mode operation. The system response time should provide flight critical information on the MFD in less than one second after switch operation.

The single pilot action should be within easy reach of the pilot and is quickly and positively identified by the red color and the lighted red "halo" ring that announces its position on the panel.

The proposed design should incorporate an automatic reversion capability that provides a complete display of all intended flight, navigation, communication, and engine information on the remaining display within one second in the event a fault is detected. A majority of possible faults are covered by this capability. Only a total loss of the display is presently identified as not capable of being reliably detected automatically, but such a failure condition would be obvious to the pilot. In the event of such a malfunction, a single pilot action by the pilot should provide a full display of all information on the remaining display within one second of the button being pushed. All modes, sources, frequencies, flight plan data, etc. would be exactly as they were on the PFD prior to the failure. The availability of a nearly identical display of all flight information in the same format as normally shown on the PFD provides a significant safety enhancement over reversion to external standby instruments, especially when the size, location, arrangement, and information provided by the standby instruments is significantly different from that on the PFD. Traditional external standby flight instruments (either electronic or mechanical) offer potential safety problems associated with 1) delay in pilot determination of the need to transition to standby instruments, and 2) transition to partial panel techniques as opposed to a simple action to switch displays.

23.1317 High Intensity Radiated Field (HIRF) Protection

The purpose of this particular rulemaking effort is to update this regulation with the standard High Intensity Radio Field (HIRF) requirements that have been imposed on applicants for many years by FAA and JAA Special Conditions, however, this proposal includes the harmonized requirements that were developed by the JAA and FAA within the ARAC Process for part 23/25/27/29.

There is no current codified standard relative to this subject except as applied through Special Conditions. Current standards were written for aircraft having systems that were less susceptible to High Intensity Radiation Fields than are some of the systems currently being installed on modern aircraft.

The proposed addition will incorporate Special Conditions that have been levied to applicants for this requirement to include the JAA requirement. The standards for these HIRF requirements have been harmonized with the JAA though the ARAC process for part 23/25/27/29. It is specifically noted that these requirements have a higher level of certitude in comparison to the standard FAA Special Conditions that have been issued for U.S. type certificate projects.

Current FAA and JAA special conditions differ greatly in the application of Special Conditions; Current FAA Special Conditions are written around standard DO-160 Equipment Qualification testing and only address Critical System Functions. Current JAA Special Conditions are written around the Proposed ARAC EHWG Proposed NPRM/NPA and address Critical, Hazardous, and Major Functions. JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23.

Having two different requirements results in having to certify to meet the U.S. Special Conditions and then having to repeat the effort to meet the JAA requirements with the resulting added costs of doing the job twice. Accepting the JAA requirements will eliminate this duplicate effort.

Due to the differences in requirements between the two special conditions, completely different compliance methods are required. JAA compliance methods require means of requirements driven by the proposed AC/AMJ. This requires the OEM to address them differently.

The intent of this regulatory change is to update the regulations to the current practices, to include the JAA standards, used for this class of airplane.

Note: The proposed change to 23.1321 was deleted, It is a duplication of 23.1305. Also, this concept was incorporated in revised section 23.1311.

23.1331 – The working group made recommendations that are meant to apply to those instruments that rely on a power source and provide required flight information. Such instruments are those that provide information for direct control of flight that are required by the “kinds of operation” for which the airplane has been approved. Consequently, this section applies to all flight instruments required by 14 CFR part 23, § 23.1303 and part 91, § 91.205. Therefore, instruments in airplanes limited to VFR operations that are not required for VFR would not have to comply with the requirements of § 23.1331.

Each independent power source must provide sufficient power for normal operations throughout the approved flight envelope of the airplane and for any operations for which the airplane is approved. For example, an IFR approved airplane must have independent power sources for the display of attitude that are not limited to altitudes below the approved service ceiling of the airplane.

Section 23.1331(c) does not require the installation of dual alternators or vacuum systems on single engine airplanes. Typically these single engine airplanes used one of each system, effectively meeting the independent power requirement. Other options include a dedicated battery with a 30 minute capacity for electrical instrument loads essential to continued safe flight and landing, use of differently powered types of instruments for primary and standby, or verifying the aircraft battery used for starting by a system safety analysis per § 23.1309.

23.1443 Minimum mass flow of supplemental oxygen – The standards need amending to address a new class of airplane that can operate at higher altitudes than originally anticipated for part 23 aircraft. Up until now very high altitudes have been addressed using special conditions derived from part 25. The working group recommended this amendment because there are a number of new jet and high performance aircraft that can operate at higher altitudes than previously envisioned for part 23 aircraft.

23.1447 Equipment standards for oxygen dispensing units – The standards need amending to address a new class of airplane that can operate at higher altitudes than originally anticipated for part 23 aircraft. Up until now very high altitudes have been addressed using special conditions derived from part 25. The working group recommended this amendment because there are a number of new jet and high performance aircraft that can operate at higher altitudes than previously envisioned for part 23 aircraft.

23.1505 Airspeed Limitations – The working group proposed this amendment because it has been standard practice for jets for many years and included on all part 23 jet special conditions.

This amendment acknowledges that airspeed limits should be based on a combination of theoretical (V_D/M_D) and demonstrated (V_{DF}/M_{DF}) dive speeds.

23.1545 Airspeed Indicator – The working group recommended that the FAA amend the regulatory language in 23.1545 to limit the white flap arc/band to reciprocating engine airplanes. This reflects standard practice for jet for many years and included on all part 23 jet special conditions.

23.1555 Control markings – Most modern turbine powered airplanes have a calibrated fuel quantity indicating system that is density compensated and very accurately indicates the actual usable fuel quantity in each tank. Many airplanes are frequently operated with less than full fuel tanks. The placards or markings required by § 23.1555(d)(1)&(2) reflect only the maximum capacity of the tank and would indicate usable fuel only if it were filled to that capacity. Further, this "capacity" is not compensated for fuel density and would indicate usable fuel only if the tank was full with standard density fuel. The placards required by § 23.1555(d)(1)&(2) are therefore redundant relative to the current industry practice and may be misleading. The working group recommends that the requirements be amended to reflect current industry practice.

23.1559 Operating limitations placard - The requirements specified on this placard are relative to preflight planning and not normally referenced in flight. As long as the placard is "in clear view of the pilot" and can be viewed by the pilot at night using a flashlight or other means, the intent of the rule is met. The requirement to light the placard has not been uniformly applied. This change makes the lighting intent clear.

23.1567 Flight maneuver placard – The working group recommended that the FAA clarify the lighting requirements for the maneuvering speed placard. Maneuvering speed is applicable to operations that may involve intentional large control input and is therefore not applicable to normal night operations. Many modern airplanes have means for the landing gear speed to be displayed in the airspeed indicator or on lighted portions of the landing gear control and for the airspeed indicator to display low speed awareness or other airspeed reference information to provide safety above V_{MC}. Lighting this placard is redundant and provides further source of lighting reflections in the cockpit.

Proposed Rule

23.3 Airplane categories - proposed change:

(d) The commuter category is limited to, multiengine airplanes that have a seating configuration, excluding pilot seats, of 19 or less, and a maximum certificated takeoff weight of 19,000 pounds or less. The commuter category operation is limited to any maneuver incident to normal flying, stalls (except whip stalls), and steep turns, in which the angle of bank is not more than 60 degrees.

23.49 Stalling Speed - proposed change

(a) V_{SO} (landing configuration is full flaps) and V_{S1} are the stalling speeds or the minimum steady flight speeds, in knots (CAS), at which the airplane is controllable with…

23.67 Climb: One Engine Inoperative – proposed change:

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category--
(1) The steady gradient of climb at an altitude of 400 feet above the takeoff surface must be not less than 1% with the-
(i) Critical engine inoperative and its propeller (if applicable) in the minimum drag position;
(ii) Remaining engine(s) at takeoff power;
(iii) Landing gear retracted;
(iv) Wing flaps in the takeoff position(s); and
(v) Climb speed equal to that achieved at 50 feet in the demonstration of Sec. 23.53.

23.73 Reference Landing approach speed – proposed change:

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category, the reference landing approach speed, V_{REF}, must not be less than the greater of V_{MC}, determined in Sec. 23.149(c), and 1.3 V_{S1}.

(c) For commuter category airplanes, the reference landing approach speed, VREF, must not be less than the greater of 1.05 V_{MC}, determined in Sec. 23.149(c), and 1.3 V_{S1}.

23.177 Static directional and lateral stability – proposed change:

(a) The static directional stability, as shown by the tendency to recover from a wings level sideslip with the rudder free, must be positive for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with symmetrical power up to maximum continuous power, and at speeds from $1.2V_{S1}$ up to the landing gear or wing flap operating limit speeds, or V_{NO} or V_{FC} / M_{FC} , whichever is appropriate. The angle of sideslip for these tests must be appropriate to the type of airplane. At larger angles of sideslip, up to that at which full rudder is used or a control force limit in Sec. 23.143 is reached, whichever occurs first, and at speeds from $1.2V_{S1}$ to V_O, the rudder pedal force must not reverse.
(b) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip with the aileron controls free, may not be negative for all landing gear and flap positions. This must be shown with symmetrical power from idle up to 75 percent of maximum continuous power at speeds from $1.2V_{S1}$ in the takeoff configuration(s) and at speeds from $1.3V_{S1}$ in other configurations, up to the maximum allowable airspeed for the configuration being investigated, (V_{fe}, V_{le}, V_{N0}, V_{FC} / $M_{FC,}$ whichever is appropriate) in the takeoff, climb, cruise, descent, and approach configurations. For the landing configuration, the power is that required to maintain a 3-degree angle of descent in coordinated flight. The angle of sideslip for these tests must be appropriate to the type of airplane, but in no case may the constant

heading sideslip angle be less than that obtainable with a 10 degree bank, or if less, the maximum bank angle obtainable with full rudder deflection or 150 pound rudder force.
(c) For airplanes with V_{MO}/M_{MO} established under 23.1505(c), the rudder gradients must meet the requirements of paragraph (b) at speeds between V_{MO}/M_{MO} and V_{FC}/M_{FC} except that the dihedral effect (aileron deflection opposite the corresponding rudder input) may be negative provided the divergence is gradual, easily recognized, and easily controlled by the pilot.
(d) Paragraph (b) of this section does not apply to acrobatic category airplanes certificated for inverted flight.
(e) In straight, steady slips at 1.2 V_{S1} for any landing gear and flap positions, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron type of airplane. At larger slip angles, up to the angle at which full rudder or aileron control is used or a control force limit contained in §23.143 is reached, the aileron and rudder control movements and forces must not reverse as the angle of sideslip is increased. Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the airplane must not result in uncontrollable flight characteristics.

23.181 Dynamic stability – proposed change:

…and rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased up to the maximum appropriate to the (b) Any combined lateral-directional oscillations ("Dutch roll") occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane must be damped to $\frac{1}{10}$ amplitude in 1) 7 cycles below 18,000 ft, and 2) 13 cycles from 18,000 ft to the certified maximum altitude with the primary controls--

(1) Free; and

(2) In a fixed position.

23.201 Wings level stall – proposed change

(d) During the entry into and the recovery from the maneuver, it must be possible to prevent more than 15 degrees of roll or yaw by the normal use of controls except as provided for in paragraph (e).
(e) For airplanes approved for operations above 25,000 feet, during the entry into and the recovery from stalls performed above 25,000 feet, it must be possible to prevent more than 25 degrees of roll or yaw by the normal use of controls.
(f) Compliance with the requirements of this section must be shown under the following conditions:

(1) Wing Flaps: Retracted, fully extended, and each intermediate normal operating position as appropriate for the altitude.

(2) Landing Gear: Retracted and extended as appropriate for the altitude.

(3) Cowl Flaps: Appropriate to configuration.

(4) Spoilers/speedbrakes: Retracted and extended unless they have little to no effect at low speeds

(5) Power:

(i) Power / Thrust off; and

(ii) For Reciprocating Engine Powered Airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power result in extreme nose-high attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of $1.4V_{SO}$, except that the power may not be less than 50 percent of maximum continuous power; or

(iii) For Turbine Engine Powered Airplanes: The maximum engine thrust except that it need not exceed the thrust necessary to maintain level flight at $1.6V_{S1}$ (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

23.203 Turning flight and accelerated turning stalls – proposed changes:

(c) Compliance with the requirements of this section must be shown under the following conditions:
(1) Wings Flaps: Retracted, fully extended, and each intermediate normal operating position as appropriate for the altitude:
(2) Landing Gear: Retracted and extended as appropriate for the altitude;
(3) Cowl Flaps: Appropriate to configuration;
(4) Spoilers/speedbrakes: Retracted and extended unless they have little to no effect at low speeds;
(5) Power:
(i) Power / Thrust off; and
(ii) For Reciprocating Engine Powered Airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power result in extreme nose-high attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of $1.4V_{SO}$, except that the power may not be less than 50 percent of maximum continuous power; or
(iii) For Turbine Engine Powered Airplanes: The maximum engine thrust except that it need not exceed the thrust necessary to maintain level flight at $1.6V_{S1}$ (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

23.251 Vibration and buffeting – proposed change:

(a) There must be no vibration or buffeting severe enough to result in structural damage, and each part of the airplane must be free from excessive vibration, under any appropriate speed and power conditions up to V_{DF}/M_{DF}. In addition, there must be no buffeting in any normal flight condition severe enough to interfere with the satisfactory control of the airplane or cause excessive fatigue to the flight crew. Stall warning buffeting within these limits is allowable.
(b) For an airplane with M_D greater than .6 or with a maximum operating altitude greater than 25,000 feet, the positive maneuvering load factors at which the onset of perceptible buffeting occurs must be determined with the airplane in the cruise configuration for the ranges of airspeed or Mach number, weight, and altitude for which the airplane is to be certificated. The envelopes of load factor, speed, altitude, and weight must provide a sufficient range of speeds and load factors for normal operations. Probable inadvertent excursions beyond the boundaries of the buffet onset envelopes may not result in unsafe conditions.

23.253 High speed characteristics – proposed changes:

(b) Allowing for pilot reaction time after occurrence of the effective inherent or artificial speed warning specified in Sec. 23.1303, it must be shown that the airplane can be recovered to a normal attitude and its speed reduced to V_{MO}/M_{MO}, without—
(1) Exceptional piloting strength or skill.
(2) Exceeding V_D/M_D, V_{DF}/M_{DF}, the maximum speed shown under Sec. 23.251, or the structural limitations; or

(3) Buffeting that would impair the pilot's ability to read the instruments or to control the airplane for recovery.

23.255 Out of Trim Characteristics – proposed change:

(a) From an initial condition with the airplane trimmed at cruise speeds up to V_{MO}/M_{MO}, the airplane must have satisfactory maneuvering stability and controllability with the degree of out-of-trim in both the airplane nose-up and nose-down directions, which results from the greater of--

(1) A three-second movement of the longitudinal trim system at its normal rate for the particular flight condition with no aerodynamic load, except as limited by stops in the trim system, including those required by Sec. 23.655(b); or

(2) The maximum mistrim that can be sustained by the autopilot while maintaining level flight in the high-speed cruising condition.

(b) In the out-of-trim condition specified in paragraph (a) of this section, when the normal acceleration is varied from +1g to the positive and negative values specified in paragraph (c) of this section--

(1) The stick force vs. g curve must have a positive slope at any speed up to and including V_{FC}/M_{FC} ; and

(2) At speeds between V_{FC}/M_{FC} and V_{DF}/M_{DF} the direction of the primary longitudinal control force may not reverse.

(c) Except as provided in paragraphs (d) and (e) of this section, compliance with the provisions of paragraph (a) of this section must be demonstrated in flight over the acceleration range--

(1) -1g to +2.5g; or

(2) 0 g to 2.0 g, and extrapolating by an acceptable method to -1g and +2.5g

(d) If the procedure set forth in paragraph (c)(2) of this section is used to demonstrate compliance and marginal conditions exist during flight test with regard to reversal of primary longitudinal control force, flight tests must be accomplished from the normal acceleration at which a marginal condition is found to exist to the applicable limit specified in paragraph (b)(1) of this section.

(e) During flight tests required by paragraph (a) of this section, the limit maneuvering load factors prescribed in Secs. 23.333(b) and 23.337 need not be exceeded. In addition, the entry speeds for flight test demonstrations at normal acceleration values less than 1 g must be limited to the extent necessary to accomplish a recovery, without exceeding V_{DF}/M_{DF}.

(f) In the out-of-trim condition specified in paragraph (a) of this section, it must be possible from an overspeed condition at V_{DF}/M_{DF} to produce at least 1.5g for recovery by applying not more than 125 pounds of longitudinal control force using either the primary longitudinal control alone or the primary longitudinal control and the longitudinal trim system. If the longitudinal trim is used to assist in producing the required load factor, it must be shown at V_{DF}/M_{DF} that the longitudinal trim can be actuated in the airplane nose-up direction with primary surface loaded to correspond to the least of the following airplane nose-up control forces:

(1) The maximum control forces expected in service as specified in Secs. 23.301 and 23.397.

(2) The control force required to produce 1.5g.

(3) The control force corresponding to buffeting or other phenomena of such intensity that it is a strong deterrent to further application of primary longitudinal control force

23.571 Metallic pressurized cabin structures – proposed changes:

For normal, utility, and acrobatic category airplanes, the strength, detail design, and fabrication of the metallic structure of the pressure cabin must be evaluated under one of the following:

(a) A fatigue strength investigation in which the structure is shown by tests, or by analysis supported by test evidence, to be able to withstand the repeated loads of variable magnitude expected in service; or
(b) A fail safe strength investigation, in which it is shown by analysis, tests, or both that catastrophic failure of the structure is not probable after fatigue failure, or obvious partial failure, of a principal structural element, and that the remaining structures are able to withstand a static ultimate load factor of 75 percent of the limit load factor at *V*C, considering the combined effects of normal operating pressures, expected external aerodynamic pressures, and flight loads. These loads must be multiplied by a factor of 1.15 unless the dynamic effects of failure under static load are otherwise considered.

(c) The damage tolerance evaluation of §23.573(b).

(d) If certification for operation above 41,000 feet is requested, a damage tolerance evaluation of the fuselage pressure boundary per §23.573(b) must be conducted and the evaluation must account for the requirements of paragraph (c) of section 23.841.

23.573 Damage tolerance and fatigue evaluation of structure

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must account for the requirements of paragraph (c) of section 23.841.

23.574 Metallic damage tolerance and fatigue evaluation of commuter category airplanes

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must account for the requirements of paragraph (c) of section 23.841.

23.629 Flutter

(b) Flight flutter tests must be made to show that the airplane is free from flutter, control reversal and divergence and to show that—
(1) Proper and adequate attempts to induce flutter have been made within the speed range up to V_D;
(2) The vibratory response of the structure during the test indicates freedom from flutter;
(3) A proper margin of damping exists at V_{DF}/M_{DF} ; and
(4) There is no large and rapid reduction in damping as V_D or V_{DF}/M_{DF} , as appropriate, is approached.
(c) Any rational analysis used to predict freedom from flutter, control reversal and divergence must cover all speeds up to 1.2 V_D or V_{DF}/M_{DF}, as appropriate.

23.703 Takeoff Warning System

(a) The system must provide to the pilots an aural warning that is automatically activated during the initial portion of the takeoff role if the airplane is in a configuration that would not allow a safe takeoff. The warning must continue until--

(1) The configuration is changed to allow safe takeoff, or

(2) Action is taken by the pilot to abandon the takeoff roll.

(b) The means used to activate the system must function properly for all authorized takeoff power settings and procedures and throughout the ranges of takeoff weights, altitudes, and temperatures for which certification is requested

23.777 Powerplant controls

(d) When separate and distinct control levers are co-located (such as located together on the pedestal), the control location order … and mixture control (condition lever and fuel cut-off for turbopropeller-powered airplanes).

23.807 Emergency exits

(e) For multiengine airplanes, ditching emergency exits must be provided in accordance with the following requirements, unless the emergency exits required by paragraph (a) or (d) of this section already comply with them:

(1) One exit above the waterline on each side of the airplane having the dimensions specified in paragraph (b) or (d) of this section, as applicable; and

(2) If side exits cannot be above the waterline, there must be a readily accessible overhead hatch emergency exit that has a rectangular opening measuring not less than 20 inches wide by 36 inches long, with corner radii not greater than one-third the width of the exit, or

(3) In lieu of paragraph (e)(2) of this section, if any side exit or exits cannot be above the waterline, a device must be placed at each of such exit or exits prior to ditching, to slow the inflow of water when such exit is, or such exits are, opened with the airplane in a ditching emergency. For commuter category airplanes, the clear opening of such exit or exits must meet the requirements defined in paragraph (d) of this section.

23.831 Ventilation – proposed changes

(a) each passenger and crew compartment must be suitably ventilated. Carbon monoxide concentration may not exceed one part in 20,000 parts of air.

(b) For pressurized airplanes, the ventilating air in the flightcrew and passenger compartments must be free of harmful or hazardous concentrations of gases and vapors in normal operations and in the event of reasonably probable failures or malfunctioning of the ventilating, heating, pressurization, or other systems and equipment. If accumulation of hazardous quantities of smoke in the cockpit area is reasonably probable, smoke evacuation must be readily accomplished starting with full pressurization and without depressurizing beyond safe limits.

(c) For turbine powered pressurized airplanes, under normal operating conditions and in the event of any probable failure conditions of any system which would adversely affect the ventilating air, the ventilation system must provide a sufficient amount of uncontaminated air to enable the crew members to perform their duties without undue discomfort or fatigue and to provide reasonable passenger comfort. For normal operating conditions, the ventilation system must be designed to provide each occupant with at least 0.55 pounds of fresh air per minute. In the event of the loss of one source of fresh air, the supply of fresh airflow must not be less than 0.4 pounds per minute for any period exceeding five minutes.

(d) Other probable and improbable Environmental Control System failure conditions that adversely affect the passenger and crew compartment environmental conditions must not affect crew performance that would result in a hazardous condition and no occupant shall sustain permanent physiological harm.

23.841 Pressurized Cabins

(a) If certification for operation above 25,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet, in event of any probable failure condition in the pressurization system. During the decompression, the cabin altitude shall not exceed 15,000 feet for more than 10 seconds and not exceed 25,000 feet for any duration.

(b) Pressurized cabins must have at least the following valves, controls, and indicators for controlling cabin pressure:

(1) Two pressure relief valves to automatically limit the positive pressure differential to a predetermined value at the maximum rate of flow delivered by the pressure source. The combined capacity of the relief valves must be large enough so that the failure of any one valve would not cause an appreciable rise in the pressure differential. The pressure differential is positive when the internal pressure is greater than the external.

(2) Two reverse pressure differential relief valves (or their equivalent) to automatically prevent a negative pressure differential that would damage the structure. However, one valve is enough if it is of a design that reasonably precludes its malfunctioning.

(3) A means by which the pressure differential can be rapidly equalized.

(4) An automatic or manual regulator for controlling the intake or exhaust airflow, or both, for maintaining the required internal pressures and airflow rates.

(5) Instruments to indicate to the pilot the pressure differential, the cabin pressure altitude, and the rate of change of cabin pressure altitude.

(6) Warning indication at the pilot station to indicate when the safe or preset pressure differential is exceeded and when a cabin pressure altitude of 10,000 feet is exceeded. The 10,000 foot cabin altitude warning can be increased up to 15,000 feet for operations from high altitude airfields provided:

(i) The landing or the take off modes (normal or high altitude) shall be clearly indicated to the flight crew.
(ii) Selection of normal or high altitude airfield mode shall require no crew action beyond normal pressurization system operation.
(iii) The pressurization system shall be designed to ensure cabin altitude does not exceed 10,000 feet when in flight above FL250.
(iv) The pressurization system and cabin altitude warning system shall be designed to ensure cabin altitude warning at 10,000 feet when in flight above FL250.

7) A warning placard for the pilot if the structure is not designed for pressure differentials up to the maximum relief valve setting in combination with landing loads.

(8) A means to stop rotation of the compressor or to divert airflow from the cabin if continued rotation of an engine-driven cabin compressor or continued flow of any compressor bleed air will create a hazard if a malfunction occurs.

(c) If certification for operation above 41,000 feet and not more than 45,000 feet is requested,

(1) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any probable pressurization system failure in conjunction with any undetected, latent pressurization system failure condition:

(i) If depressurization analysis shows that the cabin altitude does not exceed 25,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 1.

(ii) Maximum cabin altitude is limited to 30,000 feet. If cabin altitude exceeds 25,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.

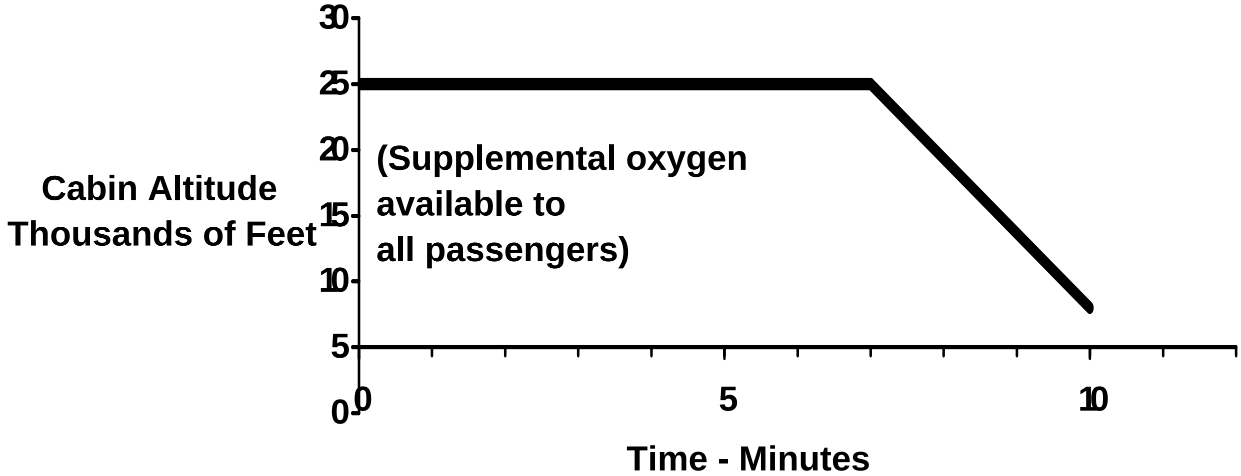
(2) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any single pressurization system failure in conjunction with any probable fuselage damage:

(i) If depressurization analysis shows that the cabin altitude does not exceed 37,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 2.

(ii) Maximum cabin altitude is limited to 40,000 feet. If cabin altitude exceeds 37,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.

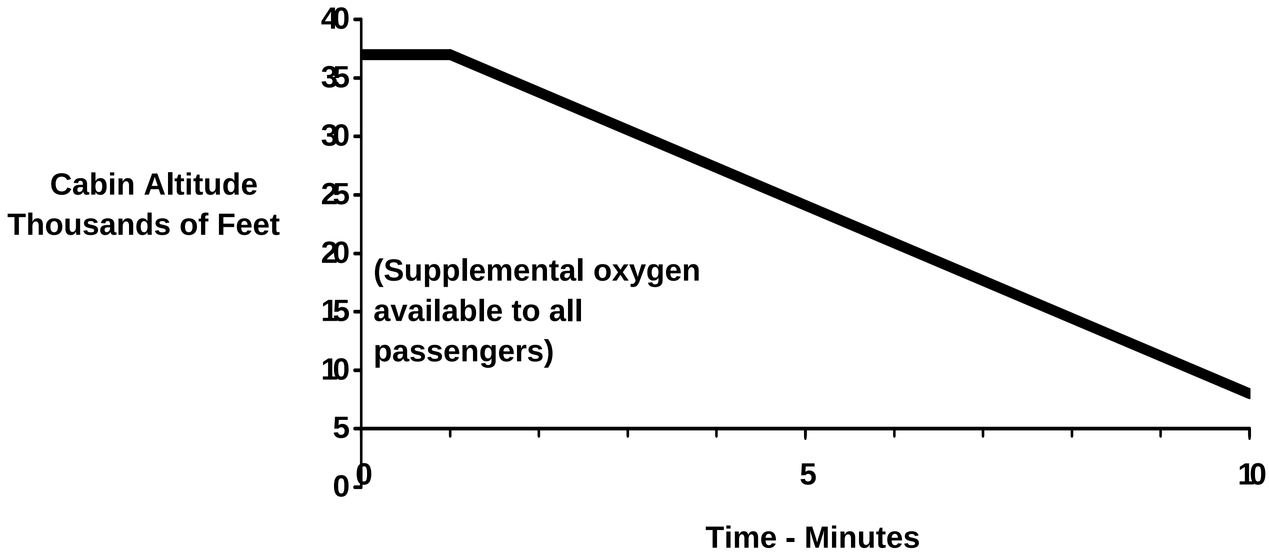
(3) In showing compliance with paragraphs (c)(1) and (c)(2) above, it may be assumed that an emergency descent is made by an approved emergency procedure. A 17-second crew recognition and reaction time must be applied between cabin altitude warning and the initiation of an emergency descent. Fuselage structure,

engine and system failures are to be considered in evaluating the cabin decompression.



Cabin Altitude - Time History
Figure 1

Note: For Figure 1, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.



Cabin Altitude - Time History
Figure 2

Note: For Figure 2, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.

(d) If certification for operation above 45,000 feet and not more than 51,000 feet is requested,
(1) Pressurized cabins must be equipped to provide a cabin pressure altitude of not more than 8000 feet at the maximum operating altitude of the airplane under normal operating conditions.

(2) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any failure condition not shown to be extremely improbable:

(i) Twenty-five thousand (25,000) feet for more than 2 minutes: or

(ii) Forty thousand (40,000) feet for any duration.

(3) Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.

(4) An aural or visual signal (in addition to the cabin altitude indicating means in (b)(6) above) must be provided to warn the flight crew when the cabin pressure altitude exceeds 10,000 feet.

(5) The sensing system and pressure sensors necessary to meet the requirements of (b)(5), (b)(6), and (d)(4) above and CFR14 part 23.1447 paragraphs (e) and (f), must, in the event of low cabin pressure, actuate the required warning and automatic presentation devices without any delay that would significantly increase the hazards resulting from decompression.

(e) If certification for operation above 41,000 feet is requested, additional damage-tolerance requirements are necessary to prevent fatigue damage that could result in a loss of pressure that exceeds the requirements of paragraphs (c) and (d) of this section. Sufficient full scale fatigue test evidence must be provided to demonstrate that this type of pressure loss due to fatigue cracking will not occur within the Limit of Validity of the Maintenance program for the airplane. In addition, a damage tolerance evaluation of the fuselage pressure boundary must be performed assuming visually detectable cracks and the maximum damage size for which the requirements of paragraphs (c) and (d) of this section can be met. Based on this evaluation, inspections or other procedures must be established and included in the Limitations Section of the Instructions for Continued Airworthiness required by **§** 23.1529.

23.853 Passenger and crew compartment interiors

(d) In addition, for commuter category airplanes the following requirements apply:

(2) Lavatories must have “No Smoking” or “No Smoking in Lavatory” placards located conspicuously on each side of the entry door and self-contained, removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if it can be seen from the cabin side of each lavatory door served.

23.1141 Powerplant controls

(e) The installation of electronic control systems shall meet the requirements of FAR 23.1309(a) through (e).

23.1165 Engine ignition systems

(f) In addition, for commuter category airplanes, each turbine engine ignition system must be an essential electrical load.

23.1301 Function and installation

Amend section 23.1301 by deleting paragraph (d).

Each item of installed equipment must--

(a) Be of a kind and design appropriate to its intended function;

(b) Be labeled as to its identification, function, or operating limitations, or any applicable combination of these factors; and

(c) Be installed according to limitations specified for that equipment.

23.1305 Powerplant instruments

(f) Powerplant indicators must either provide trend or rate-of change information, or have the ability to

(1) allow the pilot to assess necessary trend information quickly, including if and when this information is needed during engine restarts, and
(2) allow the pilot to assess how close the indicated parameter is relative to a limit, and
(3) forewarn the pilot prior to the parameter reaching an operating limit, and
(4) for multi-engine airplanes, allow the pilot to quickly and accurately compare engine-to-engine data..

Section 23.1309 is amended by adding the two applicability paragraphs and revising all the paragraphs as explained in the preamble.
Change 23.1309 Equipment, Systems, and installations – to read as follows:

The requirements of this section, except as identified below, are applicable, in addition to specific design requirements of part 23, to any equipment or system as installed in the airplane. This section is a regulation of general requirements. It should not be used to supersede any specific requirements contained in another section of part 23. Therefore, this section should not be used to increase or decrease the requirements except it can be used for determining the software and hardware development assurance levels.

This section does not apply to the performance, flight characteristics requirements of Subpart B, and structural loads and strength requirements of Subparts C and D, but it does apply to any system on which compliance with the requirements of Subparts B, C, D and E is based. The flight structure such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments are excluded. Simple conventional mechanical systems are also excluded. For example, it does not apply to an airplane's inherent stall characteristics or their evaluation of § 23.201, but it does apply to a stick pusher (stall barrier) system installed to attain compliance with § 23.201.

(a) The airplane equipment and systems must be designed and installed so that:

(1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the airplane operating and environmental conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes.
(2) Other equipment and systems do not adversely affect the safety of the airplane or its occupants, or the proper functioning of those covered by sub-paragraph (a)(1) of this paragraph.

(b) The airplane systems and associated components for the appropriate classes of airplane, considered separately and in relation to other systems, must be designed and installed so that:

(1) Each catastrophic failure condition
(i) is extremely improbable; and

(ii) does not result from a single failure; and

(2) Each hazardous failure condition is extremely remote; and

(3) Each major failure condition is remote.

(c) Information concerning unsafe system operating conditions must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimize crew errors which could create additional hazards.

(d) As used in this section, "systems" refers to all pneumatic systems, fluid systems, electrical systems, mechanical systems, and powerplant systems.

Add New Section 23.1310

23.1310 Power Source capacity and distribution -

(a) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:

(1) Loads connected to the power distribution system with the system functioning normally.

(2) Essential loads after failure of--

(i) Any one engine on two-engine airplanes; or

(ii) Any two engines on an airplane with three or more engines; or

(iii) Any power converter or energy storage device.

(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.

(b) In determining compliance with paragraph (c)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

Change section 23.1311 to read as follows: Note: The changes are explained in the preamble.

(a) Electronic display indicators, including those with features that make isolation and independence between powerplant instrument systems impractical, must:

(1) Meet the arrangement and visibility requirements of Sec. 23.1321.

(2) Be easily legible under all lighting conditions encountered in the cockpit, including direct sunlight, considering the expected electronic display brightness level at the end of an electronic display indictor's useful life. Specific limitations on display system useful life must be contained in the Instructions for Continued Airworthiness required by Sec. 23.1529.

(3) Not inhibit the primary display of attitude, airspeed, altitude, or powerplant parameters needed by any pilot to set power within established limitations, in any normal mode of operation.

(4) Not inhibit the primary display of engine parameters needed by any pilot to properly set or monitor powerplant limitations during the engine-starting mode of operation.

(5) Have an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument or electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system. These secondary instruments may be installed in panel positions that are displaced from the primary positions specified by Sec. 23.1321(d), but must be located where they meet the pilot's visibility requirements of Sec. 23.1321(a).

(6) Incorporate sensory cues that provide a quick glance sense of rate and when appropriate trend information for the pilot that are equivalent to those in the instrument being replaced by the electronic display indicators.

(7) Incorporate equivalent visual displays of instrument markings, required by Secs. 23.1541 through 23.1553, or visual displays that alert the pilot to abnormal operational values or approaches to established limitation values, for each parameter required to be displayed by this part.

(b) The electronic display indicators, including their systems and installations, and considering other airplane systems, must be designed so that one display of information essential for continued safe flight and landing will be available within one second to the crew with a single pilot action by any pilot or by automatic means for continued safe operation, after any single failure or probable combination of failures.

(c) As used in this section, "instrument" includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or components connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier, and an indicator connected together). As used in this section, "primary" display refers to the display of a parameter that is located in the instrument panel such that the pilot looks at it first when wanting to view that parameter.

Add a new section 23.1317: Note: The purpose of this addition is explained in the preamble.

23.1317 High Intensity Radiated Fields (HIRF) Protection

(a) Each electrical and electronic system that performs a function whose failure would prevent the continued safe flight and landing of the airplane must be designed and installed so that –

(1) Each function is not adversely affected during and after the time the airplane is exposed to HIRF environment I, as described in appendix J to this part;

(2) Each electrical and electronic system automatically recovers normal operation, in a timely manner, after the airplane is exposed to HIRF environment I, as described in appendix J to this part, unless the system's recovery conflicts with other operational or functional requirements of the system; and

(3) Each electrical and electronic system is not adversely affected during and after the time the airplane is exposed to HIRF environment II, as described in appendix J to this part.

(b) Each electrical and electronic system that performs a function whose failure would significantly reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions must be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 1, 2, or 3, as described in appendix J to this part.

(c) Each electrical and electronic system that performs a function whose failure would reduce the capability of the airplane or the ability of the flightcrew to cope with adverse operating conditions must be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 4, as described in appendix J to this part.

Add new appendix J to part 23 as follows:

Appendix J to part 23-HIRF Environments and Equipment HIRF Test Levels

This appendix specifies the HIRF environments and equipment HIRF test levels for electrical and electronic systems under § 23.1317. The field strength values for the HIRF environments and equipment HIRF test levels are expressed in root-mean-square units measured during the peak of the modulation cycle.

(a) HIRF environment I is specified as follows:

Table I – HIRF Environment I

FREQUENCY	**FIELD STRENGTH**	
	PEAK	AVERAGE
10 kHz – 100 kHz	50	50
100 kHz – 500 kHz	50	50
500 kHz – 2 MHz	50	50
2 MHz – 30 MHz	100	100
30 MHz – 70 MHz	50	50
70 MHz – 100 MHz	50	50
100 MHz – 200 MHz	100	100
200 MHz – 400 MHz	100	100
400 MHz – 700 MHz	700	50
700 MHz – 1 GHz	700	100
1 GHz – 2 GHz	2,000	200

2 GHz – 4 GHz	3,000	200
4 GHz – 6 GHz	3,000	200
6 GHz – 8 GHz	1,000	200
8 GHz – 12 GHz	3,000	300
12 GHz – 18 GHz	2,000	200
18 GHz – 40 GHz	600	200

(b) HIRF environment II is specified as follows:

Table II – HIRF Environment II

FREQUENCY	**FIELD STRENGTH**	
	PEAK	**AVERAGE**
10 kHz – 100 kHz	20	20
100 kHz – 500 kHz	20	20
500 kHz – 2 MHz	30	30
2 MHz – 30 MHz	100	100
30 MHz – 70 MHz	10	10
70 MHz – 100 MHz	10	10
100 MHz – 200 MHz	30	10
200 MHz – 400 MHz	10	10
400 MHz – 700 MHz	700	40
700 MHz – 1 GHz	700	40
1 GHz – 2 GHz	1,300	160
2 GHz – 4 GHz	3,000	120
4 GHz – 6 GHz	3,000	160
6 GHz – 8 GHz	400	170
8 GHz – 12 GHz	1,230	230
12 GHz – 18 GHz	730	190
18 GHz – 40 GHz	600	150

(c) Equipment HIRF Test Level 1.

(1) From 10 kilohertz (kHz) to 400 megahertz (MHz), use conducted susceptibility tests with continuous wave (CW) and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current must start at a minimum of 0.6 milliamperes (mA) at 10 kHz, increasing 20 decibels (dB) per frequency decade to a minimum of 30 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, the conducted susceptibility current must be at least 30 mA.

(3) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 volts per meter (V/M) peak, with CW and 1 kHz square wave modulation with 90 percent or greater.

(4) From 400 MHz to 8 gigahertz (GHz), use radiated susceptibility tests at a minimum of 150 V/m with pulse modulation of 0.1 percent duty cycle with 1 kHz pulse repetition frequency. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent

(5) From 400 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 28 V/m peak with 1 kHz square wave modulation with 90 percent depth or greater. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.

(d) Equipment HIRF Test Level 2.

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests with CW and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current must start at a minimum of 0.6 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 30 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, the conducted susceptibility current must be at least 30 mA.

(3) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 V/m peak with CW and 1 kHz square wave modulation with 90 percent depth or greater.

(4) From 400 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 150 V/m peak with pulse modulation of 4 percent duty cycle with a 1 kHz pulse repetition frequency. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.

(e) Equipment HIRF Test Level 3. Test level 3 is HIRF environment II in table II of this appendix reduced by acceptable aircraft transfer function and attenuation curves. Testing must cover the frequency band of 10 kHz to 8 GHz.

(f) Equipment HIRF Test Level 4.

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 0.15 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 7.5 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, use conducted susceptibility tests at a minimum of 7.5 mA.

(3) From 100 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 5 V/m.

Note: This is deleted, It is a duplication of 23.1305. Also, this concept was incorporated in revised section 23.1311. Section 23.1331 – is changed as follows: Note: The purpose of these changes is explained in the preamble.

For each instrument that uses a power source, the following apply:

(a) Each instrument must have an integral visual power annunciator or separate power indicator to indicate when power is not adequate to sustain proper instrument performance. If a separate indicator is used, it must be located so that the pilot using the instruments can monitor the indicator with minimum head and eye movement. The power must be sensed at or near the point where it enters the instrument. For electric and vacuum/pressure instruments, the power is considered to be adequate when the voltage or the vacuum/pressure, respectively, is within approved limits.

(b) The installation and power supply systems must be designed so that--

(1) The failure of one instrument will not interfere with the proper supply of energy to the remaining instrument; and

(2) The failure of the energy supply from one source will not interfere with the proper supply of energy from any other source.

(c) For heading, altitude, airspeed, and attitude there must be at least

(1) Two independent sources of power (not driven by the same engine on multiengine airplanes), and a manual or an automatic means to select each power source; or

(2) Have an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument that are independent from the airplane's primary electrical power system; or

(3) Electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system.

23.1443 Minimum mass flow of supplemental oxygen

(a) If the airplane is to be certified above 40,000 feet, a continuous flow oxygen system must be provided for each passenger.

(b) If continuous flow oxygen equipment is installed, an applicant must show compliance with the requirements of either paragraphs (b)(1) and (b)(2) or paragraph (b)(3) of this Section:

(1) For each passenger, the minimum mass flow of supplemental oxygen required at various cabin pressure altitudes may not be less than the flow required to maintain, during inspiration and while using the oxygen equipment (including masks) provided, the following mean tracheal oxygen partial pressures:

Note: Paragraph (a) is added so all following paragraphs will need to be re-lettered.

23.1445 Oxygen distribution system – The standards need amending to address a new class of airplane that can operate at much higher altitudes than originally anticipated for part 23 aircraft. Up until now that capability has been addressed using special conditions derived from part 25. The large number of new jet and high performance aircraft that will be operating at higher altitudes than previously envisioned for part 23 aircraft prompted this proposal.

23.1443 Minimum mass flow of supplemental oxygen

(a) Except for flexible lines from oxygen outlets to the dispensing units, or where shown to be otherwise suitable to the installation, nonmetallic tubing must not be used for any oxygen line that is normally pressurized during flight.

(b) Nonmetallic oxygen distribution lines must not be routed where they may be subjected to elevated temperatures, electrical arcing, and released flammable fluids that might result from any probable failure.

(c) If the flight crew and passengers share a common source of oxygen, a means to separately reserve the minimum supply required by the flight crew must be provided.

23.1447 Equipment standards for oxygen dispensing units - Add the following paragraphs:

If oxygen dispensing units are installed, the following apply:
(a) ……
(b) ……
(c) ……
(d) ……
(e) ……
(f) ……
(g) If the airplane is to be certified for operation above 40,000 feet, a quick-donning oxygen mask system, with a pressure demand, mask mounted regulator must be provided for the flight crew. This dispensing unit must be immediately available to the flight crew when seated at his station and installed so that it:

(1)Can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand, within five seconds and without disturbing eyeglasses or causing delay in proceeding with emergency duties, and

(2)Allows while in place, the performance of normal communication functions.

23.1505 Airspeed Limitations

(c) Paragraphs (a) and (b) of this section do not apply to turbine airplanes or the airplanes for which a design diving speed V_D/M_D is established under Sec. 23.335(b)(4). For those airplanes, a maximum operating limit speed (V_{MO}/M_{MO} airspeed or Mach number, whichever is critical at a particular altitude) must be established as a speed that may not be deliberately exceeded in any regime of flight (climb, cruise, or descent) unless a higher speed is authorized for flight test or pilot training operations. V_{MO}/M_{MO} must be established so that it is not greater than the design cruising speed V_C/M_C and so that it is sufficiently below V_D/M_D or V_{DF}/M_{DF} and the maximum speed shown under Sec. 23.251 to make it highly improbable that the latter speeds will be inadvertently exceeded in operations. The speed margin between V_{MO}/M_{MO} and V_D/M_D or V_{DF}/M_{DF} may not be less than that determined under Sec. 23.335(b), or the speed margin found necessary in the flight tests conducted under Sec. 23.253.

23.1545 Airspeed Indicator

(b) The following markings must be made:

(1) For the never-exceed speed V_{NE}, a radial red line.

(2) For the caution range, a yellow arc extending from the red line specified in paragraph (b)(1) of this section to the upper limit of the green arc specified in paragraph (b)(3) of this section.

(3) For the normal operating range, a green arc with the lower limit at V_{S1} with maximum weight and with landing gear and wing flaps retracted, and the upper limit at the maximum structural cruising speed V_{NO} established under §23.1505(b).

(4) For the flap operating range, a white arc with the lower limit at V_{S0} at the maximum weight, and the upper limit at the flaps-extended speed V_{FE} established under §23.1511.

(5) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the speed at which compliance has been shown with §23.69(b) relating to rate of climb at maximum weight and at sea level, a blue radial line.

(6) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the maximum value of minimum control speed, V_{MC}, (one-engine-inoperative) determined under §23.149(b), a red radial line.

(d) Paragraphs (b)(1) through (b) (4) and paragraph (c) of this section do not apply to aircraft for which a maximum operating speed V_{MO}/M_{MO} is established under Sec. 23.1505(c). For those aircraft there must either be a maximum allowable airspeed indication showing the variation of V_{MO}/M_{MO} with altitude or compressibility limitations (as appropriate), or a radial red line marking for V_{MO}/M_{MO} must be made at lowest value of V_{MO}/M_{MO} established for any altitude up to the maximum operating altitude for the airplane.

23.1555 Control markings

(d) Usable fuel capacity must be marked as follows:

1) For fuel systems having no selector controls, the usable fuel capacity of the system must be indicated at the fuel quantity indicator.
2) For fuel systems having selector controls, the usable fuel capacity available at each selector control position must be indicated near the selector control.
3) For fuel systems having a calibrated fuel quantity indication system complying with § 23.1337(b)(1) and accurately displaying the actual quantity of usable fuel in each selectable tank, no fuel capacity placards outside of the fuel quantity indicator are required.

23.1559 Operating limitations placard

(a) There must be a placard in clear view of the pilot stating--(1) That the airplane must be operated in accordance with the Airplane Flight Manual; and(2) The certification category of the airplane to which the placards apply.
(b) For airplanes certificated in more than one category, there must be a placard in clear view of the pilot stating that other limitations are contained in the Airplane Flight Manual.
(c) There must be a placard in clear view of the pilot that specifies the kind of operations to which the operation of the airplane is limited or from which it is prohibited under Sec. 23.1525.”
(d) The placard required by this section need not be lighted for night operations

23.1563 Airspeed placards

"There must be an airspeed placard in clear view of the pilot and as close as practicable to the airspeed indicator. This placard must list-
(a) The operating maneuvering speed V_A; and
(b) The maximum landing gear operating speed V_{L0}. [, and]
(c) For reciprocating multiengine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes, the maximum value of the minimum control speed, V_{MC} (one-engine-inoperative) determined under Sec. 23.149(b)."
(d) The airspeed placard required by this section need not be lighted for night operations if the landing gear operating speed is indicated on the airspeed indicator or other lighted area such as the landing gear control and the airspeed indicator has features such as low speed awareness that provide ample warning prior to V_{MC}.

23.1567 Flight maneuver placard

(a) For normal category airplanes, there must be a placard in front of and in clear view of the pilot stating: "No acrobatic maneuvers, including spins, approved."
(b) For utility category airplanes, there must be- (1) A placard in clear view of the pilot stating: "Acrobatic maneuvers are limited to the following ________" (list approved maneuvers and the recommended entry airspeed for each); and (2) For those airplanes that do not meet the spin requirements for acrobatic category airplanes, an additional placard in clear view of the pilot stating: "Spins Prohibited."
(c) For acrobatic category airplanes, there must be a placard in clear view of the pilot listing the approved acrobatic maneuvers and the recommended entry airspeed for each. If inverted flight maneuvers are not approved, the placard must bear a notation to this effect.
(d) For acrobatic category airplanes and utility category airplanes approved for spinning, there must be a placard in clear view of the pilot-- (1) Listing the control action for recovery from spinning maneuvers; and (2) Stating that recovery must be initiated when spiral characteristics appear, or after not more than six turns or not more than any greater number of turns for which the airplane has been certificated."
(e) The placard required by this section need not be lighted for night operations

23.1583 Operating limitations

(a) *Airspeed limitations.* The following information must be furnished:
  (1) ……
  (2) the speeds V_{MC}, V_O, V_{FE}, V_{LE}, and V_{LO}, if established, and their significance.

NUMBER: AWG-22 **VERSION DATE: 06/07/2005**

Source: 135ARC Steering Group

ISSUE: Part 23 Standards for Turbojet Powered and High Performance Airplanes

Regulation: 14 CFR Part 23

Review Part 23 airworthiness requirements and develop safety standards appropriate for Part 23 turbojet-powered and high-performance airplanes (Normal and Commuter category) with consideration of operations in Part 135 scheduled commuter service.

CONTENTS:

Background

- Development of tasking to develop Part 23 airworthiness standards appropriate for turbojet-powered and high-performance airplanes with consideration of operations in Part 135 scheduled commuter service
- Establishment of an AWG Working Group to accomplish this task

Appendix A

- Section-by-Section review of recommended changes to Part 23 airworthiness standards developed by the working group in ARAC format, including discussion and justification.

Appendix B

- DRAFT NPRM language developed by AWG (with significant support from FAA Small Airplane Directorate members) incorporating all AWG-22 recommendations into a single draft NPRM format and language.

BACKGROUND

Current Part 135 regulations exclude turbojet powered airplanes from operating in scheduled Commuter and scheduled On-demand service. The 135ARC Steering Committee accepted the Applicability Working Group's proposal at the February 26, 2004 meeting, to develop a recommendation in support of revising the regulations to permit the use of turbojet airplanes having a maximum passenger-seat configuration of 9 seats or less and a maximum payload capacity of 7,500 pounds or less in scheduled service under Part 135 Commuter and On-demand regulations (Reference 135ARC Rec Doc APP-20A).

However, current Part 23 regulations do not contain adequate or appropriate safety standards for Normal and Commuter category turbojet powered and high performance airplanes. The Steering Group tasked the Airworthiness Working Group to review existing Part 23 airworthiness requirements and to develop safety standards appropriate for Part 23 turbojet powered and high performance airplanes with consideration of operations in scheduled service under Part 135.

Original ARAC Tasking

On September 10, 2003, FAA published a Federal Register Notice tasking the ARAC General Aviation Certification and Operations Issues Group (GACO) to "Develop safety standards suitable for all jet and high-performance airplanes up to 19,000 pounds, including those in the commuter category" (Reference 68FR53424). This is needed to establish appropriate safety standards and to provide industry with a better understanding of potential requirements applicable to part 23 jets and high-performance airplane configurations. However, this ARAC task is not part of the Harmonization Work Program or FAA's rulemaking priority list. The Notice states that this ARAC task will not result in a change to the FAR and that FAA is not planning rulemaking action. The ARAC GACO has not initiated any activity on this task.

Re-Assignment to 135ARC

Both FAA and industry participants on the ARAC GACO and 135ARC agreed that the tasking to develop Part 23 Jet standards should be re-tasked/re-assigned to the 135ARC Airworthiness Working Group (AWG). This would ensure that the appropriate airworthiness safety standards for Part 23 jets would be available to support the proposed changes to scheduled operations under Part 135. Furthermore, the 135ARC recommendations are intended to result in rulemaking actions and are identified as part of FAA's priority rulemaking program.

The AWG established a Part 23 Jet working group (23Jet) comprised of several aircraft manufacturers and FAA Small Airplane Directorate Standards Staff engineers to accomplish this task. EASA was also invited to participate and was sent all documents for review and comment as they were developed. In addition, all persons that responded to the Federal Register Notice expressing interest in participating in the ARAC were also invited to participate in the 23Jet.

TASKING to AWG 23JET

Review existing Part 23 airworthiness requirements and develop safety standards appropriate for Part 23 turbojet powered airplanes with consideration of operations in scheduled service under Part 135. The safety standards should include performance, systems, occupant protection, and other issues for jets and high-performance part 23 airplanes.

> ***NOTE 1:*** *The 23Jet should determine if this task could be expanded to develop safety standards appropriate for all ``high performance'' airplanes as opposed to turbojet powered airplanes and be completed within the required timeline.*
> ***NOTE 2:*** *Most of the following task details are derived from the original FAA tasking assigned to ARAC (68FR53424).*

1. Review 14 CFR part 23 Normal and Commuter categories as a benchmark and identify safety concerns that are not currently addressed for turbojet powered part 23 airplanes. Give particular attention to commuter and other part 23 airplanes to be used in part 135 scheduled service.

2. Consider the safety standards prescribed by FAA special conditions and JAA CRIs applied to existing part 23 jet programs. Also consider draft working documents developed by the JAA JAR 23 Structures Study Group for commuter jet characteristics and essential requirements.

3. As part of the evaluations, consider the following:
- o Systems issues such as stick pushers and integrated flight controls
- o Structures issues such as mach effects (compressibility) and bird strike
- o Powerplant location issues

- Aircraft performance issues such as accelerate-stop distance, single-engine climb, mach buffet, stall speed
- Cabin safety issues, including Occupant Protection for Commuter Category Airplane Crashworthiness (Dynamic Seats), Fireblocking Provisions, Thermal/Acoustic Insulation
- Cockpit display issues (multifunction displays, primary flight displays)

4. Write a report following the ARAC format recommending safety standards for Part 23 turbojet powered airplanes which address the safety concerns identified above.

RECOMMENDATION:

The AWG 23JET working group proposes specific rulemaking changes for each of the following regulations in Appendix A, along with appropriate discussion and justification.

SUBPART A - GENERAL
- 23.3 Airplane Categories

SUBPART B - FLIGHT
- 23.49 Stalling Period
- 23.67 Climb: One Engine Inoperative
- 23.73 Reference Landing Approach Speed
- 23.177 Static Directional and Lateral Stability
- 23.181 Dynamic Stability
- 23.201 Wings Level Stall
- 23.203 Turning Flight and Accelerated Turning Stalls
- 23.251 Vibration and Buffeting
- 23.253 High Speed Characteristics
- 23.255 [NEW] Out of Trim Characteristics\

SUBPART C - STRUCTURE
- 23.571 Metallic Pressurized Cabin Structures
- 23.573 Damage Tolerance and Fatigue Evaluation of Structure
- 23.574 Metallic Damage Tolerance and Fatigue Evaluation of Commuter Category Airplanes

SUBPART D – DESIGN AND CONSTRUCTION
- 23.629 Flutter
- 23.703 Takeoff Warning System
- 23.777 Cockpit Controls
- 23.807 Emergency Exits
- 23.831 Ventilation
- 23.841 Pressurized Cabins
- 23.853 Passenger and Crew Compartment Interiors

SUBPART E - POWERPLANT
- 23.1165 Engine Ignition Systems

SUBPART F - EQUIPMENT
- 23.1301 Function and Installation
- 23.1309 Equipment, Systems, and Installations
- 23.1310 [NEW] Power Source and Distribution
- 23.1311 Electronic Display Instrument Systems
- 23.1311 AC 23-1311-1A, Electronic Display Instrument Systems
- 23.1311 AC 23-1311-1B, Electronic Display Instrument Systems
- 23.1317 [NEW] High Intensity Radio Field (HIRF)
- 23.1331 Instruments Using a Power Source
- 23.1443 Minimum Mass Flow of Supplemental Oxygen
- 23.1445 Oxygen Distribution System
- 23.1447 Equipment Standards for Oxygen Dispensing Units

SUBPART G – OPERATING LIMITATIONS AND INFORMATION
- 23.1505 Airspeed Limitations
- 23.1545 Airspeed Indicator
- 23.1555 Control Markings
- 23.1559 Operating Limitations Placard

- 23.1563 Airspeed Placards
- 23.1567 Flight Maneuver Placard
- 23.1583 Operating Limitations

STEERING COMMITTEE REVIEW:

FINAL ACTION:

APPENDIX A Table of Contents

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.3 Airplane Categories

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane being certified under 14 CFR 23 that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

FAR 23.3(d) was originally issued to provide a means to certify smaller propeller driven aircraft that originated as 14 CFR 23 Normal Category aircraft but through growth over time have exceeded the 12,500 lb limit. Also, because the intent was to be able to use these aircraft in commuter operations, it was determined that certain portions of the 14 CFR 25 Transport Category regulations, or their equivalent, should be made a part of the new 14 CFR 23 Commuter Category requirements. This category of aircraft also had a limitation that it only be applicable to propeller driven aircraft.

With advances in jet engines and the advent of small turbofan jet aircraft starting out in the 14 CFR 23 Normal Category but growing to exceed the 12,500 lb Normal Category weight limit the need arose to request exemptions to this limitation. To eliminate the need to continually request this exemption, taking both the applicant and the FAA's time, the time has come to eliminate the restriction of the Commuter Category to propeller driven aircraft.

The safety record on these small turbofan aircraft is equivalent to or better than the propeller driven aircraft in this category. Additionally, the safety record does not show the need to require these aircraft to step up to full 14 CFR 25 requirements. Thus it is appropriate to allow these small turbofan aircraft to be certified in the Commuter Category with the same weight and passenger restrictions as currently apply to the propeller driven Commuter Category aircraft.

In addition, many of the Special Conditions that have been applied to these small jets in the Normal Category have been incorporated into the Commuter Category or other 14 CFR 23 requirements and have been derived from 14 CFR 25 Transport Category requirements. It is planned to incorporate many of the additional Special Conditions into the 14 CFR 23 regulations along with this proposed change.

2 - What are the current FAR and JAR standards relative to this subject?

The current FAR and JAR standards are identical. The current 14 CFR 23 text is shown in question #6 along with the proposed change. Current standards were written for propeller-driven piston and turbine engine airplanes and do not adequately consider the new family of light turbojet airplanes. As a result the small turbojet airplanes have required Exemptions from this requirement.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions, Exemptions, or Equivalent Levels of Safety have been applied to date for all 14 CFR 23 turbojets, including those in the Commuter Category.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Current standards of special conditions, exemptions, or equivalent levels of safety, which have been applied to date, are not standardized. Some are based on 14 CFR 23 commuter rules while others are based on 14 CFR 25 rules.

5 – What is the proposed action?

Amend 14 CFR 23.3(d) to delete the words "propeller driven" from the first sentence as shown in question 6.

6 - What should the harmonized standard be?

23.3(d) The commuter category is limited to ~~propeller-driven~~, multiengine airplanes that have a seating configuration, excluding pilot seats, of 19 or less, and a maximum certificated takeoff weight of 19,000 pounds or less. The commuter category operation is limited to any maneuver incident to normal flying, stalls (except whip stalls), and steep turns, in which the angle of bank is not more than 60 degrees.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets, over 12,500 pounds MTOGW, to be certificated under 14 CFR 23 commuter category without the need for exemption to the current definition of commuter category. This further allows these jets to directly comply with other commuter category rules without the need for special conditions.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed new policy/advisory material will maintain the level of safety intended by the existing standard and for installations previously approved.

9 - Relative to current industry practice does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed changes will maintain or increase level of safety with respect to current industry practice by providing compliance basis in the rule rather than in special conditions, equivalent levels of safety, and letters of exemption and applying standardized rules uniformly to all airplanes in the size and performance category.

10 - What other options have been considered and why were they not selected?

The working group also considered not changing the rule and continuing to handle these airplanes through special conditions, ELOS and exemptions. This promotes inconsistent application and unneeded work for the applicant and the FAA.

11 - Who would be affected by the proposed change?

Manufacturers of high performance airplanes, certificated under 14 CFR 23, using any means of propulsion.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include jets and changes for high performance airplanes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are currently no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

The cost for certification should be less than is required under the current process of requiring an Exemption, since it will reduce the effort required of both the applicant and the FAA.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.49 Stalling Speed

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

Current part 23 needs amended to clarify the traditional small airplane definition of landing configuration stall speed, V_{SO}.

2 - What are the current FAR and JAR standards relative to this subject?

The current standard along with the proposed change is identified in question 6. The current FAR and JAR standards read the same and have been amended to look more like the same part 25 language. This is why the requirement is being interpreted more like part 25 than has been done for the past 5 decades.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not applicable

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences. There are interpretation issues.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Current means of compliance have led to confusion and required policy memos.

5 – What is the proposed action?

Revise 23.49(a) to specify that V_{SO} is the landing configuration with full flaps.

6 - What should the harmonized standard be?

23.49(a) V_{S0} (landing configuration is full flaps) and V_{S1} are the stalling speeds or the minimum steady flight speeds, in knots (CAS), at which the airplane is controllable with--

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Clarifies that implementation of a part 23 requirement is different from that in part 25.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change maintains the overall level of safety.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the current industry level of safety.

10 - What other options have been considered and why were they not selected?

Considered leaving the requirement unchanged. This was not selected because it would necessitate further project specific policy memos.

11 - Who would be affected by the proposed change?

All part 23 manufacturers.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

AC 23-8B.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Nominal.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet HWG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.67 Climb: One engine inoperative

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The Part 23 jets have had Special Conditions applied that increase the climb gradient above that required by the current regulations. In reviewing the accident data of the jets versus the propeller driven aircraft, increasing the required climb gradient for all Part 23 multi-engine aircraft would be appropriate and would help reduce some of the accidents. The increase being proposed is less than what has been applied to most of the Part 23 Jets through the Special Conditions but it is appropriate for most newly designed twin-engined aircraft.

2 - What are the current FAR and JAR standards relative to this subject?

The current standard with proposed changes marked is shown in question 6. The current standards only require a "measurably positive" climb gradient for this the condition of one-engine inoperative.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not applicable. FAR and JAR standards exist but this proposal increases the climb gradient for the one engine inoperative requirement for most multi-engine airplanes.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are no differences between the FAA and JAA standards or policy for this requirement.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable

5 – What is the proposed action?

It is proposed that for airplanes at or below 12,500 pounds TOGW and proposes that the steady gradient of climb in (b)(1) be changed from "measurably positive" to "not less than 1 percent."

6 - What should the harmonized standard be?

23.67(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category--

(1) The steady gradient of climb at an altitude of 400 feet above the takeoff surface must be ~~measurably positive~~ not less than 1% with the-

(i) Critical engine inoperative and its propeller in the minimum drag position;

(ii) Remaining engine(s) at takeoff power;

(iii) Landing gear retracted;

(iv) Wing flaps in the takeoff position(s); and

(v) Climb speed equal to that achieved at 50 feet in the demonstration of Sec. 23.53.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

The proposed change provides an improved level of safety for this condition for most Part 23 multi-engine airplanes by insuring that there is a minimum steady gradient of climb. The existing rule allows a gradient that can be very close to zero.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard would increase the level of safety for most twin-engine Part 23 airplanes.

9 - Relative to current industry practice does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard would increase the level of safety for most twin-engine Part 23 airplanes.

10 - What other options have been considered and why were they not selected?

The working group considered not changing the rule. However, it is concluded that increased performance for most Part 23 multi-engine airplanes is desirable, not just for jet airplanes.

11 - Who would be affected by the proposed change?

Manufacturers of Part 23 high performance multi-engine airplanes certificated under 14 CFR 23, using any means of propulsion.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

See 23 Jet WG Report for 14 CFR 23 Preamble.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include jets and changes for high performance airplanes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

The cost for certification should be equal to or less than the current special conditions for new 14 CFR 23 jet projects. There may be a slight cost burden for manufacturers certificating part 23 turboprop or piston engine twins.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.73 Reference Landing Approach Speed

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address airplanes being certified under 14 CFR 23 that may have more than one landing flap setting. The V_{ref} speed should be based on 1.3 times the stall speed in the appropriate landing flap configuration, V_{S1}. V_{SO} is by definition the stall speed in the maximum landing flap configuration and is not applicable to other flap configurations.

2 - What are the current FAR and JAR standards relative to this subject?

Current rule is 1.3 V_{SO}. See question 6 for current rule wording plus marked changes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

"Understanding" of what is really intended.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

Not applicable

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable

5 – What is the proposed action?

Change landing approach speed reference in 14 CFR 23.73(b) and (c) from "1.3 V_{SO}" to "1.3 V_{S1}".

6 - What should the harmonized standard be?

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category, the reference landing approach speed, VREF, must not be less than the greater of VMC, determined in Sec. 23.149(c), and 1.3 ~~V_{SO}~~ V_{S1}.
(c) For commuter category airplanes, the reference landing approach speed, VREF, must not be less than the greater of 1.05 VMC, determined in Sec. 23.149(c), and 1.3 ~~V_{SO}~~ V_{S1}.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Corrects an error.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Increased level of safety due to correction of an error.

9 - Relative to current industry practice does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The change provides the same level of safety as currently exists because industry "understands" intent of the rule and acts accordingly.

10 - What other options have been considered and why were they not selected?

Not applicable

11 - Who would be affected by the proposed change?

Manufacturers of airplanes certificated under 14 CFR 23.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

See ARAC WG Report for 14 CFR 23 Preamble.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide is already correct.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

There is no cost impact since industry is already complying with the proposed change.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.177 Static Directional and Lateral Stability

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]
The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?
See question 6 for the current standard with the proposed change. The current standards were written for propeller-driven piston and turbine engine airplanes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Condition

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?
JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]
Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23.177 to include standards for jets and high performance propeller-driven airplanes. Revise paragraphs (a) and (b) as shown in question 6, add new paragraph (c), and change existing paragraphs (c) and (d) to (d) and (e) respectively.

6 - What should the harmonized standard be?

23.177(a) The static directional stability, as shown by the tendency to recover from a wings level sideslip with the rudder free, must be positive for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with

symmetrical power up to maximum continuous power, and at speeds from 1.2V_{S1} up to the ~~maximum allowable speed for the condition being investigated~~ landing gear or wing flap operating limit speeds, or V_{NO} or V_{FC} / M_{FC} , whichever is appropriate. The angle of sideslip for these tests must be appropriate to the type of airplane. At larger angles of sideslip, up to that at which full rudder is used or a control force limit in Sec. 23.143 is reached, whichever occurs first, and at speeds from 1.2$V_{S1\ to}$ V_O, the rudder pedal force must not reverse.
(b) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip with the aileron controls free, ~~must be positive~~ may not be negative for all landing gear and flap positions. This must be shown with symmetrical power from idle up to 75 percent of maximum continuous power at speeds from 1.2V_{S1} in the takeoff configuration(s) and at speeds ~~above~~ from 1.3V_{S1} in other configurations, up to the maximum allowable airspeed for the configuration being investigated ~~in the takeoff, climb, cruise, descent, and approach configurations~~, (V_{fe}, V_{le}, V_{N0}, V_{FC} / $M_{FC,}$ whichever is appropriate) in the takeoff, climb, cruise, descent, and approach configurations. For the landing configuration, the power ~~must be~~ is that required to maintain a 3-degree angle of descent in coordinated flight. The angle of sideslip for these tests must be appropriate to the type of airplane, but in no case may the constant heading sideslip angle be less than that obtainable with a 10 degree bank, or if less, the maximum bank angle obtainable with full rudder deflection or 150 pound rudder force.
(c) For airplanes with V_{MO}/M_{MO} established under 23.1505(c), the rudder gradients must meet the requirements of paragraph (b) at speeds between V_{MO}/M_{MO} and V_{FC}/M_{FC} except that the dihedral effect (aileron deflection opposite the corresponding rudder input) may be negative provided the divergence is gradual, easily recognized, and easily controlled by the pilot. ~~in~~
(~~c~~ d) Paragraph (b) of this section does not apply to acrobatic category airplanes certificated for inverted flight.
(~~d~~ e) In straight, steady slips at 1.2 V_{S1} for any landing gear and flap positions, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron and rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased up to the maximum appropriate to the type of airplane. At larger slip angles, up to the angle at which full rudder or aileron control is used or a control force limit contained in §23.143 is reached, the aileron and rudder control movements and forces must not reverse as the angle of sideslip is increased. Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the airplane must not result in uncontrollable flight characteristics.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?
Provides an appropriate level of safety for jets certificated under 14 CFR 23 normal category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule. The proposed standard adds clarification to current standard.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule. The proposed standard adds clarification to current standard.

10 - What other options have been considered and why were they not selected?

No other options were considered. This change is a clarification adding the specific maximum speeds used in the special conditions for static longitudinal stability.

11 - Who would be affected by the proposed change?

Manufacturers of small part high performance airplanes using any means of propulsion.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include proposed clarification

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

New 14 CFR 23 jet projects should be equal or lower cost than the current special condition process. All other projects should have no cost impact. The proposed standard simply adds clarification to the existing rule.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?
No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.181(b) Dynamic Stability

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed through exemption exemptions. Part 23 needs to amend the current requirements because new part 23 airplanes are being designed to operate at higher speeds and higher altitudes, and it becomes difficult to balance the design characteristics so the airplane can meet the basic stability requirements of § 23.181(b) and still achieve high speed cruise efficiency and performance. As a result, nearly all small business jets and transport category airplanes are type certificated with automatic yaw damping stability augmentation devices to meet positive lateral-directional stability requirements.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed change marked. The current standards were written for piston and propeller-driven turbines that typically don't have yaw dampers.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions for turbojets in part 23.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences. Jets aren't addressed completely in current FAA and JAA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Revise 23.181(b) to provide damping requirements that eliminate or reduce the need for exemption from the current Part 23 rule. The proposal is similar to Part 25 for operations above 18,000 feet.

6 - What should the harmonized standard be?

23.181(b) Any combined lateral-directional oscillations ("Dutch roll") occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane must be damped to $\frac{1}{10}$ amplitude in 1) 7 cycles below 18,000 ft, and 2) 13 cycles from 18,000 ft to the certified maximum altitude with the primary controls--

(1) Free; and

(2) In a fixed position.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate relief for jets and high performance airplanes certificated under part 23.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change maintains the overall level of safety.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the current industry level of safety.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing special conditions and leaving the requirements as is in current Normal Category part 23. We determined that the requirements need revising in normal category part 23 for section 23.181(b) to include high altitude, high performance airplanes to preclude the continued granting of exemptions.

11 - Who would be affected by the proposed change?

Manufacturers of small part high performance airplanes and 23 jets.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

AC 23-8B.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include jets and changes for high performance airplanes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Moderate

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

<u>23 Jet WG Report</u>

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.201 Wings level stall

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25. Part 23 needs to amend the current requirements to accommodate the stalling characteristics of high performance aircraft at high altitude to allow additional roll or yaw during the maneuver. The current requirements were written around lower performance aircraft that typically do not reach the altitudes of the current high performance aircraft where it is more difficult to maintain the currently required roll and yaw angles. The proposed change brings the requirement more in line with the current Part 25 requirements.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard along with the proposed change. The current standards were written for piston and propeller-driven turbines and don't account for spoilers and high altitude stalls.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences. This class of airplane isn't addressed completely in current FAA and JAA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

It is proposed that 23.201 be revised to accommodate the performance characteristics of current high performance aircraft at high altitude and bring it more closely into alignment with the Part 25 requirements. Also, it is proposed to add a note to cover spoilers and speedbrakes not normally found on the lower performance Part 23 aircraft. It is also proposed to provide separate requirements for reciprocating powered aircraft vs. turbine-powered aircraft because of the differences in the performance characteristics and the way power is set for this condition.

6 - What should the harmonized standard be?

23.201(d) During the entry into and the recovery from the maneuver, it must be possible to prevent more than 15 degrees of roll or yaw by the normal use of controls except as provided for in paragraph (e).

(e) For airplanes approved for operations above 25,000 feet, during the entry into and the recovery from stalls performed above 25,000 feet, it must be possible to prevent more than 25 degrees of roll or yaw by the normal use of controls.

(e f) Compliance with the requirements of this section must be shown under the following conditions:

(1) Wing Flaps: Retracted, fully extended, and each intermediate normal operating position as appropriate for the altitude.

(2) Landing Gear: Retracted and extended as appropriate for the altitude.

(3) Cowl Flaps: Appropriate to configuration.

(4) Spoilers/speedbrakes: Retracted and extended unless they have little to no effect at low speeds

(4 5) Power:

(i) Power / Thrust off; and

(ii) For Reciprocating Engine Powered Airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power result in extreme nose-high attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{S0}, except that the power may not be less than 50 percent of maximum continuous power; or

(iii) For Turbine Engine Powered Airplanes: The maximum engine thrust except that it need not exceed the thrust necessary to maintain level flight at $1.6V_{S1}$ (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets and high performance airplanes certificated under part 23 normal and commuter category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change increases the overall level of safety. The proposed standard also normalizes the requirements, based on airplane configuration, for jets and high performance propeller-driven airplanes certificated under part 23 normal category.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the current industry level of safety.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing special conditions and leaving the requirements as is in current Normal Category part 23. The requirements need revising in both Normal and Commuter category part 23 for section 23.201 to include jet and high performance airplanes.

11 - Who would be affected by the proposed change?

Manufacturers of small part high performance airplanes and 23 jets.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

AC 23-8B.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include jets and changes for high performance airplanes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Nominal.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.203 Turning flight and accelerated turning stalls

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25. Part 23 needs to amend the current requirements to incorporate additional configurations for all airplanes and a different trim speed for turbines. . The current requirements were written around lower performance reciprocating powered aircraft that typically do not reach the altitudes of the current high performance turbine powered aircraft. The proposed change brings the requirement more in line with the current Part 25 requirements and accommodates the differences between the Part 23 reciprocating powered aircraft and the turbine powered aircraft.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current FAR standards and the proposed change.

The current standards were written for piston and propeller-driven turbines and don't account for spoilers and high altitude stalls.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences. This class of airplane isn't addressed completely in current FAA and JAA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Revise 23.203 to provide for spoilers and speedbrakes typically installed on the high performance turbine powered aircraft and also to accommodate the different power setting requirements for the turbine powered aircraft.

6 - What should the harmonized standard be?

23.203(c) Compliance with the requirements of this section must be shown under the following conditions:

(1) Wings Flaps: Retracted, fully extended, and each intermediate normal operating position as appropriate for the altitude:

(2) Landing Gear: Retracted and extended as appropriate for the altitude;

(3) Cowl Flaps: Appropriate to configuration;

(4) Spoilers/speedbrakes: Retracted and extended unless they have little to no effect at low speeds;

(4 5) Power:

(i) Power / Thrust off; and

(ii) For Reciprocating Engine Powered Airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power result in extreme nose-high attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of 1.4 V_{S0}, except that the power may not be less than 50 percent of maximum continuous power; or

(iii) For Turbine Engine Powered Airplanes: The maximum engine thrust except that it need not exceed the thrust necessary to maintain level flight at 1.6V_{S1} (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets and high performance airplanes certificated under part 23 normal and commuter category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change increases the overall level of safety. The proposed standard also normalizes the requirements, based on airplane configuration, for jets and high performance propeller-driven airplanes certificated under part 23 normal category.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the current industry level of safety.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing special conditions and leaving the requirements as is in current Normal Category part 23. The requirements need revising in both Normal and Commuter category part 23 for section 23.201 to include jet and high performance airplanes.

11 - Who would be affected by the proposed change?

Manufacturers of small part high performance airplanes and 23 jets.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

AC 23-8B.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include jets and changes for high performance airplanes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Nominal.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No.

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes.

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

<u>23 Jet WG Report</u>

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.251 Vibration and Buffeting

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]
The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?
See question 6 for the current standard plus the proposed change as marked. The current standards were written for propeller-driven piston and turbine engine airplanes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Condition

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?
JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]
Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23 to include standards for jets and high performance propeller-driven airplanes operating at higher altitudes than were originally envisioned for Part 23 aircraft.

6 - What should the harmonized standard be?
23.251
(a) There must be no vibration or buffeting severe enough to result in structural damage, and each part of the airplane must be free from excessive vibration, under any appropriate speed and power conditions up to ~~V_D/M_D~~ <u>V_{DF}/M_{DF}</u>. In addition, there must be no buffeting in any normal

flight condition severe enough to interfere with the satisfactory control of the airplane or cause excessive fatigue to the flightcrew. Stall warning buffeting within these limits is allowable.

(b) For an airplane with M_D greater than .6 or with a maximum operating altitude greater than 25,000 feet, the positive maneuvering load factors at which the onset of perceptible buffeting occurs must be determined with the airplane in the cruise configuration for the ranges of airspeed or Mach number, weight, and altitude for which the airplane is to be certificated. The envelopes of load factor, speed, altitude, and weight must provide a sufficient range of speeds and load factors for normal operations. Probable inadvertent excursions beyond the boundaries of the buffet onset envelopes may not result in unsafe conditions.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets certificated under 14 CFR 23 normal category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

10 - What other options have been considered and why were they not selected?

No other options were considered. This change represents the standards established by special conditions for previous certifications.

11 - Who would be affected by the proposed change?

The manufacturers of small Part 23 high performance airplanes designed to operate at higher altitudes than originally anticipated for Part 23 aircraft.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include proposed clarification

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

New 14 CFR 23 jet projects should be equal or lower cost than the current special condition process. All other projects should have no cost impact.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.
Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?
No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?
Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.253 High speed characteristics

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]
The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?
See question 6 for the current standard with the proposed change marked. The current standards were written for propeller-driven piston and turbine engine airplanes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Condition

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?
JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]
Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23 to include allow use of V_{DF}/M_{DF} for flight test requirements and add requirement that the recovery "not require exceptional pilot strength or skill".

6 - What should the harmonized standard be?
(b) Allowing for pilot reaction time after occurrence of the effective inherent or artificial speed warning specified in Sec. 23.1303, it must be shown that the airplane can be recovered to a normal attitude and its speed reduced to V_{MO}/M_{MO}, without—

(1) exceptional piloting strength or skill.
(2) Exceeding V_D/M_D, V_{DF}/M_{DF}, the maximum speed shown under Sec. 23.251, or the structural

limitations; or
(3) Buffeting that would impair the pilot's ability to read the instruments or to control the airplane for recovery.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?
Provides an appropriate level of safety for jets certificated under 14 CFR 23 normal category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

10 - What other options have been considered and why were they not selected?

No other options were considered. This change represents the standards established by special conditions for previous certifications.

11 - Who would be affected by the proposed change?

The Manufacturers of Part 23 airplanes using any means of propulsion would be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include proposed clarification

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

New 14 CFR 23 jet projects should be equal or lower cost than the current special condition process. All other projects should have no cost impact.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.
Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?
No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?
Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.
This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

<u>23 Jet WG Report</u>

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.255 Out of Trim Characteristics

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25. Part 23 needs to add requirements to consider potential high-speed Mach effects for airplanes with M_{MO} greater than M 0.6 and incorporating a trimmable horizontal stabilizer.

2 - What are the current FAR and JAR standards relative to this subject?

This is a new requirement. See question 6 for the proposed standard. The current standards were written for piston and propeller-driven turbines and don't account for high speed and altitude Mach effects.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences. This class of airplane isn't addressed completely in current FAA and JAA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Add 23.255 as follows:

This is nearly identical to the requirement in Part 25 except for minor changes to apply the following requirements for airplanes with a M_{MO} greater than M0=.6 and incorporating a trimmable horizontal stabilizer.

6 - What should the harmonized standard be?

23.255

(a) From an initial condition with the airplane trimmed at cruise speeds up to V_{MO}/M_{MO}, the airplane must have satisfactory maneuvering stability and controllability with the degree of out-of-trim in both the airplane nose-up and nose-down directions, which results from the greater of--

(1) A three-second movement of the longitudinal trim system at its normal rate for the particular flight condition with no aerodynamic load, except as limited by stops in the trim system, including those required by Sec. 23.655(b); or

(2) The maximum mistrim that can be sustained by the autopilot while maintaining level flight in the high-speed cruising condition.

(b) In the out-of-trim condition specified in paragraph (a) of this section, when the normal acceleration is varied from +1g to the positive and negative values specified in paragraph (c) of this section--

(1) The stick force vs. g curve must have a positive slope at any speed up to and including V_{FC}/M_{FC} ; and

(2) At speeds between V_{FC}/M_{FC} and V_{DF}/M_{DF} the direction of the primary longitudinal control force may not reverse.

(c) Except as provided in paragraphs (d) and (e) of this section, compliance with the provisions of paragraph (a) of this section must be demonstrated in flight over the acceleration range--

(1) -1g to +2.5g; or

(2) 0 g to 2.0 g, and extrapolating by an acceptable method to -1g and +2.5g

(d) If the procedure set forth in paragraph (c)(2) of this section is used to demonstrate compliance and marginal conditions exist during flight test with regard to reversal of primary longitudinal control force, flight tests must be accomplished from the normal acceleration at which a marginal condition is found to exist to the applicable limit specified in paragraph (b)(1) of this section.

(e)During flight tests required by paragraph (a) of this section, the limit maneuvering load factors prescribed in Secs. 23.333(b) and 23.337 need not be exceeded. In addition, the entry speeds for flight test demonstrations at normal acceleration values less than 1 g must be limited to the extent necessary to accomplish a recovery, without exceeding V_{DF}/M_{DF}.

(f) In the out-of-trim condition specified in paragraph (a) of this section, it must be possible from an overspeed condition at V_{DF}/M_{DF} to produce at least 1.5g for recovery by applying not more than 125 pounds of longitudinal control force using either the primary longitudinal control alone or the primary longitudinal control and the longitudinal trim system. If the longitudinal trim is used to assist in producing the required load factor, it must be shown at V_{DF}/M_{DF} that the longitudinal trim can be actuated in the airplane nose-up direction with primary surface loaded to correspond to the least of the following airplane nose-up control forces:

(1) The maximum control forces expected in service as specified in Secs. 23.301 and 23.397.

(2) The control force required to produce 1.5g.

(3) The control force corresponding to buffeting or other phenomena of such intensity that it is a strong deterrent to further application of primary longitudinal control force

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets and high performance airplanes certificated under part 23 normal and commuter category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change increases the overall level of safety. The proposed standard also normalizes the requirements, based on airplane configuration, for jets and high performance propeller-driven airplanes certificated under part 23 normal category.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the current industry level of safety.

10 - What other options have been considered and why were they not selected?

We considered adopting the existing special conditions and doing nothing. Mach tuck caused fatal accidents in the early development of jets which brought about the part 25, section 255 requirements in place today. Part 23 does not address this phenomenon and therefore should add the requirement.

11 - Who would be affected by the proposed change?

The Manufacturers of small Part 23 high performance airplanes and 23 jets would be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

AC 23-8B.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include jets and changes for high performance airplanes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Nominal.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes.

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.571 Metallic pressurized cabin structures

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

Current part 23 needs to be amended to provide additional pressurized fuselage damage tolerance requirements for high performance aircraft certified for operations above 41,000 feet

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current rule with the proposed change marked. The current FAR and JAR standards read the same but do not address high performance Part 23 aircraft operating above 41,000 feet.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are no differences.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

There are no differences.

5 – What is the proposed action?

It is proposed that 23.571 be revised to add paragraph (c) requiring a damage tolerance evaluation of the fuselage for airplanes certified for operation above 41,000 feet.

6 - What should the harmonized standard be?

23.571

For normal, utility, and acrobatic category airplanes, the strength, detail design, and fabrication of the metallic structure of the pressure cabin must be evaluated under one of the following:

(a) A fatigue strength investigation in which the structure is shown by tests, or by analysis supported by test evidence, to be able to withstand the repeated loads of variable magnitude expected in service; or

(b) A fail safe strength investigation, in which it is shown by analysis, tests, or both that catastrophic failure of the structure is not probable after fatigue failure, or obvious partial failure, of a principal structural element, and that the remaining structures are able to withstand a static ultimate load factor of 75 percent of the limit load factor at *V*C, considering the combined effects of normal operating pressures, expected external aerodynamic pressures, and flight loads. These loads must be multiplied by a factor of 1.15 unless the dynamic effects of failure under static load are otherwise considered.

(c) The damage tolerance evaluation of §23.573(b).

(d) If certification for operation above 41,000 feet is requested, a damage tolerance evaluation of the fuselage pressure boundary per §23.573(b) must be conducted and the evaluation must account for the requirements of paragraph (c) of section 23.841.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

It provides a requirement for a damage tolerance evaluation of the pressure vessel for those aircraft operating above 41,000 feet.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change increases the overall level of safety by requiring a damage tolerance investigation for operations not covered by the current regulation.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the current industry level of safety.

10 - What other options have been considered and why were they not selected?

Considered leaving the requirement unchanged. This was not selected because it would not provide the level of safety appropriate for operations above 41,000 feet and would continue to require Special Conditions be applied.

11 - Who would be affected by the proposed change?

Only those manufacturers who are building high performance aircraft for operation above 41,000 feet will be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

Not applicable

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Not applicable

14 - How does the proposed standard compare to the current ICAO standard?

ICAO standards to do not currently address the requirements for high performance aircraft operating at the altitudes that many Part 23 aircraft are currently operating at. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Nominal.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.573 Damage tolerance and fatigue evaluation of structure

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

Current part 23 needs amended to provide additional fuselage pressurization damage tolerance requirements for high performance aircraft operating above 41,000 feet

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current rule with the proposed change marked. The current FAR and JAR standards read the same but do not address high performance Part 23 aircraft operating above 41,000 feet.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

There are no differences.

5 – What is the proposed action?

It is proposed that 23.573 be revised to add paragraph (c) requiring a damage tolerance evaluation of the fuselage for airplanes certified for operation above 41,000 feet.

6 - What should the harmonized standard be?

23.573

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must account for the requirements of paragraph (c) of section 23.841.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

It provides additional damage tolerance evaluation of the pressure vessel for those aircraft operating above 41,000 feet.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change increases the overall level of safety by requiring additional investigation for operations in an environment not covered by the current regulation.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will increase the level of safety for high altitude operation.

10 - What other options have been considered and why were they not selected?

Considered leaving the requirement unchanged. This was not selected because it would not provide the level of safety appropriate for operations above 41,000 feet and would continue to require Special Conditions be applied.

11 - Who would be affected by the proposed change?

Only those manufacturers who are building high performance aircraft for operation above 41,000 feet will be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

Not applicable

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Not applicable

14 - How does the proposed standard compare to the current ICAO standard?

ICAO standards to do not currently address the requirements for high performance aircraft operating at the altitudes that many Part 23 aircraft are currently operating at. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Nominal

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No.

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because some manufacturers are already complying with this for aircraft operating designed for high altitude operations.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

14 CFR 23.574 Metallic damage tolerance and fatigue evaluation of category airplanes

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

Current part 23 needs amended to provide additional fuselage pressurization damage tolerance requirements for high performance aircraft operating above 41,000 feet

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed change marked. The current FAR and JAR standards read the same but do not address high performance Part 23 aircraft operating above 41,000 feet.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

There are no differences.

5 – What is the proposed action?

It is proposed that 23.574 be revised to add paragraph (c) requiring a damage tolerance evaluation of the fuselage for airplanes certified for operation above 41,000 feet.

6 - What should the harmonized standard be?

23.574

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must account for the requirements of paragraph (c) of section 23.841.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

It provides additional damage tolerance evaluation of the pressure vessel for those aircraft operating above 41,000 feet.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change increases the overall level of safety by requiring additional investigation for operations in an environment not covered by the current regulation.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will increase the level of safety for high altitude operation.

10 - What other options have been considered and why were they not selected?

Considered leaving the requirement unchanged. This was not selected because it would not provide the level of safety appropriate for operations above 41,000 feet and would continue to require Special Conditions be applied.

11 - Who would be affected by the proposed change?

Only those manufacturers who are building high performance aircraft for operation above 41,000 feet will be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

Not applicable

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Not applicable

14 - How does the proposed standard compare to the current ICAO standard?

ICAO standards to do not currently address the requirements for high performance aircraft operating at the altitudes that many Part 23 aircraft are currently operating at. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Nominal.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes.

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because some manufacturers are already complying with this for aircraft operating designed for high altitude operations.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: FAR 23.629 Flutter

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standard need amending to reflect FAA and industry interpretation of the regulation.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed change marked. The current standard requires testing out to the design dive envelope rather than the demonstrated dive envelope. This may not be appropriate for many aircraft.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are no differences.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23.629 (b) to allow use of V_{DF} in place of V_D for flight testing.

6 - What should the harmonized standard be?

23.629
(b) Flight flutter tests must be made to show that the airplane is free from flutter, control reversal and divergence and to show that—
(1) Proper and adequate attempts to induce flutter have been made within the speed range up to ~~V_D~~ V_{DF};
(2) The vibratory response of the structure during the test indicates freedom from flutter;

(3) A proper margin of damping exists at ~~V_D~~ V_{DF}; and

(4) There is no large and rapid reduction in damping as ~~V_D~~ V_{DF} is approached.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate test requirement for airplanes certificated under 14 CFR 23.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

It maintains the same level of safety as currently exists since this has been the accepted interpretation and practice by both industry and the FAA.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

It maintains the same level of safety as currently exists since this has been the accepted practice by both industry and the FAA.

10 - What other options have been considered and why were they not selected?

No other options were considered since this has been an accepted practice and has been applied by special condition.

11 - Who would be affected by the proposed change?

The manufacturers of small part 23 high performance airplanes.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, may need to be updated to reflect this change.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

There is no cost impact.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification and the change agrees with the FAA policy.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.703 Takeoff Warning System

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25. The current Part 23 requirements need to be amended to incorporate takeoff warning systems for commuter and all other airplanes that incorporate a trimmable horizontal stabilizer or other features that could affect lift generation in a way that would cause an unsafe condition if not set in an manner approved for takeoff.

2 - What are the current FAR and JAR standards relative to this subject?

The current standard wording along with the proposed change is shown in the response to question 6. The current standards were written for piston and propeller-driven turbines that typically have had trimmable elevators with fixed horizontal stabilizers and no spoilers or other such devices.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions have been used previously for Part 23 jets. This requirement currently exists for commuter category airplanes.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There aren't differences. This concern has not been addressed completely in current FAA and JAA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Revise 23.703 as follows to include requirement to require a Takeoff Warning System if the requirements of 23.703 cannot be met for all Part 23 Category airplanes over 6,000 lbs.

6 - What should the harmonized standard be?

23.703
For commuter category airplanes and other airplanes over 6,000 pounds, unless it can be shown that a lift or longitudinal trim device that affects the takeoff performance of the aircraft would not give an unsafe takeoff configuration when selected out of an approved takeoff position, a takeoff warning system must be installed and meet the following requirements:

(a) The system must provide to the pilots an aural warning that is automatically activated during the initial portion of the takeoff role if the airplane is in a configuration that would not allow a safe takeoff. The warning must continue until--
  (1) The configuration is changed to allow safe takeoff, or
  (2) Action is taken by the pilot to abandon the takeoff roll.

(b) The means used to activate the system must function properly for all authorized takeoff power settings and procedures and throughout the ranges of takeoff weights, altitudes, and temperatures for which certification is requested

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for all airplanes certificated under Part 23 category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change increases the overall level of safety. The proposed standard also normalizes the requirements, based on airplane configuration, for all airplanes certificated under Part 23.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will increase the current industry level of safety.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing special conditions and leaving the requirements as is in current Normal Category Part 23. We determined that the requirements need revising in Part 23 for section 23.703 to include all airplanes over 6,000 pounds.

11 - Who would be affected by the proposed change?

Manufacturers of small Part 23 airplanes.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

AC 23-8B.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to clarify the requirement and include all Part 23 airplanes over 6,000 pounds.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

Moderate

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Section: FAR/JAR 23.777 Cockpit controls

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The requirement in discussion is FAR 23.777(d) as amended by Amendment 23-33. This requirement provides specific cockpit powerplant controls location and height requirements. This amendment was incorporated to standardize these items due to operational problems with using the wrong controls on propeller driven aircraft. However, this requirement didn't envision single power levers or controls that do not have the separate, distinct controls located in the same areas (such as typical turbojet installations).

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed change marked. The current FAR and JAR standards are identical.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not applicable.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

The FAA has allowed equivalent safety findings to this requirement for design features that meet or exceed the safety intent (such as single power levers).

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

See item 3.

5 – What is the proposed action?

Revise the requirement to make it specific for the intent (i.e., for propeller-driven aircraft with separate and distinct controls).

6 - What should the harmonized standard be?

23.777

(d) When separate and distinct control levers are co-located (such as located together on the pedestal), the ~~The~~ control location order from left to right must be power (thrust) lever, propeller (rpm control), and mixture control (condition lever and fuel cutoff for ~~turbine-powered~~ turbopropeller-powered airplanes). Power (thrust) levers must be at least one inch higher or longer to make them more prominent than propeller (rpm control) or mixture controls. Carburetor heat or alternate air control must be to the left of the throttle or at least eight inches from the mixture control when located other than on a pedestal. Carburetor heat or alternate air control, when located on a pedestal must be aft or below the power (thrust) lever. Supercharger controls must be located below or aft of the propeller controls. Airplanes with tandem seating or single-place airplanes may utilize control locations on the left side of the cabin compartment; however, location order from left to right must be power (thrust) lever, propeller (rpm control) and mixture control.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Since this proposal simply revises the current regulation to clarify the intended purpose, it would meet the intent.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Maintains – codifying what is currently done through equivalent safety findings.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Maintains - current industry practice is to perform equivalent safety findings.

10 - What other options have been considered and why were they not selected?

Doing nothing and continue equivalent safety findings. This was rejected since this will continue to require numerous equivalent safety findings considering how technology has evolved away from the regulation.

11 - Who would be affected by the proposed change?

Manufacturers of Part 23 airplanes with specific design features (will be a positive impact).

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

AC 23-17A, which discusses the regulation, intents, and basis of equivalency.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

See item 12.

14 - How does the proposed standard compare to the current ICAO standard?

This proposal does not conflict with the current ICAO standards.

15 - Does the proposed standard affect other HWG's?

No.

16 - What is the cost impact of complying with the proposed standard?

Cost positive by reducing the need for administrative paperwork for equivalency.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

Yes. It agrees with current practice and reduces the need for an Equivalent Level of Safety to be developed.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.807 Emergency Exits

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

Current Part 23 needs amended to provide an alternate means for meeting the requirement for an emergency exit on both sides of multi-engine airplanes that would be above the waterline in the event of a water ditching. For most of the small Part 23 jets this creates significant cost and weight impact to add a second emergency exit either in the side of the aircraft or overhead in addition to the main door. The proposed alternative is to allow the use of a water barrier to be placed in the door opening prior to opening the door to slow the inflow of water in a manner that would be similar to what would be accomplished with the emergency exit. This has already been approved by means of an Equivalent Level of Safety on several airplanes and the proposal would be to include that option in the rule so that an ELOS is not required for these small airplanes.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed change marked. The current FAR and JAR standards require an emergency exit on each side of Part 23 multi-engine airplanes, the bottom of which would be above the waterline in an emergency water ditching. See question #5 below for the exact wording.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Equivalent Level of Safety

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are no differences.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The current means of compliance has been to develop an Equivalent Level of Safety as appropriate.

5 – What is the proposed action?

It is proposed that 23.807(e) be revised to allow the use of a water barrier in the main cabin doorway in lieu of having to have a separate second exit on the same side of the aircraft:

6 - What should the harmonized standard be?

23.807
(e) For multiengine airplanes, ditching emergency exits must be provided in accordance with the following requirements, unless the emergency exits required by paragraph (a) or (d) of this section already comply with them:
(1) One exit above the waterline on each side of the airplane having the dimensions specified in paragraph (b) or (d) of this section, as applicable; and

(2) If side exits cannot be above the waterline, there must be a readily accessible overhead hatch emergency exit that has a rectangular opening measuring not less than 20 inches wide by 36 inches long, with corner radii not greater than one-third the width of the exit, or

(3) In lieu of paragraph (e)(2) of this section, if any side exit or exits cannot be above the waterline, a device must be placed at each of such exit or exits prior to ditching, to slow the inflow of water when such exit is, or such exits are, opened with the airplane in a ditching emergency. For commuter category airplanes, the clear opening of such exit or exits must meet the requirements defined in paragraph (d) of this section.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

It provides a means of slowing the inflow of water through the open cabin door when the bottom of the door opening is below the waterline in an emergency water ditching.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change maintains the overall level of safety as required by the current regulation.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the current level of safety.

10 - What other options have been considered and why were they not selected?

The other option is to add a second emergency exit on the same side of the aircraft or in the roof of the aircraft. This option was not selected because of the significant added weight and cost.

11 - Who would be affected by the proposed change?

Those manufacturers building multi-engine Part 23 aircraft would be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

Not applicable

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Not applicable

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

The proposed standard will reduce the cost to both industry and the FAA by not having to address Equivalent Levels of Safety on these new airplanes. Without the Equivalent Level of Safety or the proposed change to the regulation there is a significant cost impact to the manufacturers to provide the additional emergency exit currently defined in the regulations.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because the Equivalent Level of Safety has already been granted in a number of cases and continued use of the Equivalent Level of Safety adds additional burden to the applicant and the FAA.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group
Rule Section: 23.831 Ventilation

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The intent of the proposed § 23.831(c) and (d) is to ensure that in the event of ventilation system failure in turbine powered pressurized airplanes, the temperature and humidity within the airplane shall not exceed values that are hazardous to the occupants or that affect crew performance

Existing special conditions that have been levied on Part 23 jets are equivalent to the requirements in 25.831(g), Amendment 25-87. The special condition requires that any failure or combination of failures that could lead to temperature exposures that would cause undue discomfort must be shown to be improbable. Minor corrective actions (e.g., selection of alternate equipment or procedures) would be allowed if necessary for probable failures. The special condition also requires that any failure or combination of failures that could lead to intolerable temperature exposures must be extremely improbable. Major corrective actions (e.g., emergency descent, configuration changes) would be allowed for an improbable failure condition.

The Part 23 special conditions have a time-temperature relationship containing a single-point humidity requirement. It is difficult or impossible to comply with this humidity limit under the assumption of loss of all conditioned airflow for flight following failure, including descent and landing, because this humidity level is often exceeded at lower altitudes at and near sea level for airport ambient conditions. Thus, this requirement would prohibit the use of outside air to ventilate the aircraft during high humidity conditions above 27 mBar.

This proposal is to use different language in the regulation that will specify a more performance-based criteria in that failures cannot hazardously affect crew performance or result in permanent physiological damage to passengers (note that it is a different standard for the crew than the passengers). Associated guidance material would have a acceptable means of compliance that would consider a combination of temperature, humidity, time exposure, and activity level. This standard is a closer approximation of human tolerance to adverse environments than the single point humidity requirement in the existing special conditions.

2 - What are the current FAR and JAR standards relative to this subject? [Reproduce the FAR and JAR rules text as indicated below.]

See question 6 for the current standard with the proposed change marked. There are no FAR 23 requirements specific to cabin environmental requirements after system failures. Special conditions are addressed in 2a below.

Current JAR text:

There is no equivalent JAR regulation in Part 23, nor has JAA promulgated a Part 25 rule that is equivalent to Amendment 25-87. JAA addresses the issue in special conditions for both Part 23 and Part 25.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed? [Reproduce text from issue papers, special conditions, policy, certification action items, etc., that have been used relative to this issue]

For Part 23 jets the FAA has issued special conditions for airplanes to be certified with a maximum altitude greater than or equal to 41,000 feet. The special condition has equivalent requirements to 25.831(g), Amendment 25-87.

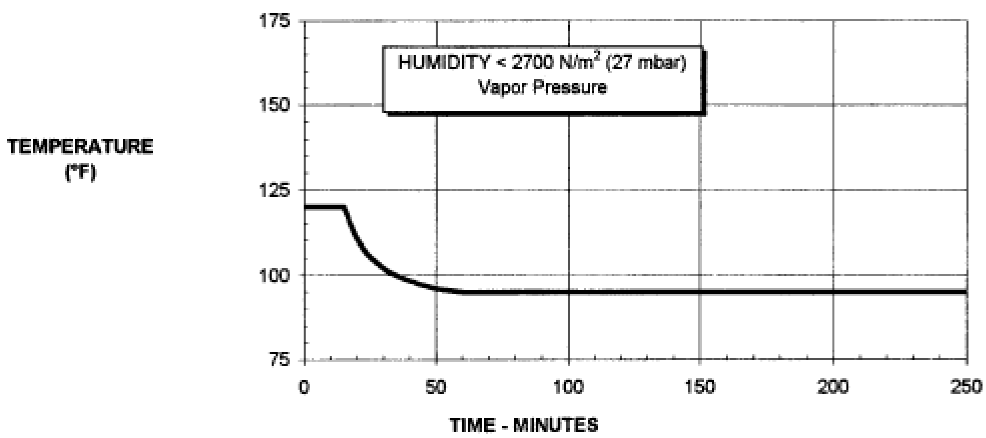
Current special condition (from SC 23-102-SC for Cessna 525A):

3. Air Conditioning

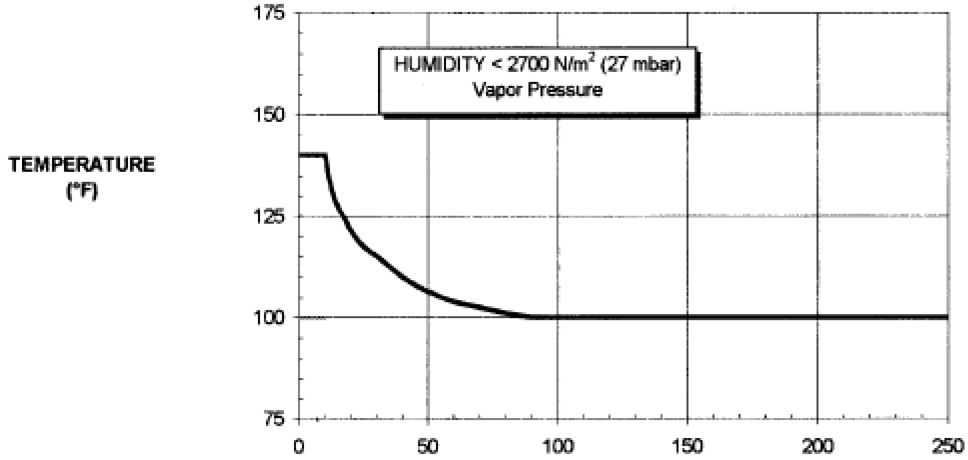
In addition to the requirements of Sec. 23.831, the cabin cooling system must be designed to meet the following conditions during flight above 15,000 feet mean sea level (MSL):

(a) After any probable failure, the cabin temperature/time history may not exceed the values shown in Figure 1.

(b) After any improbable failure, the cabin temperature/time history may not exceed the values shown in Figure 2.



TIME - TEMPERATURE RELATIONSHIP
FIGURE 1



TIME - TEMPERATURE RELATIONSHIP
FIGURE 2

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?: [Explain the differences in the standards or policy, and what these differences result in relative to (as applicable) design features/capability, safety margins, cost, stringency, etc.]

There are no differences in FAA and JAA standards or policy. Both airworthiness codes lack requirements for cabin environment after system failures. Both authorities have addressed the issue as special conditions for Part 23 certification. FAA has imposed the special condition on Part 23 jets with maximum altitudes at or above 41,000 feet.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The Special Conditions and means of compliance to the special conditions have been similar for FAA and JAA for Part 23 certification. The main area of difference in terms of means of compliance between the FAA and JAA is application of the rule below 15,000 feet altitude for Part 25 certification. The JAA generic Special Condition is limited to at or above 15,000 feet, whereas the FAA rule is applied to all altitudes for Part 25. Limiting the application to above 15,000 feet removes the issue of high ambient humidity making compliance with the special condition impossible because the ambient humidities at that altitude are below the 27mbar limit.

5 – What is the proposed action? [Describe the new proposed requirement, or the proposed change to the existing requirement, as applicable. Is the proposed action to introduce a new standard, or to take some other action? Explain what action is being proposed (not the regulatory text, but the underlying rationale) and why that direction was chosen for each proposed action.]

The proposed action is to implement a new, performance-based standard for failure conditions not shown to be extremely improbable. The objective of this standard is to preserve a tolerable environment by limiting the metabolic and environmental heat loads to passengers and crew during exposures to a potential heat stress event. Compliance to this new regulation will require a combination of quantitative and qualitative means to demonstrate compliance.

6 - What should the harmonized standard be? [Insert the proposed text of the harmonized standard here]

23.831 Ventilation

(a) Each passenger and crew compartment must be suitably ventilated. Carbon monoxide concentration may not exceed one part in 20,000 parts of air.

(b) For pressurized airplanes, the ventilating air in the flightcrew and passenger compartments must be free of harmful or hazardous concentrations of gases and vapors in normal operations and in the event of reasonably probable failures or malfunctioning of the ventilating, heating, pressurization, or other systems and equipment. If accumulation of hazardous quantities of smoke in the cockpit area is reasonably probable, smoke evacuation must be readily accomplished starting with full pressurization and without depressurizing beyond safe limits.

(c) For turbine powered pressurized airplanes, under normal operating conditions and in the event of any probable failure conditions of any system which would adversely affect the ventilating air, the ventilation system must provide a sufficient amount of uncontaminated air to enable the crew members to perform their duties without undue discomfort or fatigue and to provide reasonable passenger comfort. For normal operating conditions, the ventilation system must be designed to provide each occupant with at least 0.55 pounds of fresh air per minute. In the event of the loss of one source of fresh air, the supply of fresh airflow must not be less than 0.4 pounds per minute for any period exceeding five minutes.

(d) Other probable and improbable Environmental Control System failure conditions that adversely affect the passenger and crew compartment environmental conditions must not affect crew performance that would result in a hazardous condition and no occupant shall sustain permanent physiological harm.

EXPLANATION:
It should be noted that the proposed rule is based on human performance. The intent of the rule is to provide flight deck and cabin environments that do not result in crew mental errors or physical exhaustion that prevent the crew from successfully completing their assigned tasks – continued safe flight and landing. Analysis showing the flight deck crew performance is not degraded is an acceptable means of demonstrating compliance.

Further, while it is recognized there is a lack of data for infants and frail passengers, the cabin environment resulting from an event shall be conservatively specified such that no permanent physiological harm shall be incurred by any occupant. The environmental and physiological performance limits used for demonstrating compliance must originate from recognized and cognizant authorities as accepted by the regulatory authority reviewing the compliance finding.

The entire flight profile of the aircraft during the event is to be considered. This includes cruise and transient conditions during descent, approach, landing and rollout to a stop on the runway. Taxi is not included in compliance considerations since the aircraft is on the ground and can be evacuated, or flight deck windows and cabin doors opened for ventilation. The intent of having to consider the condition from initiation of the event to the termination of the landing roll is to make sure the entire event is accounted for until it is safe to depart the airplane.

The words "… shall not adversely affect crew performance …" have been chosen to indicate the crew can be expected to reliably perform their published and/or trained duties to complete a safe flight and landing. This has been measured in the past by a person's ability to track and perform their tasks. The event should not result in expecting the crew to perform tasks beyond the procedures defined by the manufacturer, or required by existing regulations.

The phrase "No occupant shall sustain permanent physiological harm" is intended to mean that the occupants who may have required some form of assistance, once treated, shall be expected to return to their normal activities.

In showing compliance to the proposed rule, the applicant should consider the consequential airplane and system effects of the event. Operational provisions, which provide for, or mitigate the resulting environmental effects to airplane occupants, may be considered. If the manufacturer provides an approved procedure(s) for the event, the flight deck and cabin crew may configure the aircraft to moderate temperature and/or humidity extremes on the flight deck and in the cabin. This may include turning off non-critical electrical equipment and opening the flight deck door, or opening the flight deck window(s).

7 – How does this proposed standard address the underlying safety issue (identified under #1)? [Explain how the proposed standard ensures that the underlying safety issue is taken care of.]

The special condition limits the humidity to an absolute moisture content - approximately 120 grains of moisture per pound of air (27 mBar). If this moisture content limit is applied at saturation (RH=100%), the corresponding air temperature limit is 72 Deg F (22 Deg C) dry-bulb temperature. These temperature/humidity limits are unrealistic when applied to tropical latitudes following a failure event during low altitude flight, descent and landing. Furthermore, these limits are significantly less than those accepted by recognized cognizant authorities. For example, the National Institute of Occupational Safety and Health, in "Criteria for a Recommended Standard; Occupational Exposure to Hot Environments Revised Criteria 1986," (National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 86-113, April 1986) advises that 86 Deg F (30 Deg C) WBGT (equivalent to 86 deg F dry bulb temperature at saturation) is acceptable for continuous light work by unacclimated persons.

The proposed standard ensures the flight deck crew's ability to perform their assigned tasks and not compromise safe flight and landing of the aircraft. The proposed standard utilizes data as accepted by recognized cognizant authorities to ensure the crew is provided a safe working environment. It can be safely assumed that any environment that does not impact the performance of the flight crew will not have a permanent adverse effect on passengers.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Explain how each element of the proposed change to the standards affects the level of safety relative to the current FAR. It is possible that some portions of the proposal may reduce the level of safety even though the proposal as a whole may increase the level of safety.]

The proposed standard increases the level of safety relative to the existing requirements 23.831 because the existing code has no limits on exposure to high temperatures and humidities. The proposed standard maintains the same level of safety compared to the special conditions that have been previously imposed on Part 23 jets by ensuring an adequately safe environment after system failures, but it relieves a regulatory burden from the single-point humidity limit.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Since industry practice may be different than what is required by the FAR (e.g., general industry practice may be more restrictive), explain how each element of the proposed change to the standards affects the level of safety relative to current industry practice. Explain whether current industry practice is in compliance with the proposed standard.]

Relative to current industry practice, the proposed standard maintains an equivalent level of safety. The proposed standard adheres to recognized industry and regulatory guidelines and preserves the crew's ability to perform their expected duties, as defined in Question 6 above, while maintaining an acceptable level of safety and health for all aircraft occupants during the event. The proposed standard recommends consideration of the effects on crew performance of all relevant heat sources and humidity levels. The proposed regulation requires a comprehensive, performance-based analysis, and therefore has greater credibility and scientific basis than the existing regulation, which is based on simplistic, independent limits of humidity and temperature.

10 - What other options have been considered and why were they not selected?: [Explain what other options were considered, and why they were not selected (e.g., cost/benefit, unacceptable decrease in the level of safety, lack of consensus, etc.) Include the pros and cons associated with each alternative.]

The Part 23 Jet Airworthiness Working Group did not consider other options, but the following is excerpted from the report from ARAC's Mechanical Systems Harmonzation Working Group that proposes a similar change to 25.831(g), Amendment 25-87 and in that report they describe the efficacy of other regulatory options:

Among the proposed alternatives to a performance based regulation that have been discussed and eliminated are; basing the analysis on dry bulb temperature, omitting analysis of the approach and landing phase of the mission, skipping the ETOPS airport and flying a longer distance to a cooler airport, and limiting the environment the airplane flies in and is analyzed for. Each represents a compromise of the intent of the original rule. Dry bulb temperature analysis does not account for the effects of humidity that contribute to stress on the human physiology. Diverting to another airport could exceed the ETOPS range capability of the airplane. Omitting the approach and landing phase of the mission is not realistic in that eventually the airplane has to land. Each proposal potentially compromised the crew's ability to perform their duties to complete a safe flight and landing as intended by the original regulation. Another option discussed is to recommend repealing FAR 25.831(g) for new Type Certificate aircraft, and then showing compliance under FAR 25.1309 as has been done in the past for Amended Type Certificate aircraft. Discussions between the FAA and the manufacturers came to the conclusion that a specific FAR was still needed to address the event as a result of industry experience. Consequently it was concluded that a rewriting of the FAR 25.831(g) regulation was necessary.

11 - Who would be affected by the proposed change? [Identify the parties that would be materially affected by the rule change – airplane manufacturers, airplane operators, etc.]

Airplane manufacturers and suppliers will be affected. They will see a benefit from the single well-defined harmonized ruling thereby reducing certification costs. The proposed change would affect the airplane manufacturers by having a regulation that defines a reasonable means for showing compliance. There is a potential design savings for the manufacturer by not having to design the aircraft systems to accommodate the fixed humidity limit of 27 mbar. Added standby equipment would have to be incorporated to the aircraft to condition the air drawn into the airplane to an acceptable humidity level under the 27-mBar limit during an event in hot and humid conditions. This equipment would be an operational weight penalty to the operators that do not fly in such hot and humid conditions when research data has shown it is not necessary for providing working conditions conducive for the crew to complete safe flight and landing operation of the aircraft.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

There is no existing Part 23 guidance for showing compliance to the special condition requirements. There is guidance in Advisory Circular 25-20 for showing compliance to 25.831, Amendment 25-87.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted? [Indicate whether the existing advisory material (if any) is adequate. If the current advisory material is not adequate, indicate whether the existing material should be revised, or new material provided. Also, either insert the text of the proposed advisory material here, or summarize the information it will contain, and indicate what form it will be in (e.g., Advisory Circular, policy, Order, etc.)]

If the proposed Part 25 rule change is promulgated before this proposal is implemented, then the associated Part 25 guidance could be used for showing compliance to these Part 23 requirements. If this change is implemented before the Part 25 rule change the following material should be provided as guidance.

A transient heat stress analysis can be used as a means of compliance. For applicable failure events prior to final descent, an acceptable means of compliance (MOC) is considered to be a 1 deg C rise, not to exceed 38 deg C body core temperature see page 2 of "Criteria for a Recommended Standard; Occupational Exposure to Hot Environments Revised Criteria 1986," National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 86-113, April 1986. As discussed in the report this is a conservative criteria for exposure of unacclimatized people working for long periods of time in a hot environment. It is assumed that occupants will be able to receive appropriate medical treatment immediately after landing. Therefore, a 38.5 deg C body core temperature limit is acceptable, only for final approach and landing, during any time period not to exceed 20 minutes. 38.5 deg C body core temperature shall not be exceeded or sustained for any amount of time.

In showing compliance to the proposed rule, the applicant should consider the consequential airplane and system effects of the event. Operational provisions, which provide for, or mitigate the resulting environmental effects to airplane occupants, may be considered. If the manufacturer provides an approved procedure(s) for the event, the flight deck and cabin crew may configure the aircraft to moderate temperature and/or humidity extremes on the flight deck and in the cabin. This may include turning off non-critical electrical equipment and opening the flight deck door, or opening the flight deck window(s).

Due to the unique design of each type of aircraft, the mission profile resulting from an event must take into consideration the flight profile that results from the event. This includes longer cruise times that result from having to operate at lower altitudes and slower speeds. Such flight profiles shall consider the longest potential exposure times, including the critical diversion point with respect to temperature/humidity.

Residual heat from equipment exposed to the flight deck or cabin will be included in the evaluation. For example the residual heat from electronic equipment that has been shut down and activated chemical oxygen systems will be included in the compartment heat load considerations.

The condition shall be assumed to take place under the maximum solar load conditions taking into account geographical and calendar considerations for the environment the aircraft was designed to operate in. A recognized source such as MIL-HDBK-310 provides guidance for determining hot day extremes. The direction of flight and solar orientation

should be considered in determining the time-dependent solar load into the airframe. For compliance purposes an emergency descent at maximum rate of descent speed can be assumed.

The solar load must be included in the respective cabin/flight deck heat load calculations based on aircraft heat transfer properties. This includes solar heat through the skin and windows of the aircraft. If so equipped, window shades or other equipment may be utilized to reduce window solar load. But the calculated heat transfer through the shade (or equipment) must be considered as a general compartment heat load much as is done for the skin of the airplane.

The use of fans (i.e. recirculation, or lav/galley, etc.), if available to distribute the heat loads throughout the aircraft shall be taken into consideration when assessing aircraft compartment temperatures and occupant convective cooling.

The maximum occupancy shall be the basis of calculating the aircraft heat load.

Occupants of the aircraft will be assumed to be able to shed layers of clothing down to a level equivalent to "light summer clothing" in an attempt to remain comfortable.

14 - How does the proposed standard compare to the current ICAO standard? [Indicate whether the proposed standard complies with or does not comply with the applicable ICAO standards (if any)]

The proposed standard does not conflict with the intent of International Civil Aviation Organization (ICAO) Annex 8 "Airworthiness of Aircraft" requirements, as there are no specific ICAO requirements defining cabin environmental limits following a failure.

15 - Does the proposed standard affect other HWG's? [Indicate whether the proposed standard should be reviewed by other harmonization working groups and why.]

No

16 - What is the cost impact of complying with the proposed standard [Please provide information that will assist in estimating the change in cost (either positive or negative) of the proposed rule. For example, if new tests or designs are required, what is known with respect to the testing or engineering costs? If new equipment is required, what can be reported relative to purchase, installation, and maintenance costs? In contrast, if the proposed rule relieves industry of testing or other costs, please provide any known estimate of costs.]

Additional certification costs are associated with tests simulating maximum cabin occupancy and WBGT instrumentation. Reduced certification costs are associated with elimination of the documented approval process for Special Conditions.

17. - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Addressed in Item 13.

18. - Does the 23 Jet WG wish to answer any supplementary questions specific to this project? [If the HWG can think of customized questions or concerns relevant to this project, please present the questions and the HWG answers and comments here.]

No

19. – Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes.

20. – In light of the information provided in this report, does the 23 Jet WG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain. [A negative answer to this question will prompt the FAA to pull the project out of the Fast Track process and forward the issues to the FAA's Rulemaking Management Council for consideration as a "significant" project.]

The 23 Jet WG considers this proposal appropriate for the "Fast Track" process.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.841 Pressurized cabins

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

To provide adequate standards for safe operation of Part 23 aircraft up to 51,000 feet, the standards need amending to address a new class of airplane that, until now, has been addressed using Special Conditions and grants of Equivalent Level of Safety based on 14 CFR Part 25 aircraft Special Conditions and Equivalent Levels of Safety.

The intent of 14 CFR 23.841 is to prevent exposure of the occupants to cabin pressure altitudes that could prevent the flight crew from safely flying and landing the aircraft, or cause permanent physiological injury to the occupants. The intent of the proposed changes to § 23.841 is to provide airworthiness standards that allow subsonic turbine powered pressurized airplanes to operate at their maximum achievable altitudes. This is the highest altitude an applicant chooses to demonstrate that, after decompression: (1) the flight crew will remain alert and be able to fly the airplane; (2) the cabin occupants will be protected from the effects of hypoxia; and (3) in the event some occupants do not receive supplemental oxygen, they will be protected against permanent physiological harm.

Existing rules require the cabin pressure control system to be able to maintain a cabin altitude of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system. Cabin pressure control systems on 14 CFR Part 23 airplanes frequently exhibit a slight overshoot above 15,000 feet cabin altitude before stabilizing below 15,000 feet. Existing technology for cabin pressure control systems on 14 CFR Part 23 cannot prevent this momentary exceedance, which prevents strict compliance with the rule. Findings of Equivalent Level of Safety have been previously granted for this characteristic, because physiological data shows the brief duration of the overshoot will have no significant effect on the airplane occupants.

Existing Special Conditions that have been levied on 14 CFR Part 23 jets are similar and, for operating altitudes above 45,000 feet, equivalent to the requirements in § 25.841, Amendment 25-87. The Special Conditions required consideration of specific failures. Subsequent to the issuance of the Special Conditions, reliability, probability, and damage tolerance concepts addressing other failures and methods of analysis were incorporated into 14 CFR 25. This proposal recommends the use of these additional methods of analysis.

This proposal is to use language in the regulation that will specify a more performance-based criterion such that failures cannot hazardously affect crew performance or result in permanent physiological harm to passengers (note that it is a different standard for the crew than the passengers). Associated guidance material based on prior special conditions would provide an acceptable means of compliance for showing compliance to the amended standards.

Existing Part 23 and Part 25 regulations require warning of excessive cabin altitude at 10,000 Ft and do not adequately address airfield operation above 10,000 Ft. Rather than disable the cabin altitude warning to prevent nuisance annunciations, grants of Equivalent Level of Safety have been issued that allow the warning altitude setting to be shifted above the maximum approved field elevation, not exceeding 15,000 Ft. This proposal incorporates language from existing Equivalent Levels of Safety into the regulation.

2 - What are the current FAR and JAR standards relative to this subject? [Reproduce the FAR and JAR rules text as indicated below.]

Current 14 CFR Part 23 text:

Sec 23.841 Pressurized cabins.

(a) If certification for operation over 25,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system.

(b) Pressurized cabins must have at least the following valves, controls, and indicators, for controlling cabin pressure:

(1) Two pressure relief valves to automatically limit the positive pressure differential to a predetermined value at the maximum rate of flow delivered by the pressure source. The combined capacity of the relief valves must be large enough so that the failure of any one valve would not cause an appreciable rise in the pressure differential. The pressure differential is positive when the internal pressure is greater than the external.

(2) Two reverse pressure differential relief valves (or their equivalent) to automatically prevent a negative pressure differential that would damage the structure. However, one valve is enough if it is of a design that reasonably precludes its malfunctioning.

(3) A means by which the pressure differential can be rapidly equalized.

(4) An automatic or manual regulator for controlling the intake or exhaust airflow, or both, for maintaining the required internal pressures and airflow rates.

(5) Instruments to indicate to the pilot the pressure differential, the cabin pressure altitude, and the rate of change of cabin pressure altitude.

(6) Warning indication at the pilot station to indicate when the safe or preset pressure differential is exceeded and when a cabin pressure altitude of 10,000 feet is exceeded.

(7) A warning placard for the pilot if the structure is not designed for pressure differentials up to the maximum relief valve setting in combination with landing loads.

(8) A means to stop rotation of the compressor or to divert airflow from the cabin if continued rotation of an engine driven cabin compressor or continued flow of any compressor bleed air will create a hazard if a malfunction occurs.

[Amdt. 23-14, 38 FR 31822, Nov. 19, 1973, as amended by Amdt. 23-17, 41 FR 55464, Dec. 20, 1976; Amdt. 23-49, 61 FR 5167, Feb. 9, 1996]

Current JAR text:

The current JAR is identical to the 14 CFR Part 23 text.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed? [Reproduce text from issue papers, special conditions, policy, certification action items, etc., that have been used relative to this issue]

The current standard was written for piston and turbopropeller engine airplanes. For 14 CFR Part 23 jets the FAA has issued Special Conditions for airplanes to be certified with a maximum approved altitude greater than 41,000 feet.

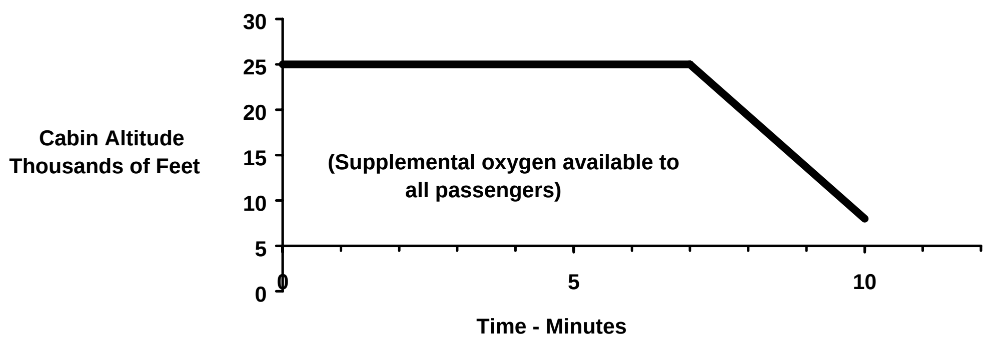
Current High Altitude Special Condition (from SC 23-102-SC for Cessna 525A and 525B):

Condition 4 - Pressurization

(a) The pressurization system, which includes for this purpose bleed air, air conditioning, and pressure control systems, must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 3 after each of the following:
  (1) Any probable malfunction or failure of the pressurization system, in conjunction with any undetected, latent malfunctions or failures, must be considered.
  (2) Any single failure in the pressurization system combined with the occurrence of a leak produced by a complete loss of a door seal element, or a fuselage leak through an opening having an effective are 2.0 times the effective area which produces the maximum permissible fuselage leak rate approved for normal operation, whichever produces a more severe leak.

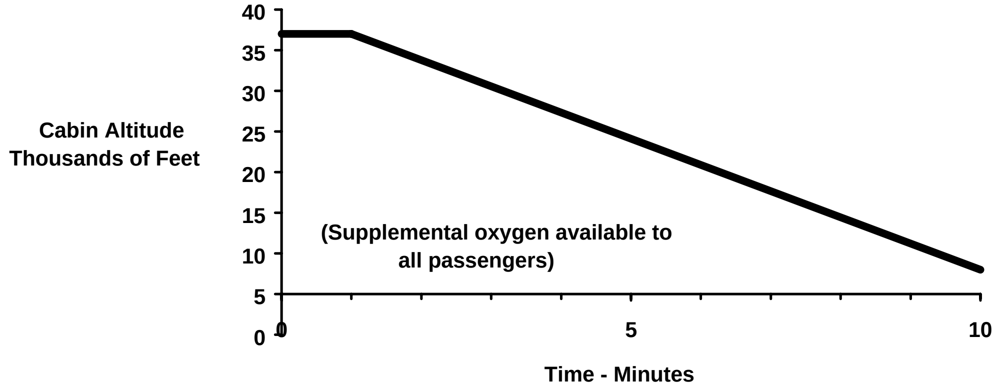
(b) The cabin altitude-time history may not exceed that shown in Figure 4 after each of the following:
  (1) The maximum pressure vessel opening resulting from an initially detectable crack propagating for a period encompassing four normal inspection intervals. Mid-panel cracks and cracks through skin-stringer and skin-frame combinations must be considered.
  (2) The pressure vessel opening or duct failure resulting from probable damage (failure effect) while under maximum operating cabin pressure differential due to a tire burst, engine rotor burst, loss of antennas or stall warning vanes, or any probable equipment failure (bleed air, pressure control, air-conditioning, electrical source(s), etc.) that affects pressurization.
  (3) Complete loss of thrust from all engines.

(c) In showing compliance with paragraphs 4a and 4b of these special conditions (Pressurization), it may be assumed that an emergency descent is made by an approved emergency procedure. A 17-second crew recognition and reaction time must be applied between cabin altitude warning and the initiation of an emergency descent.



Cabin Altitude - Time History
Figure 3

Note: For figure 3, time starts at the moment cabin altitude exceeds 8,000 feet during depressurization. If depressurization analysis shows that the cabin altitude limit of this curve is exceeded, the following alternate limitations apply: After depressurization, the maximum cabin altitude exceedence is limited to 30,000 feet. The maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.



Cabin Altitude - Time History
Figure 4

Note: For figure 4, time starts at the moment cabin altitude exceeds 8,000 feet during depressurization. If depressurization analysis shows that the cabin altitude limit of this curve is exceeded, the following alternate limitations apply: After depressurization, the maximum cabin altitude exceedence is limited to 40,000 feet. The maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.

Current special condition (from 23-ACE-87 for Sino-Swearingen SJ-30-2)

30. Pressurization

Instead of compliance with § 23.841, the following apply:

(a) Pressurized cabins must be equipped to provide a cabin pressure altitude of not more than 8,000 feet at the maximum operating altitude of the airplane under normal operating conditions.
  (1) If certification for operation above 25,000 feet is requested, the airplane must be designed so that occupants will not be exposed to cabin pressure altitudes in excess of 15,000 feet after any probable failure condition in the pressurization system.
  (2) The airplane must be designed so that occupants will not be exposed to a cabin pressure altitude that exceeds that following after decompression from any failure conditions not shown to be extremely improbable:
    (i) Twenty-five thousand (25,000) feet for more than 2 minutes; or
    (ii) Forty thousand (40,000) feet for any duration.
  (3) Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.

(b) Pressurized cabins must have at least the following valves, controls, and indicators for controlling cabin pressure:
  (1) Two pressure relief valves to automatically limit the positive pressure differential to a predetermined value at the maximum rate of flow delivered by the pressure source. The combined capacity of the relief valves must be large enough so that the failure of any one valve would not cause an appreciable rise in the pressure differential. The pressure differential is positive when the internal pressure is greater than the external.
  (2) Two reverse pressure differential relief valves (or their equivalents) to automatically prevent a negative pressure differential that would damage the structure. One valve is enough, however, if it is of a design that reasonably precludes its malfunctioning.
  (3) A means by which the pressure differential can be rapidly equalized.
  (4) An automatic or manual regulator for controlling the intake or exhaust airflow, or both, for maintaining the required internal pressure and airflow rates.
  (5) Instruments at the pilot station to show the pressure differential, the cabin pressure altitude, and the rate of change of the cabin pressure altitude.
  (6) Warning indication at the pilot station to indicate when the safe or preset pressure differential and cabin pressure altitude limits are exceeded. Appropriate warning marking on the cabin pressure differential indicator meets the warning requirement for pressure differential limits and an aural or visual signal (in

addition to cabin altitude indicating means) meets the warning requirement for cabin pressure altitude limits if it warns the flight crew when the cabin pressure altitude exceeds 10,000 feet.

(7) A warning placard at the pilot station, if the structure is not designed for pressure differentials up to the maximum relief valve setting in combination with landing loads.

(8) The pressure sensors necessary to meet the requirements of paragraphs (b)(5) and (b)(6) of this section and § 23.1447, paragraphs (e) and (f), must be located and the sensing system must be designed so that, in the event of low of cabin pressure, the warning and automatic presentation devices, required by those provisions, will be actuated without any delay that would significantly increase the hazards resulting from decompression.

The current standard requires the airplane be able to maintain a cabin pressure altitude of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system. This has been interpreted to prohibit any transient exceedance of this limit. Specific requirements and compensating factors vary in each Equivalent Level of Safety, but typically include:

- Demonstration that the integrated duration and cabin altitude above 15,000 feet is less than the duration and cabin altitude below 15,000 feet, once system operation has stabilized.
- Review of physiological effects data that shows the hypoxia effects to only gradually increase with altitude and that the difference in effects for a small increase above 15,000 feet is negligible.

The current standard requires a cabin altitude warning at 10,000 Ft and does not provide for airfield operations above 10,000 feet field elevation. Specific requirements and compensating factors vary in each Equivalent Level of Safety, but typically include:

- Cabin altitude warning setting shall shift automatically, not to exceed 15,000 Ft, based on inputs of airplane on ground, airplane altitude and set landing altitude.
- Shift of cabin altitude warning setting above 10,000 Ft shall be locked-out when in flight above 25,000 Ft.
- Scheduled rates of cabin climb and descent shall be increased automatically when operating from a high altitude airfield to minimize the time the cabin altitude is above 10,000 Ft.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?: [Explain the differences in the standards or policy, and what these differences result in relative to (as applicable) design features/capability, safety margins, cost, stringency, etc.]

There are no differences in FAA and JAA standards or policy. Both airworthiness codes lack requirements for cabin pressurization for aircraft operation above 41,000 feet and for airfield operations above 10,000 feet. Both authorities have addressed the issue with Special Conditions and grants of Equivalent Levels of Safety for Part 23 certification. FAA has imposed the Special Conditions on Part 23 jets with maximum operating altitudes above 41,000 feet and granted findings of Equivalent Level of Safety for Part 23 jets approved for airfield operations above 10,000 feet.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

There are no differences in the means of compliance to the FAA and JAA standards.

5 – What is the proposed action? [Describe the new proposed requirement, or the proposed change to the existing requirement, as applicable. Is the proposed action to introduce a new standard, or to take some other action? Explain what action is being proposed (not the regulatory text, but the underlying rationale) and why that direction was chosen for each proposed action.]

The proposed action is to implement a new, performance-based standard for pressurization system failure conditions during high altitude operation. The objective of this standard is to assure that pressurization system failures cannot hazardously affect crew performance or result in permanent physiological harm to passengers. This new regulation will require advisory guidance material based on prior Special Conditions to provide an acceptable means of compliance.

6 - What should the harmonized standard be? [Insert the proposed text of the harmonized standard here]

§23.841 Pressurized cabins

(a) If certification for operation above 25,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet, in event of any probable failure ~~or malfunction~~ condition in the pressurization system. During the decompression, the cabin altitude shall not exceed 15,000 feet for more than 10 seconds and not exceed 25,000 feet for any duration.

(b) Pressurized cabins must have at least the following valves, controls, and indicators for controlling cabin pressure:

(1) Two pressure relief valves to automatically limit the positive pressure differential to a predetermined value at the maximum rate of flow delivered by the pressure source. The combined capacity of the relief valves must be large enough so that the failure of any one valve would not cause an appreciable rise in the pressure differential. The pressure differential is positive when the internal pressure is greater than the external.

(2) Two reverse pressure differential relief valves (or their equivalent) to automatically prevent a negative pressure differential that would damage the structure. However, one valve is enough if it is of a design that reasonably precludes its malfunctioning.

(3) A means by which the pressure differential can be rapidly equalized.

(4) An automatic or manual regulator for controlling the intake or exhaust airflow, or both, for maintaining the required internal pressures and airflow rates.

(5) Instruments to indicate to the pilot the pressure differential, the cabin pressure altitude, and the rate of change of cabin pressure altitude.

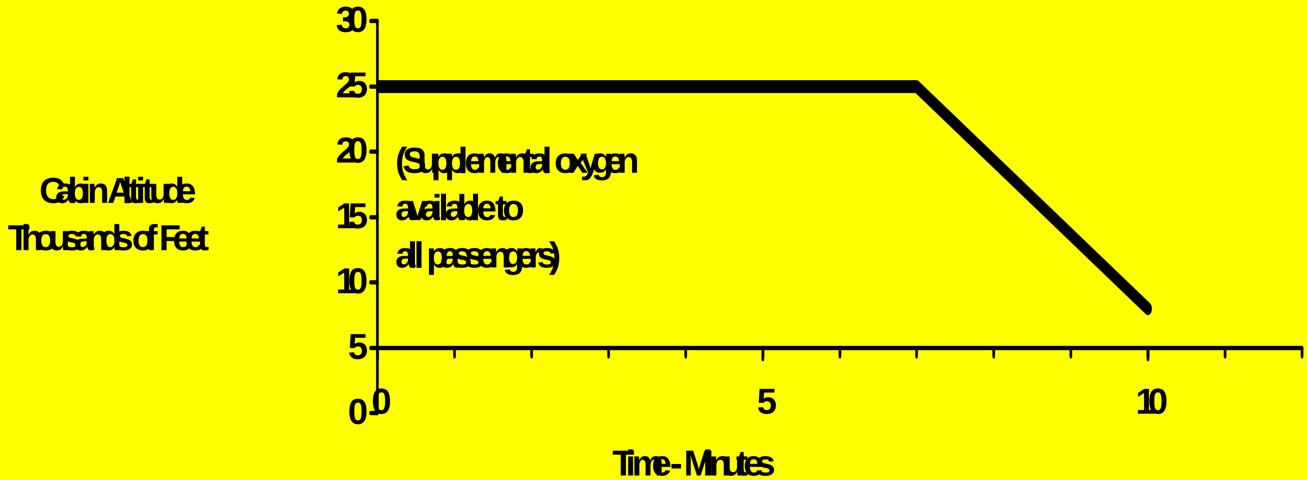
(6) Warning indication at the pilot station to indicate when the safe or preset pressure differential is exceeded and when a cabin pressure altitude of 10,000 feet is exceeded. The 10,000 foot cabin altitude warning can be increased up to 15,000 feet for operations from high altitude airfields provided:

(i) The landing or the take off modes (normal or high altitude) shall be clearly indicated to the flight crew.
(ii) Selection of normal or high altitude airfield mode shall require no crew action beyond normal pressurization system operation.
(iii) The pressurization system shall be designed to ensure cabin altitude does not exceed 10,000 feet when in flight above FL250.
(iv) The pressurization system and cabin altitude warning system shall be designed to ensure cabin altitude warning at 10,000 feet when in flight above FL250.

7) A warning placard for the pilot if the structure is not designed for pressure differentials up to the maximum relief valve setting in combination with landing loads.

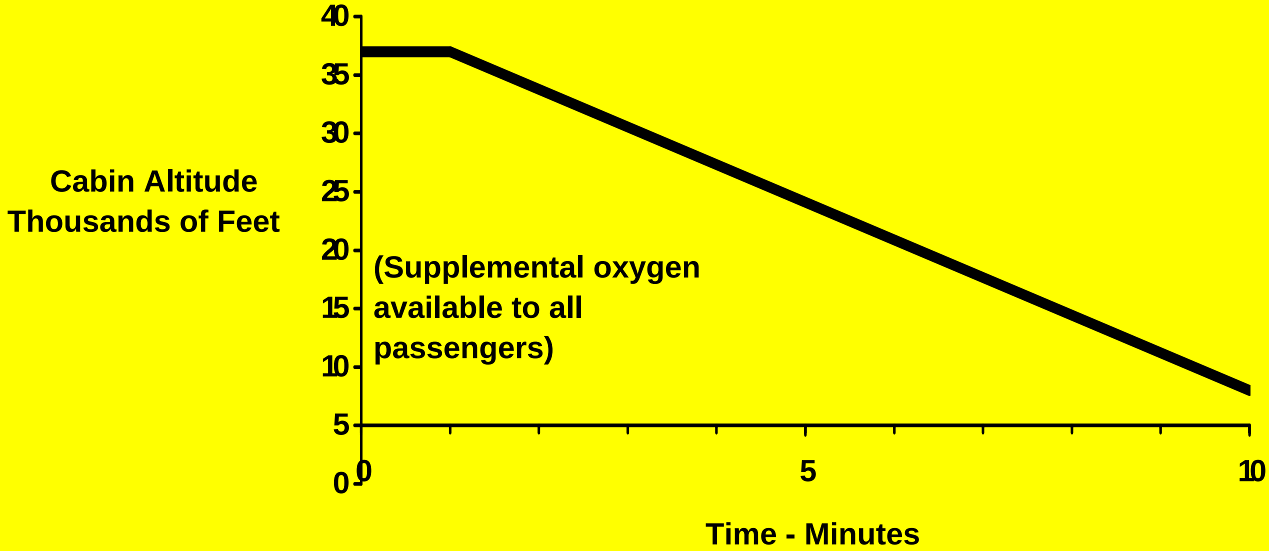
(8) A means to stop rotation of the compressor or to divert airflow from the cabin if continued rotation of an engine-driven cabin compressor or continued flow of any compressor bleed air will create a hazard if a malfunction occurs.

(c) If certification for operation above 41,000 feet and not more than 45,000 feet is requested,
(1) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any probable pressurization system failure in conjunction with any undetected, latent pressurization system failure condition:
(i) If depressurization analysis shows that the cabin altitude does not exceed 25,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 1.
(ii) Maximum cabin altitude is limited to 30,000 feet. If cabin altitude exceeds 25,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.
(2) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any single pressurization system failure in conjunction with any probable fuselage damage:
(i) If depressurization analysis shows that the cabin altitude does not exceed 37,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 2.
(ii) Maximum cabin altitude is limited to 40,000 feet. If cabin altitude exceeds 37,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.
(3) In showing compliance with paragraphs (c)(1) and (c)(2) above, it may be assumed that an emergency descent is made by an approved emergency procedure. A 17-second crew recognition and reaction time must be applied between cabin altitude warning and the initiation of an emergency descent. Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.



Cabin Altitude - Time History
Figure 1

Note: For Figure 1, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.



Cabin Altitude - Time History
Figure 2

Note: For Figure 2, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.

(d) If certification for operation above 45,000 feet and not more than 51,000 feet is requested,

(1) Pressurized cabins must be equipped to provide a cabin pressure altitude of not more than 8000 feet at the maximum operating altitude of the airplane under normal operating conditions.

(2) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any failure condition not shown to be extremely improbable:
(i) Twenty-five thousand (25,000) feet for more than 2 minutes: or
(ii) Forty thousand (40,000) feet for any duration.
(3) Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.
(4) An aural or visual signal (in addition to the cabin altitude indicating means in (b)(6) above) must be provided to warn the flight crew when the cabin pressure altitude exceeds 10,000 feet.
(5) The sensing system and pressure sensors necessary to meet the requirements of (b)(5), (b)(6), and (d)(4) above and CFR14 Part 23.1447 paragraphs (e) and (f), must, in the event of low cabin pressure, actuate the required warning and automatic presentation devices without any delay that would significantly increase the hazards resulting from decompression.

(e) If certification for operation above 41,000 feet is requested, additional damage-tolerance requirements are necessary to prevent fatigue damage that could result in a loss of pressure that exceeds the requirements of paragraphs (c) and (d) of this section. Sufficient full scale fatigue test evidence must be provided to demonstrate that this type of pressure loss due to fatigue cracking will not occur within the Limit of Validity of the Maintenance program for the airplane. In addition, a damage tolerance evaluation of the fuselage pressure boundary must be performed assuming visually detectable cracks and the maximum damage size for which the requirements of paragraphs (c) and (d) of this section can be met. Based on this evaluation, inspections or other procedures must be established and included in the Limitations Section of the Instructions for Continued Airworthiness required by § 23.1529.

7 – How does this proposed standard address the underlying safety issue (identified under #1)? [Explain how the proposed standard ensures that the underlying safety issue is taken care of.]

The proposed standard provides an appropriate level of safety for jets and high performance aircraft certificated to 14 CFR 23 normal and commuter category. The proposed standard codifies the intent of existing Special Conditions and Equivalent Levels of Safety previously approved for 14 CFR Part 23 normal and commuter category applicants.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Explain how each element of the proposed change to the standards affects the level of safety relative to the current FAR. It is possible that some portions of the proposal may reduce the level of safety even though the proposal as a whole may increase the level of safety.]

The proposed standard normalizes the requirements for turbojet and turbopropeller high performance aircraft certificated for 14 CFR Part 23 normal and commuter category.

The proposed standard increases the level of safety relative to the existing requirements of §23.841 because the existing code has no limits on cabin altitude during decompression. The proposed standard maintains the same level of safety compared to the Special Conditions that have been previously imposed on Part 23 jets by ensuring an adequately safe environment after system failures.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain. [Since industry practice may be different than what is required by the FAR (e.g., general industry practice may be more restrictive), explain how each element of the proposed change to the standards affects the level of safety relative to current industry practice. Explain whether current industry practice is in compliance with the proposed standard.]

Relative to current industry practice, the proposed standard maintains an equivalent level of safety. The proposed standard adheres to recognized industry and regulatory guidelines. The proposed standard preserves the crew's ability to remain alert and be able to fly the airplane during a decompression event while maintaining an acceptable level of safety and protection from permanent physiological harm for all aircraft occupants.

Current industry practice would be in compliance with the proposed standard based on certification by showing compliance to special conditions or equivalent levels of safety.

10 - What other options have been considered and why were they not selected?: [Explain what other options were considered, and why they were not selected (e.g., cost/benefit, unacceptable decrease in the level of safety, lack of consensus, etc.) Include the pros and cons associated with each alternative.]

The Part 23 Jet Airworthiness Working Group considered the option of adopting the equivalent of Amendment 25-87. A review of the safety records of 14 CFR Part 23 normal and commuter category aircraft certified with special conditions for high altitude operation supports this Part 23 Jet Airworthiness Working Group proposal using the special conditions previously used for certification for operation below 45,000 feet.

11 - Who would be affected by the proposed change? [Identify the parties that would be materially affected by the rule change – airplane manufacturers, airplane operators, etc.]

Airplane manufacturers and suppliers will be affected. The proposed change would affect the airplane manufacturers by having a regulation that defines a requirement for showing compliance for aircraft operating at altitudes above 41,000 feet. They will see a benefit from an amended rule that would reduce certification costs and the associated delay related to application for, or extension of, Equivalent Levels of Safety.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

No advisory guidance material developed from the existing Special Conditions or Equivalent Level of Safety grants is recommended for inclusion in the rule text or preamble. There is no existing Part 23 guidance for showing compliance to the Special Condition requirements. There is guidance in Advisory Circular 25-20 for showing compliance to § 25.841, Amendment 25-87. This Part 25 rule is similar to the Part 23 Special Conditions required for operation above 45,000 feet.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted? [Indicate whether the existing advisory material (if any) is adequate. If the current advisory material is not adequate, indicate whether the existing material should be revised, or new material provided. Also, either insert the text of the proposed advisory material here, or summarize the information it will contain, and indicate what form it will be in (e.g., Advisory Circular, policy, Order, etc.)]

Draft AC23 –17B should be updated prior to release to include advisory material relative to §23.841 based on the prior Special Conditions. The Special Conditions defined the fuselage structure damage, engine and system failures to be considered in the evaluation of the decompression. The advisory material should also address the allowable leakage based on the Special Conditions.

14 - How does the proposed standard compare to the current ICAO standard? [Indicate whether the proposed standard complies with or does not comply with the applicable ICAO standards (if any)]

The proposed standard does not conflict with the intent of International Civil Aviation Organization (ICAO) Annex 8 "Airworthiness of Aircraft" requirements, as there are no specific ICAO requirements defining cabin pressure altitude limits after decompression.

15 - Does the proposed standard affect other HWG's? [Indicate whether the proposed standard should be reviewed by other harmonization working groups and why.]

No. There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard [Please provide information that will assist in estimating the change in cost (either positive or negative) of the proposed rule. For example, if new tests or designs are required, what is known with respect to the testing or engineering costs? If new equipment is required, what can be reported relative to purchase, installation, and maintenance costs? In contrast, if the proposed rule relieves industry of testing or other costs, please provide any known estimate of costs.]

No additional certification costs are anticipated with this proposal. Reduced certification costs are associated with elimination of the documented approval process for Special Conditions and grants of Equivalent Levels of Safety.

17. - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Addressed in Item 13.

18. - -Does the 23 Jet WG wish to answer any supplementary questions specific to this project? [If the HWG can think of customized questions or concerns relevant to this project, please present the questions and the HWG answers and comments here.]

Yes

19. – Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes.

20. – In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain. [A negative answer to this question will prompt the FAA to pull the project out of the Fast Track process and forward the issues to the FAA's Rulemaking Management Council for consideration as a "significant" project.]

Yes, because this proposed change just adopts already defined Special Conditions and Equivalent Levels of Safety as the standard.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.853 Passenger and crew compartment interiors

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed change. The current standards are unique to commuter category airplanes. The No Smoking lettering size in 14 CFR 25 was deleted at Amdt 25-72 when the requirements were moved from 25.853 to 25.791, effective August 20, 1990. The 23.853(d)(2) requirement was never changed accordingly.

The proposed change will make the No Smoking sign requirements consistent between 14 CFR 23 and 25.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Equivalent Level of Safety

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. Since there are essentially no differences in the requirements and the ELOS meets the Part 25 requirements this does not create any issues.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23 to delete the requirement for ½ inch letters to agree with current Part 25 requirements.

(d) In addition, for commuter category airplanes the following requirements apply:
(1) Each disposal receptacle for towels, paper, or waste must be fully enclosed and constructed of at least fire resistant materials and must contain fires likely to occur in it under normal use. The ability of the disposal receptacle to contain those fires under all probable conditions of wear, misalignment, and ventilation expected in service must be demonstrated by test. A placard containing the legible words "No Cigarette Disposal" must be located on or near each disposal receptacle door.
(2) Lavatories must have "No Smoking" or "No Smoking in Lavatory" placards located conspicuously on each side of the entry door and self-contained, removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if it can be seen from the cabin side of each lavatory door served. ~~The placards must have red letters at least ½ inch high on a white background at least 1 inch high (a "No Smoking" symbol may be included on the placard)~~.

6 - What should the harmonized standard be?

The same as proposed for 14 CFR 23.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for aircraft certificated under 14 CFR 23 normal category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard normalizes the requirements between 14 CFR 23 normal and 14 CFR 25 transport category aircraft and maintains the same level of safety as currently exists.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard maintains the same level of safety as is currently being applied to Part 25 aircraft and to Part 23 aircraft by means of an Equivalent Level of Safety.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing ELOS and leaving the requirements as is in current Normal Category part 23. However, this requires an ELOS for many applications and this adds to the burden of both the FAA and the applicant so elected to remove the requirement. Plus this change makes the requirement the same as currently applied to Part 25 aircraft.

11 - Who would be affected by the proposed change?

The manufacturers of Part 23 airplanes.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Not applicable

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are currently no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

This will eliminate the cost to the applicant and the FAA of having to process the ELOS. The No Smoking signs are still required.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because ELOS's are already granted for relief of this requirement and this will help reduce the burden on both the FAA and the applicant.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.1165 Engine ignition systems

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of Part 23 airplane using turbojet engines that up until now has been addressed using an FAA interpretation.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed change marked. The current standard was written for turbopropeller engine airplanes and did not include jet engines.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

FAA Interpretation/Agreement

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are no differences between the FAA and JAA standards. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane with jet engines isn't addressed completely in current FAA, JAA, or EASA standards and thus results in FAA agreements being applied.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23.1165(f) to include standards for jets airplanes as well as propeller-driven airplanes.

6 - What should the harmonized standard be?

23.1165(f) In addition, for commuter category airplanes, each ~~turbopropeller~~ turbine engine ignition system must be an essential electrical load.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Includes requirements for jets as well as turbopropeller airplanes in the rule.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard maintains the same level of safety since the requirement has been applied by agreement with the FAA.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change maintains the same level of safety.

10 - What other options have been considered and why were they not selected?

This change provides clarification and expands the requirement to cover jet powered aircraft as well as propeller driven aircraft.

11 - Who would be affected by the proposed change?

The manufacturers of small part high performance airplanes using any turbine means of propulsion would be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Not applicable.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

No

16 - What is the cost impact of complying with the proposed standard?

There should be no cost impact since the proposed change simply provides clarification of the regulation and extends coverage of the requirement to jet aircraft that have already been meeting the requirement.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with this requirement for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1301 Function and installation

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The purpose of this particular rulemaking effort is to update this regulation to what is considered a more reasonable approach to certification of equipment standards. The proposed change would require certificating only the equipment required for type certification and/or operations rules to "perform their intended function". Item 2 and 5 below lists the current regulation and the proposed changes. Furthermore, this requirement has been modified and moved to 23.1309(a).

2 - What are the current FAR and JAR standards relative to this subject?
See question 6 for the current standard with the proposed change marked.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not Applicable.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The proposed change would require certificating only the equipment required for type certification and/or operations rules to "perform their intended functions".

5 – What is the proposed action?

Proposed Change is to delete § 23.1301(d) " Function properly when installed". Paragraph (d) of the current § 23.1301 ("Function and installation") states that each item of installed equipment must "function properly when installed." This rule applies to all equipment installed in the airplane whether required or not required. The new rule would reduce the burden since it would only be required on equipment required for type certification or operating rules. The FAA proposes to delete this paragraph, because it would be redundant to the proposed revision to § 23.1309(a).

6 - What should the harmonized standard be?

23.1301 Each item of installed equipment must--

(a) Be of a kind and design appropriate to its intended function;

(b) Be labeled as to its identification, function, or operating limitations, or any applicable combination of these factors; and

(c) Be installed according to limitations specified for that equipment.

~~(d) Function properly when installed.~~

The proposed changes are not harmonized with EASA at this time but it is recommended that the harmonized standard be as proposed in #5 above.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

The proposed change would require certificating only the equipment required for type certification and/or operations rules to "perform their intended function". Other equipment will be certificated on a non-hazardous basis.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change would require certificating only the equipment required for type certification and/or operations rules to "perform their intended function". The FAA views this as a maintaining the level of safety because the affected equipment will be installed to ensure that there can be no adverse safety affect on the required equipment and crew.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed change would require certificating only the equipment required for type certification and/or operations rules to "perform their intended function". Industry views this as a maintaining the level of safety because the affected equipment will be installed to ensure that there can be no adverse safety affect on the required equipment and crew.

10 - What other options have been considered and why were they not selected?

Not Applicable.

11 - Who would be affected by the proposed change?

FAA, airframe manufacturer, and systems specific manufactures.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

The proposed changes would require revision to the current advisory material. Harmonization with foreign airworthiness authorities would have to be accomplished.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Advisory material would have to be revised to address this change in equipment standards philosophy.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There currently are no harmonization working groups in session.

16 - What is the cost impact of complying with the proposed standard?

This proposed rulemaking will lower the certification burden, thus reducing the cost, for equipment that "is not required to perform it's intended function" if it is not required by regulation and or operational rules and does not adversely affect safety.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

As stated, a revision to the applicable Advisory Circulars will need to be accomplished after this regulation is updated.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

There currently are currently no harmonization working groups in session. However, the 23 Jet WG proposes that this change be fast tracked.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1309 Equipment, systems, and installation

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The purpose of this rulemaking effort is to update this regulation to what is currently being accomplished for this class of airplane. Some of the major issues being addressed are as follows:

- Applying clarification to 23.1309 that is currently cited in Advisory Circular (AC) 23.1309-1C.
- Adding electronic engine controls to be applicable in section 23.1309 to eliminate the requirement for special conditions.
- Deleting unnecessary and redundant requirements.
- Incorporating probability values and software and hardware assurance levels for the four classes of airplanes that are currently in AC 23.1309-1C.
- Replacing outdated failure conditions terminology with the updated/current terminology.
- Warning for unsafe conditions would not have to be provided if the airplane has adequate inherent characteristics
- Moving the power source capacity and distribution requirements from section 23.1309 to a new section.
- Changing the compliance for environmental conditions from "any foreseeable condition" to "airplane operating environmental conditions."

2 - What are the current FAR and JAR standards relative to this subject?

Reference latest amendment to 23.1309.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

The proposed changes will incorporate Special Condition, Equivalent Level of Safety, and Advisory Circular information into the regulations. This will streamline certification activities of this class of airplane.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The intent of this regulatory change is to update the regulations to the current practices used for this class of airplane.

5 – What is the proposed action?

The proposed action is best explained in the response to question 6.

6 - What should the harmonized standard be?

The proposed changes are not harmonized with JAA or EASA at this time. However, this should be the proposed standard for harmonization.

Section. 23.1309

Equipment, systems, and installations.

ADD.

The requirements of this section, except as identified below, are applicable, in addition to specific design requirements of Part 23, to any equipment or system as installed in the airplane. This section is a regulation of general requirements. It should not be used to supersede any specific requirements contained in another section of Part 23. Therefore, this section should not be used to increase or decrease the requirements except it can be used for determining the software and hardware development assurance levels.

This section does not apply to the performance, flight characteristics requirements of Subpart B, and structural loads and strength requirements of Subparts C and D, but it does apply to any system on which compliance with the requirements of Subparts B, C, D and E is based. The flight structure such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments are excluded. Simple conventional mechanical systems are also excluded. For example, it does not apply to an airplane's inherent stall characteristics or their evaluation of § 23.201, but it does apply to a stick pusher (stall barrier) system installed to attain compliance with § 23.201.

Explanation: The introduction provides a clarification of applicability: The FAA's historical policy in applying the requirements of § 23.1309 has been to consider that the rule is one of general applicability. This change will reduce the burden by applying § 23.1309 of the current rule to only certain sections. This means that the requirements of the § 23.1309 are not applicable to any specific requirements contained in another section of Part 23. Since software or hardware development assurance levels are not addressed elsewhere in Part 23, the development assurance criteria by the use of this section together with AC 23.1309-1C or later version are applicable. Subpart E, Powerplant, is added for electronic engine control (EEC) systems for only their installation effects. Currently, special conditions have been applied to electronic engine controls. The functions of the EEC may be considered critical. Additionally, the EEC system may be susceptible to disruption of both command/response/engine health-monitoring signals as a result of electrical and magnetic interference. This disruption of signals could result in the loss of critical engine functions, flight displays and annunciations, or present misleading information, including the health of the engine, to the pilot.

DELETE:

~~(a) Each item of equipment, each system, and each installation:~~

~~(1) When performing its intended function, may not adversely affect the response, operation, or accuracy of any--~~

~~(i) Equipment essential to safe operation; or~~

~~(ii) Other equipment unless there is a means to inform the pilot of the effect.~~

~~(2) In a single-engine airplane, must be designed to minimize hazards to the airplane in the event of a probable malfunction or failure.~~

~~(3) In a multiengine airplane, must be designed to prevent hazards to the airplane in the event of a probable malfunction or failure.~~

~~(4) In a commuter category airplane, must be designed to safeguard against hazards to the airplane in the event of their malfunction or failure.~~

Explanation: Delete 23.1309(a). This section is not needed with the new 23.1309(a) and current 23.1309(b) and materials contained in AC 23.1309-1C/D that established the four classes of airplanes and with various probability ranges. Paragraph (a) would be a duplication of requirements with the new paragraphs (a) and (b). AC 23.1309-1C/D allows a much better approach to safety assessment when qualitative analysis and engineering judgment are encouraged. Originally most of 23.1309 (a) requirements were for older airplanes that were developed under amendment 23-14. These airplanes can use the older certification basis when applicable. Also, with 23.1309 (b) an evaluation is required even on airplanes without complex systems. If the systems are not complex, the AC 23.1309-1C/D does not require a quantitative assessment.

ADD.

(a) The airplane equipment and systems must be designed and installed so that:

(1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the airplane operating and environmental conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered.

(2) Other equipment and systems do not adversely affect the safety of the airplane or its occupants, or the proper functioning of those covered by sub-paragraph (a)(1) of this paragraph.

Explanation: The FAA proposes to revise § 23.1309(a) to specify that, with certain exceptions, the airplane equipment and systems must be designed and installed so that they "perform as intended" under the airplane's operating and environmental conditions. The proposed change broadens the scope of existing paragraph 23.1309(a) to all installed airplane equipment and systems whose improper functioning would reduce safety regardless of whether required by type certification rules, operating rules, or not required. The phrase "improper functioning" is intended to identify equipment and system failures that have an effect on airplane safety and are, therefore, failure conditions. Any installed equipment or system, the failure or malfunction of which results in a minor or more severe failure condition, is considered to have an effect on the safe operation of the airplane.

Paragraph 23.1309(a) would have requirements for two different classes of equipment and systems installed in the airplane. Paragraph 23.1309(a)(1) covers the equipment and systems that have a safety effect, or are installed in order to meet regulatory requirement. This class of equipment and systems are required to "perform as intended under the airplane operating and environmental conditions." Paragraph 23.1309(a)(2) requires all other equipment and systems to not have an adverse effect on the safe operation of the airplane. Consequently these equipment and systems are not required to "perform as intended."

Clarification of "Perform as Intended":

The FAA sometimes finds type designs subject to such failures acceptable if these failures are judged to not significantly contribute to the risks already accepted under § 23.1309(b). For example, some degradation in functionality and capability are routinely allowed during some environmental qualifications, such as HIRF and lightning testing. In fact, paragraph (d) of § 23.1309 (System lightning protection") specifically allows the functionality and capabilities of some electrical/electronic systems to be lost when the airplane is exposed to lightning, provided that "these functions can be recovered in a timely manner."

Clarification of "Under the Airplane Operating and Environmental Conditions":

With this proposed revision to § 23.1309(a), the conditional qualifiers of "when installed" and "under any foreseeable operating condition," contained in the current §§ 23.1301(d) and 23.1309(b)(1), would be replaced by:

". . . under the airplane operating and environmental conditions . . ."

The proposed phrase is intended to mean:

- Throughout the full normal operating envelope of the airplane, as defined by the Airplane Flight Manual, together with any modification to that envelope associated with abnormal or emergency procedures and any anticipated crew action; and
- Under the anticipated external and internal airplane environmental conditions, as well as any additional conditions where equipment and systems are assumed to "perform as intended".

This change was made in response to the observation that although certain operating conditions are foreseeable, achieving normal performance when they exist is not always possible. For example, ash clouds from volcanic eruptions are foreseeable, but airplanes with current technology cannot safely fly in such clouds.

Provisions for Equipment and Systems with No Safety Effect on the Operation of the Airplane:

Modern airplanes contain equipment that is not intended to have an effect on the safe operation of the airplane. Typically, this equipment is associated with amenities for the passengers and includes such items as:

- Entertainment displays,
- Audio systems,
- In-flight telephones,
- Non-emergency lighting, and
- Equipment for food storage and preparation.

A difficulty for airplane manufacturers arises when certification authorities have questioned installations of this type when the equipment does not perform in accordance with its system specifications and, therefore, is "not functioning properly when installed." This poses a non-compliance issue because the present regulations require that all equipment, systems, and installations function properly when installed.

However, the proper functioning of "amenities," such as those items listed above, is not necessary for the safe operation of the airplane. The only safety issues associated with this type of equipment and systems are the possibility that, as a result of its normal operation or in the event of its failure, it could directly injure someone or adversely affect the functioning of the crew or other equipment and systems. Accordingly, the provision for exceptions in the proposed § 23.1309(a)(2) allows these types of "amenities" to be approved even if they frequently do not perform as intended.

Under proposed § 23.1309(a)(2), any frequent failure of amenities to "perform as intended" must not adversely affect the safety of the airplane or its occupants, or the proper functioning of the equipment and systems that do have a safety impact. That is, they must not directly injure persons or adversely affect the crew or other equipment and systems. The intent of this accommodation is to reduce the cost of certification to airplane and equipment manufacturers without reducing the level of safety provided by part 23. No safety benefit is derived from demonstrating that equipment performs as intended, if failing to perform as intended would not result in a "minor" or more severe failure condition. Instead, as a minimum, the FAA would require that a qualitative evaluation of the design and installation of such equipment and systems as installed in the airplane be performed to determine that neither their normal operation nor their failure will adversely affect crew workload, the operation of other systems, or the safety of persons.

The FAA expects that, in most cases, normal installation practices will result in sufficiently obvious isolation of the impacts of such equipment on safety that substantiation can be based on a relatively simple qualitative installation evaluation. If the possible impacts, including failure modes or effects, are questionable or isolation between systems is provided by complex means, more formal structured evaluation methods or a design change may be necessary.

Environmental Qualification of "Amenities": In accordance with the proposed revision to § 23.1309, the environmental qualification requirements for certification of the airplane equipment and systems that are not associated with any functional hazard would be reduced to those tests necessary only to verify that their presence, operation, or failure does not:

- Interfere with the proper operation of other equipment,
- Directly injure anyone, or
- Increase the flightcrew's workload unreasonably.

Although these types of equipment and systems are not required to function properly when installed, they would be required to be functioning when they are tested to verify that they do not interfere with the operation of other airplane equipment and systems and do not pose a hazard in and of themselves. Other environmental testing for this type of equipment is no longer required.

DELETE:

~~(b) The design of each item of equipment, each system, and each installation must be examined separately and in relationship to other airplane systems and installations to determine if the airplane is dependent upon its function for continued safe flight and landing and, for airplanes not limited to VFR conditions, if failure of a system would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions. Each item of equipment, each system, and each installation identified by this examination as one upon which the airplane is dependent for proper functioning to ensure continued safe flight and landing, or whose failure would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions, must be designed to comply with the following additional requirements:~~

~~(1) It must perform its intended function under any foreseeable operating condition.~~

~~(2) When systems and associated components are considered separately and in relation to other systems--~~

~~(i) The occurrence of any failure condition that would prevent the continued safe flight and landing of the airplane must be extremely improbable; and~~

~~(ii) The occurrence of any other failure condition that would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions must be improbable.~~

~~(4) Compliance with the requirements of paragraph (b)(2) of this section may be shown by analysis and, where necessary, by appropriate ground, flight, or simulator test. The analysis must consider –~~

~~(i) Possible modes of failure, including malfunctions and damage from external sources;~~

~~(ii) The probability of multiple failures and the probability or undetected faults;~~

~~(iii) The resulting effects of the airplane and occupants, considering the stage of flight and operating conditions; and~~

~~(iv) The crew warning cues, corrective action required, and the crew's capability of determining faults.~~

ADD:

(b) The airplane systems and associated components for the appropriate classes of airplane, considered separately and in relation to other systems, must be designed and installed so that:

(1) Each catastrophic failure condition

(i) is extremely improbable; and

(ii) does not result from a single failure; and

(2) Each hazardous failure condition is extremely remote; and

(3) Each major failure condition is remote.

Explanation. The FAA proposes to revise § 23.1309(b) to reduce the certification burden by dividing the small airplanes into four classes of airplanes, to require that the airplane systems and associated components considered separately and in relation to other systems must be designed and installed so that the requirements would be the same as defined in AC 23.1309-1C/D. It updates the terminology and adds the classes of airplanes as defined in AC 23.1309-1C/D, uses the later terms, and makes it read much easier to determine compliance.

Since their adoption by the FAA, these probability guidelines and their role in demonstrating and finding compliance with §23.1309(b) have been a source of misinterpretation, confusion, and controversy. The FAA intends the numerical values in AC 23.1309-1C/D associated with the probabilistic terms in §23.1309(b) to be used as acceptable risk guidelines in those cases where the effect of system failures are examined by quantitative probability methods of analysis. The use of numerical probability analysis and these guidelines is simply intended to supplement, but not replace, qualitative methods based on engineering and operational judgments. Whether a design meets these guidelines simply provides some evidence to support an informed finding by the FAA as to whether or not the design complies with the intent of the rule.

The Intent of the Term "Extremely Improbable":

The objective of using this term in the regulations has been to describe a condition (usually a failure condition) that has a probability of occurrence so remote that it is not anticipated to occur in service on any commuter category airplane to which the standard applies. For other classes of airplanes, likelihood of occurrence may be greater. However, while a rule sets a minimum standard for all the airplanes to which it applies, compliance determinations are limited to individual type designs. Experience indicates that the level of conservatism traditionally provided in proper safety assessments more than compensates for the cumulative risk effects across airplane types.

The means of demonstrating that the occurrence of an event is "extremely improbable" varies widely, depending on the type of system, component, or situation that must be assessed. Failure conditions arising from a single failure are not considered "extremely improbable;" thus, probability assessments normally involve failure conditions arising from multiple failures. Both qualitative and quantitative assessments are used in practice, and both are often necessary to some degree to support a conclusion that an event is "extremely improbable." Generally, performing only a quantitative analysis to demonstrate that a failure condition is extremely improbable is insufficient due to the variability and uncertainty in the analytical process. Any analysis used as evidence that a failure condition is extremely improbable should include justification of any assumptions made, data sources and analytical techniques to account for the variability and uncertainty in the analytical process. Refer to AC23.1309-1C/D, or later revision, for acceptable means of compliance. In short, wherever part 23 requires that a condition be "extremely improbable," the compliance method -- whether qualitative, quantitative, or a combination of the two -- along with engineering judgment, must provide convincing evidence that the condition should not occur in service.

Inclusion of Specific Failure Condition Categories and Probabilities:

The proposed § 23.1309(b) would include specific terms to describe failure condition categories and probabilities that are in current usage within the aviation industry. It is recognized that some of these terms may be used elsewhere within 14 CFR with different meanings. The FAA may consider issuing a miscellaneous regulatory amendment in the future to standardize the use of these terms to classify failure conditions. However, for the purposes of this proposed regulation, these terms are defined in AC 23.1309-1C/D.

Although the terminology in § 23.1309(b) would be changed from the current regulation, the intent would not be changed. The new text of the rule would serve to "document" and formally institute the current interpretation and application of these terms.

Prohibiting Catastrophic Single Failures:

The proposed text of § 23.1309(b) would explicitly include a fail-safe design requirement that single failures must not result in catastrophic failure conditions, regardless of their probability. This has been the FAA's practice and, in fact, was the only requirement of this sort under the FAA's early Civil Air Regulations (CAR) and the earliest version of part 23. Further guidance concerning § 23.1309(b) has been made part of the new proposed Advisory Circular (AC) 25.1309-1C/D.

Additional Explanation taken from AC 23.1309-1C.

The safety objective is to ensure an acceptable safety level for equipment and systems installed on the airplane. A logical and acceptable inverse relationship should exist between the Average Probability Per Flight Hour and the severity of Failure Conditions effects (as shown in the Figure 2 of AC 23.1309-1C/D). This figure defines the appropriate airplane systems probability standards for four certification classes of airplanes designed to 14 CFR Part 23 standards. The relationship between probability and severity of Failure Condition Effects is as follows:

- Failure Conditions with No Safety Effect have no probability requirement.
- Minor Failure Conditions may be Probable.
- Major Failure Conditions must be no more frequent than Remote.

- Hazardous Failure Conditions must be no more frequent than Extremely Remote.
- Catastrophic Failure Conditions must be Extremely Improbable.

(1) The four certification classes of airplanes in Figure 2 are as follows: Class I (Typically SRE under 6,000 pounds (#)), Class II (Typically MRE and STE under 6,000 pounds), Class III (Typically SRE, STE, MRE, and MTE equal or over 6,000 pounds), and Class IV (Typically Commuter Category). The acronyms for these airplanes in the four classes of Part 23 airplanes are Single Reciprocating Engine (SRE), Multiple Reciprocating Engine (MRE), Single Turbine Engine (STE), and Multiple Turbine Engine (MTE).

(2) Numerical values are assigned for use in those cases where the impact of system failures is examined by quantitative methods of analysis. Also, the related new Software Development Assurance Levels for the various Failure Conditions are part of the matrix. The new probability standards are based on historical accident data, systems analyses, and engineering judgment for each class of airplane.

(3) In assessing the acceptability of a design, the FAA recognized the need to establish rational probability values. Historically, failures in GA airplanes that might result in Catastrophic Failure Conditions are predominately associated with the primary flight instruments in Instrument Meteorological Conditions (IMC). Historical evidence indicates that the probability of a fatal accident in restricted visibility due to operational and airframe-related causes is approximately one per ten thousand hours of flight for single-engine airplanes under 6,000 pounds. Furthermore, from accident databases, it appears that about 10 percent of the total were attributed to Failure Conditions caused by the airplane's systems. It is reasonable to expect that the probability of a fatal accident from all such Failure Conditions would not be greater than one per one hundred thousand flight hours or 1×10^{-5} per flight hour for a newly designed airplane. It is also assumed, arbitrarily, that there are about ten potential Failure Conditions in an airplane that could be catastrophic. The allowable target Average Probability Per Flight Hour of 1×10^{-5} was thus apportioned equally among these Failure Conditions, which resulted in an allocation of not greater than 1×10^{-6} to each. The upper limit for the Average Probability per Flight Hour for Catastrophic Failure Conditions would be 1×10^{-6}, which establishes an approximate probability value for the term "Extremely Improbable." Failure Conditions having less severe effects could be relatively more likely to occur. Similarly, airplanes over 6,000 pounds have a lower fatal accident rate; therefore, they have a lower probability value for Catastrophic Failure Conditions.

c. Acceptable criteria for Software and Hardware Development Assurance Levels of Part 23 airplanes are shown in Figure 2.

(1) The criteria shown in Figure 2 directly reflect the historical accident and equipment probability of failure data in the Civil Air Regulations (CAR) 3 and 14 CFR Part 23 airplane fleet. Characteristics of the airplane, such as stall speed, handling characteristics, cruise altitude, ease of recognizing system failures, recognition of entry into stall, pilot workload, and other factors (which include pilot training and experience) affect the ability of the pilot to safely handle various types of system failures in small airplanes. The criteria considered over all airplanes' Failure Conditions is based on service experience, operational exposure rates, and total airplane system reliability. The values for individual system probability of failure could be higher than probability values shown in Figure 2 for specific Failure Conditions since it considers the installed airplane systems, events, and factors.

(2) These classes were defined based on the way accident and safety statistics are currently collected. Generally, the classes deal with airplanes of historically equivalent levels of system complexity, type of use, system reliability, and historical divisions of airplanes according to these characteristics. However, these classes could change because of new technologies and the placement of a specific airplane in a class must be done in reference to all the airplane's missions and performance characteristics. The applicant should have the cognizant certification authority concurrence on the applicable airplane class early in the program. When unusual situations develop, consult the Small Airplane Directorate to obtain specific policy guidance or approval.

(3) For example, multi-turbine-engine airplanes traditionally have been subject to more stringent requirements than a single-engine reciprocating airplane, with the fuel consumption of a reciprocating engine, which permits a wider stall-cruise speed ratio than traditional turbine-engine airplanes. Such an airplane with a stall speed under 61 knots with simple systems, and with otherwise similar characteristics to a traditional single-engine reciprocating airplane (except for a higher cruise speed and a more reliable engine that is simpler to operate), can be treated as a Class I airplane under this analysis. Conversely, if a single-engine reciprocating airplane has the performance, mission capability, and system complexity of a higher class (such as cabin pressurization, high cruise altitude, and extended range), then that type of airplane design may align itself with the safety requirements of a higher class (for example, Class II airplane). These determinations should be made during the development of the certification basis.

DELETE:

~~(b) (3) Warning information must be provided to alert the crew to unsafe system operating conditions and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed to minimize crew errors that could create additional hazards.~~

ADD:

(c) Information concerning unsafe system operating conditions must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimize crew errors which could create additional hazards.

Explanation:

Description of the Specific Changes:

The FAA proposes to revise the text of § 23.1309(b)(3) to continue to require that:

- Information concerning unsafe system operating conditions be provided to the crew to enable them to take appropriate corrective action, and
- systems and controls, including indications and annunciation, be designed to minimize crew errors that could create additional hazards.

The proposed revised paragraph § 23.1309(c) would also require that a warning indication be provided if immediate corrective action is required.

Categorization of Required Flightcrew Information:

Proposed § 23.1309(c) would be compatible with the requirements of the current § 23.1322 ("Warning, caution, and advisory lights"), which distinguishes between caution, warning, and advisory lights installed on the flight deck. Rather than only providing a warning to the flightcrew, which is required by the current rule, the proposed § 23.1309(c) would require that information concerning unsafe system operating conditions be provided to the flightcrew. A warning indication would still be required if immediate action by a flightcrew member were required. However, the particular method of indication would depend on the urgency and need for flightcrew awareness or action that is necessary for the particular failure. Inherent airplane characteristics may be used in lieu of dedicated indications and annunciations if they can be shown to be timely and effective. However, the use of periodic maintenance or flightcrew checks to detect significant latent failures when they occur is undesirable and should not be used in lieu of practical and reliable failure monitoring and indications.

Minimization of Crew Errors:

The proposed wording of § 23.1309(c) is intended to clarify the current rule by specifying that the design of systems and controls, including indications and annunciations, must minimize crew errors that could create additional hazards. The additional hazards to be minimized are those that could occur after a failure and are caused by inappropriate actions made by a crew member in response to the failure. Unless they are accepted as part of normal aviation abilities, any procedures for the flightcrew to follow after the occurrence of a failure indication or annunciation should be described in the approved Airplane Flight Manual (AFM), AFM revision, or AFM supplement.

Interpretation of Unsafe System Operating Conditions:

The following interpretive material provides guidance to aid in making determinations as to whether a given system operating condition is "unsafe". It is not intended to be the only way to define an unsafe condition.

Any system operating condition which, if not detected and properly accommodated by crew action, would significantly contribute to or cause one or more serious injuries is an "unsafe system operating condition" for the purposes of this regulation. Even if airplane operation or performance is unaffected or insignificantly affected at the time of a failure, information to the flightcrew is required if it is considered necessary for the flightcrew to take any action or observe any precautions. If operation or performance is unaffected or insignificantly affected, information and alerting indications may be inhibited during specific phases of flight where informing the flightcrew is considered more hazardous than not informing them.

DELETE:

~~(c) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:~~

~~(1) Loads connected to the power distribution system with the system functioning normally.~~

~~(2) Essential loads after failure of--~~

~~(i) Any one engine on two-engine airplanes; or~~

~~(ii) Any two engines on an airplane with three or more engines; or~~

~~(iii) Any power converter or energy storage device.~~

~~(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.~~

~~(d) In determining compliance with paragraph (c)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.~~

Explanation: The FAA proposes to remove the current paragraphs (c) and (d) from § 23.1309 and include them as a new § 23.1310. These requirements are not directly related to the other safety and analysis requirements of § 23.1309, and the FAA considers it appropriate to state them separately for the purpose of clarity. There would be no change to these requirements, other than their new section number. The addition of proposed § 23.1310 would entail no significant change to the current requirements, and there would be no increase in costs associated with it.

DELETE

~~(e) In showing compliance with this section with regard to the electrical power system and to equipment design and installation, critical environmental and atmospheric conditions, including~~

~~radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered. For electrical generation, distribution, and utilization equipment required by or used in complying with this chapter, the ability to provide continuous, safe service under foreseeable environmental conditions may be shown by environmental tests, design analysis, or reference to previous comparable service experience on other airplanes.~~

Explanation: Current paragraph (e) is being deleted since it is redundant to proposed paragraph (a). Except the words "including radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered" are being retained and moved to propose paragraph (a) with the environmental conditions.

CHANGE and DELETE

(~~f~~ d) As used in this section, "systems" refers to all pneumatic systems, fluid systems, electrical systems, mechanical systems, and powerplant systems. ~~included in the airplane design, except for the following:~~

~~(1) Powerplant systems provided as part of the certificated engine.~~

~~(2) The flight structure (such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments) whose requirements are specific in subparts C and D of this part.~~

Explanation: Paragraph identification is changed from (f) to (d). Deleted the exceptions. The exceptions and applicability were added to the introductory paragraphs. The words "The flight structure such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments" are being retained and moved to the introductory paragraphs.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

The intent of this regulatory change is to update the regulations to the current practices used for this class of airplane.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed changes maintain the current standard practices used for this class of airplane.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Same level of safety that is currently being applied for this class of airplane.

10 - What other options have been considered and why were they not selected?

Currently, FAA issues Special Conditions, Equivalent Levels of Safety, or Exemptions to address the proposed changes. This regulatory update will eliminate the burden of both the applicant and the FAA to process these actions that have been assessed as standard practice.

11 - Who would be affected by the proposed change?

FAA, airframe manufacturer, and systems specific manufactures.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

The proposed changes are accepted as standard practices within the FAA. Therefore, harmonization with foreign airworthiness authorities should be achieved with minimal impact.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

The proposed changes will take information that is currently in advisory form and be put in the regulation. As a result, AC 23.1309-1C and AC 23.1311-1B will need to be revised.

14 - How does the proposed standard compare to the current ICAO standard?

There currently are no similar ICAO standards. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There currently are currently no harmonization working groups in session.

16 - What is the cost impact of complying with the proposed standard?

Updating these regulations will reflect the current practices, thereby reducing the time required to establish special conditions and Equivalent Levels of Safety. This in turn will eliminate costs, primarily in the time required to process these SCs, ELOSs, and Exemptions.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

A revision to the applicable Advisory Circulars will need to be accomplished after these regulations are updated.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

There are currently no harmonization working groups in session. Since this proposal is currently what Industry and the FAA are doing it should be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1310 Power source and distribution

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The working group proposes to remove the current paragraphs (c) and (d) from § 23.1309 and include them as a new § 23.1310. These requirements are not directly related to the other safety and analysis requirements of § 23.1309, and the working group considers it appropriate to state them separately for the purpose of clarity. There would be no change to these requirements, other than their new section number. The addition of proposed § 23.1310 would entail no significant change to the current requirements, and there would be no increase in costs associated with it.

2 - What are the current FAR and JAR standards relative to this subject?

There is no 23.1310 currently. This is being added by moving paragraphs (c) and (d) from § 23.1309 to make a new 23.1310.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not Applicable

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

5 – What is the proposed action?

Move paragraphs (c) and (d) from 23.1309 to make new 23.1310 (a) and (b) respectively. There is no change in the requirement.

6 - What should the harmonized standard be?

The proposed changes are not harmonized with JAA or EASA at this time. It is recommended that the proposed standard become the harmonized standard.

New

23.1310 Power Source capacity and distribution.

(a) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:

(1) Loads connected to the power distribution system with the system functioning normally.

(2) Essential loads after failure of--

(i) Any one engine on two-engine airplanes; or

(ii) Any two engines on an airplane with three or more engines; or

(iii) Any power converter or energy storage device.

(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.

(b) In determining compliance with paragraph (c)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

10 - What other options have been considered and why were they not selected?

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

11 - Who would be affected by the proposed change?

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

The proposed changes are not harmonized with EASA at this time.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

14 - How does the proposed standard compare to the current ICAO standard?

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

15 - Does the proposed standard affect other HWG's?

There currently are no harmonization working groups in session.

16 - What is the cost impact of complying with the proposed standard?

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity so there should be no cost impact.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable. The intent of this regulatory change is to move the requirements of paragraphs (c) and (d) from § 23.1309 creating a new paragraph, 23.1310, for clarity.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

There are currently no harmonization working groups in session. However, since this proposal is not changing any requirements, but simply moving the requirement to a different paragraph and clarifying, it is recommended that this be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1311 Electronic display instrument systems

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The purpose of this particular rulemaking effort is to update this regulation with more specific technical language to add clarity.

2 - What are the current FAR and JAR standards relative to this subject?

The current rule, with the recommended changes, is included in question 6 below.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not applicable

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

The proposed changes are not harmonized with EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The purpose of this particular rulemaking effort is to update this regulation with more specific technical language to add clarity.

5 – What is the proposed action?

The proposed action is to change the regulations to allow the use of electronic flight and multifunction displays for flight, engine, and other data.

6 - What should the harmonized standard be?

The proposed changes are not harmonized with JAA or EASA at this time. It is recommended that this would become the harmonized standard.

23.1311 Electronic display instrument systems.

(a) Electronic display indicators, including those with features that make isolation and independence between powerplant instrument systems impractical, must:

(1) Meet the arrangement and visibility requirements of Sec. 23.1321.

(2) Be easily legible under all lighting conditions encountered in the cockpit, including direct sunlight, considering the expected electronic display brightness level at the end of an electronic display indictor's useful life. Specific limitations on display system useful life must be contained in the Instructions for Continued Airworthiness required by Sec. 23.1529.

(3) Not inhibit the primary display of attitude, airspeed, altitude, or powerplant parameters needed by any pilot to set power within established limitations, in any normal mode of operation.

(4) Not inhibit the primary display of engine parameters needed by any pilot to properly set or monitor powerplant limitations during the engine starting mode of operation.

(5) Have an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument or ~~individual electronic display indicators~~ electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system. These secondary instruments may be installed in panel positions that are displaced from the primary positions specified by Sec. 23.1321(d), but must be located where they meet the pilot's visibility requirements of Sec. 23.1321(a).

Explanation: For clarification of the language that has caused confusion, replace "individual electronic display indicators" with "electronic display parameters" for clarification that has caused confusion. These electronic display parameters could be integrated on one electronic display that is independent from the primary flight display.

(6) Incorporate sensory cues that provide a quick glance sense of rate and when appropriate trend information for the pilot that are equivalent to those in the instrument being replaced by the electronic display indicators.

Explanation: Add "that provides a quick glance sense of rate and when appropriate trend information" for clarification of sensory cue that has caused confusion.

(7) Incorporate equivalent visual displays of instrument markings, required by Secs. 23.1541 through 23.1553, or visual displays that alert the pilot to abnormal operational values or approaches to established limitation values, for each parameter required to be displayed by this part.

Explanation: The word equivalent was added to allow instrument markings on electronic displays that are equivalent to those instrument markings on conventional mechanical and electromechanical instruments.

(b) The electronic display indicators, including their systems and installations, and considering other airplane systems, must be designed so that one display of information essential for continued safe flight and landing will ~~remain available to the crew, without need for immediate action by any pilot~~ be available within one second to the crew with a single pilot action by any pilot or by automatic means for continued safe operation, after any single failure or probable combination of failures.

Explanation: Replace "remain available to the crew without need for immediate action" with "be available within one second to the crew with a single pilot action or by automatic means" This change would allow reversionary flight displays as additional displays such as secondary primary flight display (PFD) or a Multifunction Display (MFD) that can provide a secondary means to provide primary flight information (PFI). The function of a MFD system is to provide the crew access to a variety of data, or combinations of data, used to fly the aircraft, to navigate, to communicate, and to manage aircraft systems. MFDs may also display PFI as needed to ensure continuity of operations. MFDs are designed to depict PFI, navigation, communication, aircraft state, aircraft system management, terrain, weather, traffic, and/or other information used by the flight crew for command and control of the aircraft. Display of PFI on reversionary (secondary) displays should be arranged in the basic T-configuration. However, the displays should be legible and usable from the pilot's position with minimal head movement. The reversionary (secondary) guidance display, if required, may be outside the pilot's primary field-of-view, if it is usable from the pilot's position with minimum head movement. There would be three acceptable methods.

1. Reversionary flight information should be presented by an independent source and display to prevent complete loss of PFI due to a single failure. Reversionary flight information need not be continuously displayed as long as the information is available without crewmember action for any single failure or probable combination of failures.
2. Primary information displayed continuously on the reversionary displays could be available during critical phases of flight (e.g., takeoff, landing, and missed or final approach) is acceptable. Manual activation of reversionary displays through single action by the pilot is acceptable when procedures to activate them are accomplished prior to entering critical phases of flight.
3. Another acceptable method is automatic selection and with a single pilot action to restore information essential for continued safe flight and landing via duplicate displays on the PFD and MFD. Most all detectable faults involving display of essential information (attitude, altitude, and airspeed) should result in an automatic selection of secondary information or reversion of the PFD to the MFD.

The electronic display system for this configuration should have a two-display system that incorporates dual, independently powered Attitude Heading Reference (AHRS) and dual Air Data Computer (ADC) sub-systems that provide primary flight parameters. This configuration is significantly more reliable than presently certified mechanical systems, and the skills required while flying in reversionary mode are identical to those used when flying in primary mode.

The configuration provides backup information essential to continued safe flight and landing by the use of an intuitive control that allows instant, simultaneous access to reversionary mode on both the PFD and MFD displays. The single pilot action would force both the PFD and MFD displays into reversionary mode operation. The system response time should provide flight critical information on the MFD in less than one second after switch operation.

The single pilot action should be within easy reach of the pilot and is quickly and positively identified by the red color and the lighted red “halo” ring that announces its position on the panel.

The proposed design should incorporate an automatic reversion capability that provides a complete display of all intended flight, navigation, communication, and engine information on the remaining display within one second in the event a fault is detected. A majority of possible faults are covered by this capability. Only a total loss of the display is presently identified as not capable of being reliably detected automatically, but such a failure condition would be obvious to the pilot. In the event of such a malfunction, a single pilot action by the pilot should provide a full display of all information on the remaining display within one second of the button being pushed. All modes, sources, frequencies, flight plan data, etc. would be exactly as they were on the PFD prior to the failure. The availability of a nearly identical display of all flight information in the same format as normally shown on the PFD provides a significant safety enhancement over reversion to external standby instruments, especially when the size, location, arrangement, and information provided by the standby instruments is significantly different from that on the PFD. New systems envisioned by this proposal have inherently greater potential safety benefits than traditional external standby flight instruments.

(c) As used in this section, "instrument" includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or components connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier, and an indicator connected together). As used in this section, "primary" display refers to the display of a parameter that is located in the instrument panel such that the pilot looks at it first when wanting to view that parameter.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

The purpose of this particular rulemaking effort is to update this regulation with more specific technical language to add clarity.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The purpose of this particular rulemaking effort is to update this regulation with more specific technical language to add clarity. Therefore, the same level of safety will be maintained.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The purpose of this particular rulemaking effort is to update this regulation with more specific technical language to add clarity. Therefore, the same level of safety will be maintained.

10 - What other options have been considered and why were they not selected?

Not applicable

11 - Who would be affected by the proposed change?

FAA, airframe manufacturer, and systems specific manufactures.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

The proposed changes would require a small revision to the current advisory material. Harmonization with foreign airworthiness authorities would have to be accomplished.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Advisory material would have to be revised to address these changes.

14 - How does the proposed standard compare to the current ICAO standard?

There is no current ICAO standard for this. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8. This might be considered as a part of this effort.

15 - Does the proposed standard affect other HWG's?

There are currently no harmonization working groups in session.

16 - What is the cost impact of complying with the proposed standard?

The purpose of this particular rulemaking effort is to update this regulation with more specific technical language to add clarity. Therefore, the cost impact will be minimal, if any.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

As stated, a revision to the applicable Advisory Circulars will need to be accomplished after this regulation is updated.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

There are currently no harmonization working groups in session. However, since there is no significant change to the regulations and the proposed change brings the requirements more in line with current technology and capabilities, it is recommended that this be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Advisory Circular: AC 23.1311-1A

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The advisory material needs amending to address new digital instrumentation to require the appropriate trend indicating capability to assist the pilot in maintaining awareness of any change in status of a particular parameter, or a change relative to the other engines, that up until now has been addressed using an Equivalent Level of Safety.

2 - What are the current FAR and JAR standards relative to this subject?

The current standard was written for analog type instrumentation with needle or other similar type displays. The current standard is shown in the answer to question 6 along with the proposed change. The deletions are lined through and the additions underlined.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Equivalent Level of Safety

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Amend AC 23.1311-1A to include trend monitoring requirements for digital direct reading instrumentation as appropriate.

6 - What should the harmonized standard be?

Proposed AC 23/1311-1X Language:

8.5.6 Direct -reading alphanumeric displays are most valuable when integrated with an analog display by adding a precise quantitative indication to compliment an analog display's qualitative indication. Direct-reading alphanumeric powerplant displays should not be used in place of analog instruments to indicate values of engine parameters where trend or rate of change information is important. Direct-reading alphanumeric displays limit the crew's ability to assess trend information and result in reduced crew awareness. Direct-reading alphanumeric displays are also limited in their ability to provide a comparison of parameters from multiple engines or to check the general proximity of differing parameters against their individual limits. While these shortcomings can be compensated for with additional design provisions, the use of direct-reading alphanumeric displays should be made with care and evaluated for each airframe, engine, and airframe/engine integration. The required 23.1305 powerplant instruments referred to as "indicators" should have the ability to provide trend or rate-of-change information if appropriate to the specific engine parameter.~~unless a finding of equivalence is made for direct-reading alphanumeric displays. The finding of equivalence should consider the following factors:~~ If direct-reading alphanumeric displays are used, the following factors must be considered:

8.5.6.1 The visibility …….

8.5.6.2 The ability to assess necessary ……

8.5.6.3 The ability to assess how…..

8.5.6.4 For multi-engine aircraft……

8.5.6.5 Compensating engine design features….

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Requires Part 23 airplanes using direct reading digital instruments to have the ability to display information in a manner to assist the pilot in monitoring the trend of specific parameters or comparing the data against that of the other engine(s) if applicable.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard maintains the same level of safety as has been achieved in the past using the ELOS's.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard maintains the same level of safety that is currently industry practice.

10 - What other options have been considered and why were they not selected?

The only other option was to leave the standard as currently written. This was not selected because it would continue to require ELOS's for this type of equipment and this adds burden to both the FAA and the applicant.

11 - Who would be affected by the proposed change?

The Manufacturers of Part 23 aircraft using digital direct reading instrumentation.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

This is the proposal to change the AC 23.1311 to support 14 CFR 23.1311.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23.1311-1A is inadequate relative to state of the art propulsion displays. Revision to the current advisory material is appropriate to eliminate repetitive ELOS's.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not address Part 23 jets or other aircraft using digital direct reading instrumentation.

15 - Does the proposed standard affect other HWG's?

There are currently no Part 23 Harmonization Working Groups. EASA Plans to start a Part 23 Jet group in 2005.

16 - What is the cost impact of complying with the proposed standard?

The cost for certification should be less than under the current process of requiring an ELOS. The current process adds burden to both the applicant and the FAA that would be removed with this change.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

This is the proposed change to the advisory material.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

Not at this time.

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the proposed change by means of ELOS's.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Advisory Circular: DRAFT AC 23.1311-1B

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?

Current standard was written for turbopropeller engine airplanes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions, Exemptions, or Equivalent Levels of Safety

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Amend AC 23.1311-B to include standards for jets and high performance propeller-driven airplanes.

6 - What should the harmonized standard be?

Draft AC 23.1311-B Language:

Proposed AC 23/1311-1X Language:

8.5.6 Direct -reading alphanumeric displays are most valuable when integrated with an analog display by adding a precise quantitative indication to compliment an analog display's qualitative indication. Direct-reading alphanumeric powerplant displays should not be used in place of analog instruments to indicate values of engine parameters where trend or rate of change information is important. Direct-reading alphanumeric displays limit the crew's ability to assess trend information and result in reduced crew awareness. Direct-reading alphanumeric displays are also limited in their ability to provide a comparison of parameters from multiple engines or to check the general proximity of differing parameters against their individual limits. While these shortcomings can be compensated for with additional design provisions, the use of direct-reading alphanumeric displays should be made with care and evaluated for each airframe, engine, and airframe/engine integration. The required 23.1305 powerplant instruments referred to as "indicators" should have the ability to provide trend or rate-of-change information if appropriate to the specific engine parameter. ~~unless a finding of equivalence is made for direct-reading alphanumeric displays. The finding of equivalence should consider the following factors:~~ If direct-reading alphanumeric displays are used, the following factors must be considered:

- The visibility …….
- The ability to assess necessary ……
- The ability to assess how…..
- For multi-engine aircraft……
- Compensating engine design features….

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets certificated under 14 CFR 23 normal and commuter category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard normalizes the requirements for turbojet and turbopropeller airplanes certificated under 14 CFR 23 normal and commuter category.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for most sections.

10 - What other options have been considered and why were they not selected?

The only other option was to leave the standard as currently written. This was not selected because it would continue to require ELOS's for this type of equipment and this adds burden to both the FAA and the applicant.

11 - Who would be affected by the proposed change?

The manufacturers of small part high performance airplanes using any turbine means of propulsion would be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23.1311-1A is inadequate relative to state of the art propulsion displays. Revision to the current advisory material is appropriate to eliminate repetitive ELOS's.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not address Part 23 jets.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

The cost for certification should be less than under the current process of requiring an ELOS. The current process adds burden to both the applicant and the FAA that would be removed with this change.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the HWG wish to answer any supplementary questions specific to this project?

Not Applicable.

19 - Does the HWG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Not Applicable.

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Report from the Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: FAR 23.1317 HIRF Subpart F

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

The purpose of this particular rulemaking effort is to update this regulation with the standard High Intensity Radio Field (HIRF) requirements that have been imposed on applicants for many years by FAA and JAA Special Conditions, however, this proposal includes the harmonized requirements that were developed by the JAA and FAA within the ARAC Process for Part 23/25/27/29.

2 - What are the current FAR and JAR standards relative to this subject?

There is no current codified standard relative to this subject except as applied through Special Conditions. Current standards were written for aircraft having systems that were less susceptible to High Intensity Radiation Fields than are some of the systems currently being installed on modern aircraft. See question 5 for the current Special Condition requirements.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions, Exemptions, or Equivalent Levels of Safety

The proposed changes will incorporate Special Conditions that have been levied to applicants for this requirement to include the JAA requirement. The standards for these HIRF requirements have been harmonized with the JAA though the ARAC process for Part 23/25/27/29. It is specifically noted that these requirements have a higher level of certitude in comparison to the standard FAA Special Conditions that have been issued for U.S. type certificate projects.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

Current FAA and JAA special conditions differ greatly in the application of Special Conditions; Current FAA Special Conditions are written around standard DO-160 Equipment Qualification testing and only address Critical System Functions. Current JAA Special Conditions are written around the Proposed ARAC EHWG Proposed NPRM/NPA and address Critical, Hazardous, and Major Functions. JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23.

The standards for these HIRF requirements have been harmonized with the JAA through the ARAC process for Part 23/25/27/29. It is specifically noted that these requirements have a higher level of certitude at a comparable cost in comparison to the FAA standard Special Conditions that have been issued for U.S. type certificate projects. Having two different requirements results in having to certify to meet the U.S. Special Conditions and then having to repeat the effort to meet the JAA requirements with the resulting added costs of doing the job twice. Accepting the JAA requirements will eliminate this duplicate effort.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Due to the differences in requirements between the two special conditions, completely different compliance methods are required. JAA compliance methods require means of requirements driven by the proposed AC/AMJ. This requires the OEM to address them differently.

The intent of this regulatory change is to update the regulations to the current practices, to include the JAA standards, used for this class of airplane.

5 – What is the proposed action?

Amend 14 CFR 23 to include HIRF standards for jets and propeller-driven airplanes. Following for comparison purposes is the current FAA Standard Special Conditions and the proposed new 14 CFR 23.1317.

Current FAA Standard Special Conditions

These special conditions require qualification of systems that perform critical functions, as installed in aircraft, to the defined HIRF environment in paragraph 1 or, as an option to a fixed value using laboratory tests, in paragraph 2, as follows:

(1) The applicant may demonstrate that the operation and operational capability of the installed electrical and electronic systems that perform critical functions are not adversely affected when the aircraft is exposed to the HIRF environment defined below:

	Field Strength (volts per meter)	
Frequency	**Peak**	**Average**
10 kHz - 100 kHz	50	50
100 kHz - 500 kHz	50	50
500 kHz - 2 MHz	50	50
2 MHz - 30 MHz	100	100
30 MHz - 70 MHz	50	50
70 MHz - 100 MHz	50	50
100 MHz - 200 MHz	100	100
200 MHz - 400 MHz	100	100
400 MHz - 700 MHz	700	50

700 MHz - 1 GHz	700	100
1 GHz - 2 GHz	2000	200
2 GHz - 4 GHz	3000	200
4 GHz - 6 GHz	3000	200
6 GHz - 8 GHz	1000	200
8 GHz - 12 GHz	3000	300
12 GHz - 18 GHz	2000	200
18 GHz - 40 GHz	600	200
The field strengths are expressed in terms of peak root-mean-square (rms)		

or,

(2) The applicant may demonstrate by a system test and analysis that the electrical and electronic systems that perform critical functions can withstand a minimum threat of 100 volts per meter, electrical field strength, from 10 kHz to 18 GHz. When using this test to show compliance with the HIRF requirements, no credit is given for signal attenuation due to installation.

A preliminary hazard analysis must be performed by the applicant, for approval by the FAA, to identify either electrical or electronic systems that perform critical functions. The term "critical" means those functions whose failure would contribute to, or cause, a failure condition that would prevent the continued safe flight and landing of the airplane. The systems identified by the hazard analysis that perform critical functions are candidates for the application of HIRF requirements. A system may perform both critical and non-critical functions. Primary electronic flight display systems, and their associated components, perform critical functions such as attitude, altitude, and airspeed indication. The HIRF requirements apply only to critical functions.

Compliance with HIRF requirements may be demonstrated by tests, analysis, models, similarity with existing systems, or any combination of these. Service experience alone is not acceptable since normal flight operations may not include an exposure to the HIRF environment. Reliance on a system with similar design features for redundancy as a means of protection against the effects of external HIRF is generally insufficient since all elements of a redundant system are likely to be exposed to the fields concurrently.

6 - What should the harmonized standard be?

The Proposed NPRM/NPA from the ARAC EHWG

The standards for these HIRF requirements have been harmonized with the JAA through the ARAC process for Part 23/25/27/29. It is specifically noted that these requirements have a higher level of certitude in comparison to the standard Special Conditions that have been issued for U.S. type certificate projects.

§ 23.1317 High Intensity Radiated Fields (HIRF) Protection.

(a) Each electrical and electronic system that performs a function whose failure would prevent the continued safe flight and landing of the airplane must be designed and installed so that –

(1) Each function is not adversely affected during and after the time the airplane is exposed to HIRF environment I, as described in appendix J to this part;

(2) Each electrical and electronic system automatically recovers normal operation, in a timely manner, after the airplane is exposed to HIRF environment I, as described in appendix J to this part, unless the system's recovery conflicts with other operational or functional requirements of the system; and

(3) Each electrical and electronic system is not adversely affected during and after the time the airplane is exposed to HIRF environment II, as described in appendix J to this part.

(b) Each electrical and electronic system that performs a function whose failure would significantly reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions must be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 1, 2, or 3, as described in appendix J to this part.

(c) Each electrical and electronic system that performs a function whose failure would reduce the capability of the airplane or the ability of the flightcrew to cope with adverse operating conditions must be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 4, as described in appendix J to this part.

Add appendix J to part 23 to read as follows:

Appendix J to Part 23-HIRF Environments and Equipment HIRF Test Levels

This appendix specifies the HIRF environments and equipment HIRF test levels for electrical and electronic systems under § 23.1308. The field strength values for the HIRF environments and equipment HIRF test levels are expressed in root-mean-square units measured during the peak of the modulation cycle.

(a) HIRF environment I is specified as follows:

Table I – HIRF Environment I

FREQUENCY	**FIELD STRENGTH (V/M)**	
	PEAK	AVERAGE
10 kHz – 100 kHz	50	50
100 kHz – 500 kHz	50	50
500 kHz – 2 MHz	50	50
2 MHz – 30 MHz	100	100
30 MHz – 70 MHz	50	50
70 MHz – 100 MHz	50	50
100 MHz – 200 MHz	100	100
200 MHz – 400 MHz	100	100
400 MHz – 700 MHz	700	50
700 MHz – 1 GHz	700	100
1 GHz – 2 GHz	2,000	200
2 GHz – 4 GHz	3,000	200
4 GHz – 6 GHz	3,000	200
6 GHz – 8 GHz	1,000	200
8 GHz – 12 GHz	3,000	300
12 GHz – 18 GHz	2,000	200
18 GHz – 40 GHz	600	200

[editing will combine the frequencies with identical field strengths for all the charts and add the language “up to and including”]

(b) HIRF environment II is specified as follows:

Table II – HIRF Environment II

FREQUENCY	FIELD STRENGTH (V/M) PEAK	FIELD STRENGTH (V/M) AVERAGE
10 kHz – 100 kHz	20	20
100 kHz – 500 kHz	20	20
500 kHz – 2 MHz	30	30
2 MHz – 30 MHz	100	100
30 MHz – 70 MHz	10	10
70 MHz – 100 MHz	10	10
100 MHz – 200 MHz	30	10
200 MHz – 400 MHz	10	10
400 MHz – 700 MHz	700	40
700 MHz – 1 GHz	700	40
1 GHz – 2 GHz	1,300	160
2 GHz – 4 GHz	3,000	120
4 GHz – 6 GHz	3,000	160
6 GHz – 8 GHz	400	170
8 GHz – 12 GHz	1,230	230
12 GHz – 18 GHz	730	190
18 GHz – 40 GHz	600	150

(c) Equipment HIRF Test Level 1.

(1) From 10 kilohertz (kHz) to 400 megahertz (MHz), use conducted susceptibility tests with continuous wave (CW) and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current must start at a minimum of 0.6 milliamperes (mA) at 10 kHz, increasing 20 decibels (dB) per frequency decade to a minimum of 30 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, the conducted susceptibility current must be at least 30 mA.

(3) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 volts per meter (V/M) peak, with CW and 1 kHz square wave modulation with 90 percent or greater.

(4) From 400 MHz to 8 gigahertz (GHz), use radiated susceptibility tests at a minimum of 150 V/m with pulse modulation of 0.1 percent duty cycle with 1 kHz pulse repetition frequency. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent

(5) From 400 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 28 V/m peak with 1 kHz square wave modulation with 90 percent depth or greater. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.

(d) Equipment HIRF Test Level 2.

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests with CW and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current must start at a minimum of 0.6 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 30 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, the conducted susceptibility current must be at least 30 mA.

(3) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 V/m peak with CW and 1 kHz square wave modulation with 90 percent depth or greater.

(4) From 400 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 150 V/m peak with pulse modulation of 4 percent duty cycle with a 1 kHz pulse repetition frequency. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.

(e) Equipment HIRF Test Level 3.

Test level 3 is HIRF environment II in table II of this appendix reduced by acceptable aircraft transfer function and attenuation curves. Testing must cover the frequency band of 10 kHz to 8 GHz.

(f) Equipment HIRF Test Level 4.

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 0.15 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 7.5 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, use conducted susceptibility tests at a minimum of 7.5 mA.

(3) From 100 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 5 V/m.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets certificated under 14 CFR 23 normal category.

The standards for these HIRF requirements have been harmonized with the JAA though the ARAC process for Part 23/25/27/29. These standards, as presented, will address the safety concerns of both the FAA and JAA relative to HIRF.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

There is no current FAR for this requirement. The requirement is currently being applied by Special Condition.

The proposed standards are more stringent than the FAA Special Conditions that have been levied to U.S. applicant for HIRF requirements in the past. U.S. applicants had to meet the JAA Special Conditions for foreign certification, however, if these standards are adopted, they will address both the FAA and JAA requirements.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

As noted in 8 above, the standards proposed are more stringent than the Special Conditions that have been levied to U.S. applicant for HIRF requirements in the past. However, if these standards are adopted, they will address both the FAA and JAA requirements.

10 - What other options have been considered and why were they not selected?

The HIRF requirements that have been levied as standard industry practice are an option. If these standards are selected, further HIRF requirements will be required by the FAA and JAA. Therefore, FAA recommends that we incorporate the proposed NPRM from the ARAC EEHWG to present an acceptable harmonized position.

11 - Who would be affected by the proposed change?

The Manufacturers of small Part 23 airplanes and equipment incorporating electronic equipment that could be affected by HIRF.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None. The standards for these HIRF requirements have been harmonized with the JAA through the ARAC process for **Part 23/25/27/29** . It is specifically noted that these requirements have a higher level of certitude in comparison to the standard Special Conditions that have been issued for U.S. type certificate projects. A draft AC is available to show an acceptable means of compliance with the new rule.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Yes

The proposed advisory material from the ARAC EEHWG should be used to address this requirement. .

14 - How does the proposed standard compare to the current ICAO standard?

There currently are no similar ICAO standards. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

This proposed standard is the result of the ARAC EHWG.

16 - What is the cost impact of complying with the proposed standard?

There is a moderate cost impact to OEMs or others that are currently certifying only to the Special condition. However, when considering that most of the OEMs are having to certify to both the Special Condition and to JAA requirements there should be a net decrease in cost.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

There currently is no advisory material to address this requirement. A draft AC 20-XXX has been harmonized with the JAA.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No There currently are no harmonization working groups in session. However, if these standards are adopted, they present a standard that is acceptable to both the FAA and JAA.

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification for JAA or European Countries.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1331 Instruments using a power source

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The purpose of this particular rulemaking effort is to update this regulation with more specific information on flight display information, differentiating the operation of aircraft certified for VFR and IFR modes of flight.

2 - What are the current FAR and JAR standards relative to this subject?

Reference latest amendment to Section. 23.1331

Note: The rule, with the recommended changes, is included in Item 6 below.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not applicable

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The purpose of this particular rulemaking effort is to differentiate the operation of aircraft certified for VFR and IFR modes of flight.

5 – What is the proposed action?

The proposed action can best be explained in the notes in question 6.

6 - What should the harmonized standard be?

The proposed changes are not harmonized with JAA or EASA at this time. It is recommended that this become the harmonized standard.

Section. 23.1331

Instruments using a power source.

For each instrument that uses a power source, the following apply:

(a) Each instrument must have an integral visual power annunciator or separate power indicator to indicate when power is not adequate to sustain proper instrument performance. If a separate indicator is used, it must be located so that the pilot using the instruments can monitor the indicator with minimum head and eye movement. The power must be sensed at or near the point where it enters the instrument. For electric and vacuum/pressure instruments, the power is considered to be adequate when the voltage or the vacuum/pressure, respectively, is within approved limits.

(b) The installation and power supply systems must be designed so that--

(1) The failure of one instrument will not interfere with the proper supply of energy to the remaining instrument; and

(2) The failure of the energy supply from one source will not interfere with the proper supply of energy from any other source.

(c) For heading, altitude, airspeed, and attitude there must be at least

(1) Two independent sources of power (not driven by the same engine on multiengine airplanes), and a manual or an automatic means to select each power source; or

(2) Have an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument that are independent from the airplane's primary electrical power system; or

(3) Electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system.

Explanation: These changes are meant to apply to those instruments that rely on a power source and provide required flight information. Such instruments are those that provide information for direct control of flight that are required by the kinds of operation for which the airplane has been approved. Consequently, this section applies to all flight instruments required by 14 CFR part 23, § 23.1303 and part 91, § 91.205. Therefore, instruments in airplanes limited to VFR operations that are not required for VFR would not have to comply with the requirements of § 23.1331.

Each independent power source must provide sufficient power for normal operations throughout the approved flight envelope of the airplane and for any operations for which the airplane is approved. For example, an IFR approved airplane must have independent power sources for the display of attitude that are not limited to altitudes below the approved service ceiling of the airplane.

Section 23.1331(c) does not require the installation of dual alternators or vacuum systems on single engine airplanes. Other options include a dedicated battery with a 30 minute capacity for electrical instrument loads essential to continued safe flight and landing, use of differently powered types of instruments for primary and standby, or verifying the aircraft battery used for starting by a system safety analysis per § 23.1309.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

The purpose of this particular rulemaking effort is to differentiate the operation of aircraft certified for VFR and IFR modes of flight, with regard to flight instrument displays.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The purpose of this particular rulemaking effort is to differentiate the operation of aircraft certified for VFR and IFR modes of flight, with regard to flight instrument displays. Therefore, the intent of this change will maintain the same level of safety for the respective flight conditions.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The purpose of this particular rulemaking effort is to differentiate the operation of aircraft certified for VFR and IFR modes of flight, with regard to flight instrument displays. Therefore, the intent of this change will maintain the same level of safety for the respective flight conditions.

10 - What other options have been considered and why were they not selected?

Not applicable

11 - Who would be affected by the proposed change?

FAA, airframe manufacturer, and systems specific manufactures.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

The proposed changes would require a revision to the current advisory material. Harmonization with foreign airworthiness authorities would have to be accomplished.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Advisory material would have to be revised to address these changes.

14 - How does the proposed standard compare to the current ICAO standard?

There is currently no ICAO standard specifically addressing this issue. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8. This may be a topic to be considered as a part of that effort.

15 - Does the proposed standard affect other HWG's?

There are currently no harmonization working groups in session. These changes will need to be harmonized

16 - What is the cost impact of complying with the proposed standard?

The impact of this rule change can potentially lower the cost of airplanes certificated specifically for VFR operation.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

As stated, a revision to the applicable Advisory Circulars will need to be accomplished after this regulation is updated.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

Since there are no significant changes to this regulation, it is recommended that this be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.1443 Minimum Mass Flow of Oxygen

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that can operate at much higher altitudes than originally anticipated for Part 23 aircraft. Up until now that capability has been addressed using special conditions derived from Part 25. The large number of new jet and high performance aircraft that will be operating at higher altitudes than previously envisioned for Part 23 aircraft prompted this proposal.

2 - What are the current FAR and JAR standards relative to this subject?

The current standards are shown in question 6 with the proposed changes marked. The current standard was written for propeller driven airplanes that generally operate at lower maximum altitudes than the current Part 23 Jet and other high performance aircraft.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions derived from Part 25 have previously been applied to aircraft operating at high altitudes.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, since the FAA applies Special Conditions to aircraft operating at high altitude this potentially results in increased requirements as compared to the JAA, and EASA requirements. In reality however, the JAA and EASA would most likely require similar requirements thru Certification Requirement Items (CRIs).

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in criteria, methodology, or application that result in a difference in stringency between the standards.]

Incorporating the proposed change will not result in any difference in the current means of compliance for aircraft certified under 14 CFR 23 requirements since it will simply incorporate what have been previously required by Special Condition.

5 – What is the proposed action?

Amend 14 CFR 23 to include requirement for continuous flow oxygen system for jets and high performance propeller-driven airplanes certified for operation above 40,000 feet. Add a new (a) and renumber the subsequent paragraphs.

6 - What should the harmonized standard be?

It is recommended that this proposed change be the harmonized standard.

23.1441

(a) If the airplane is to be certified above 40,000 feet, a continuous flow oxygen system must be provided for each passenger.

(~~a~~ b) If continuous flow oxygen equipment is installed, an applicant must show compliance with the requirements of either paragraphs (~~a~~ b)(1) and (~~a~~ b)(2) or paragraph (~~a~~ b)(3) of this Section:

(1) For each passenger, the minimum mass flow of supplemental oxygen required at various cabin pressure altitudes may not be less than the flow required to maintain, during inspiration and while using the oxygen equipment (including masks) provided, the following mean tracheal oxygen partial pressures:

(i) …….

(ii) ……

(2) For each…..

(3) The minimum.…..

(~~b~~ c) If demand …….

(~~c~~ d) If first-aid …….

(~~d~~ e) As used in ……

Amdt. 23-43 Eff 05/10/93

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for passengers in jets and high performance aircraft certificated under 14 CFR 23.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard normalizes the requirements for jet and propeller driven high performance aircraft certificated under 14 CFR 23 normal and commuter category

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety that has been applied to Part 23 jet aircraft and bring the level of safety for high performance propeller driven aircraft that could potentially be designed to operate in the same environment to the same level of safety as the jets have currently been required to meet.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing special conditions and leaving the requirements as is in current Normal Category part 23. Leaving the requirements as is would have required continuing to have special conditions for any aircraft operating above 40,000 feet. However, by incorporating the special condition into the regulations we eliminate the need to produce the special condition.

11 - Who would be affected by the proposed change?

Those affected would be manufacturers of small Part 23 high performance airplanes that operate at high altitude.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

The Regulation is self-explanatory and all existing material is adequate.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups currently working these issues although EASA is planning to restart a Part 23 Jet Group in 2005 to review the CS 23 requirements.

16 - What is the cost impact of complying with the proposed standard?

The cost for certification should be equal to or less than the current special conditions for new 14 CFR 23 jet projects. For Part 23 propeller driven aircraft operating above 40,000 feet this condition would most likely be applied as a special condition so the cost for

meeting this requirement on those aircraft should be equal to or less than the current requirements if special conditions were applied.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

No advisory or interpretive material is planned to be submitted for this change.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification and the same special condition would most likely be applied to any propeller driven aircraft operating in the same environment. Thus this would eliminate the need for both the manufacturers and the FAA to have to deal with another Special Condition on high performance Part 23 aircraft.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.1445 Oxygen Distribution Systems

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that can operate at much higher altitudes than originally anticipated for Part 23 aircraft. Up until now that capability has been addressed using special conditions derived from Part 25. The large number of new jet and high performance aircraft that will be operating at higher altitudes than previously envisioned for Part 23 aircraft prompted this proposal.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed changes marked. Both the current FAR and JAR standards were written for aircraft that were expected to be operating at much lower altitudes than current high performance aircraft are capable of operating at such that there was not significant concern for insuring that the crew had sufficient oxygen to safely control the airplane in an emergency.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions derived from Part 25 have previously been applied to aircraft operating at high altitudes.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, since the FAA applies Special Conditions to aircraft operating at high altitude this potentially results in increased requirements as compared to the JAA, and EASA requirements. In reality however, the JAA and EASA would most likely require similar requirements thru Certification Requirement Items (CRIs).

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Incorporating the proposed change will not result in any difference in the current means of compliance for aircraft certified under 14 CFR 23 requirements since it will simply incorporate what have been previously required by Special Condition.

5 – What is the proposed action?

Amend 14 CFR 23.1445 to include requirement to provide a means for the crew to separately reserve a minimum supply of oxygen for the flight crew for jets and high performance propeller-driven airplanes operating at high altitude by adding paragraph (c).

6 - What should the harmonized standard be?

It is recommended that this proposed change be the harmonized standard.

23.1445

(a) Except for flexible lines from oxygen outlets to the dispensing units, or where shown to be otherwise suitable to the installation, nonmetallic tubing must not be used for any oxygen line that is normally pressurized during flight.

(b) Nonmetallic oxygen distribution lines must not be routed where they may be subjected to elevated temperatures, electrical arcing, and released flammable fluids that might result from any probable failure.

(c) If the flight crew and passengers share a common source of oxygen, a means to separately reserve the minimum supply required by the flight crew must be provided.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

It insures that the flight crew has sufficient oxygen to perform their functions during an emergency for aircraft certified under 14 CFR 23.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard normalizes the requirements for jet and propeller high performance aircraft certificated under 14 CFR 23 normal and commuter category

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety that has been applied to Part 23 jet aircraft and bring the level of safety for high performance propeller driven aircraft that could potentially be designed to operate in the same environment to the same level of safety as the jets have currently been required to meet.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing special conditions and leaving the requirements as is in current Normal Category part 23. Leaving the requirements as is would have required continuing to have special conditions for any aircraft operating above 40,000 feet. However, by incorporating the special condition into the regulations we eliminate the need to produce the special condition.

11 - Who would be affected by the proposed change?

Those affected would be manufacturers of small Part 23 high performance airplanes that operate at high altitude.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

The Regulation is self-explanatory and all existing material is adequate.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups currently working these issues although EASA is planning to restart a Part 23 Jet Group in 2005 to review the CS 23 requirements.

16 - What is the cost impact of complying with the proposed standard?

The cost for certification should be equal to or less than the current special conditions for new 14 CFR 23 jet projects. For Part 23 propeller driven aircraft operating above 40,000 feet this condition would most likely be applied as a special condition so the cost for meeting this requirement on those aircraft should be equal to or less than the current requirements if special conditions were applied.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

No advisory or interpretive material is planned to be submitted.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification and the same special condition would most likely be applied to any propeller driven aircraft operating in the same environment. Thus this would eliminate the need for both the manufacturers and the FAA to have to deal with another Special Condition on high performance Part 23 aircraft.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group
Rule Section: 14 CFR 23.1447 Equipment standards for oxygen dispensing units

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist?

What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that can operate at much higher altitudes than originally anticipated for Part 23 aircraft. Up until now that capability has been addressed using special conditions derived from Part 25. The large number of new jet and high performance aircraft that will be operating at higher altitudes than previously envisioned for Part 23 aircraft prompted this proposal.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed changes marked. Both the current FAR and JAR standards were written for aircraft that were expected to be operating at much lower altitudes than current high performance aircraft are capable of operating at such that there was not significant concern for insuring that the crew had sufficient oxygen to safely control the airplane in an emergency.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Conditions derived from Part 25 have previously been applied to aircraft operating at high altitudes.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, since the FAA applies Special Conditions to aircraft operating at high altitude this potentially results in increased requirements as compared to the JAA, and EASA requirements. In reality however, the JAA and EASA would most likely require similar requirements thru Certification Requirement Items (CRIs).

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Incorporating the proposed change will not result in any difference in the current means of compliance for aircraft certified under 14 CFR 23 requirements since it will simply incorporate what have been previously required by Special Condition.

5 – What is the proposed action?

Amend 14 CFR 23 to include standards for jets and high performance propeller-driven airplanes operating at altitudes above 40,000 feet.

6 - What should the harmonized standard be?

It is recommended that this proposed change be the harmonized standard.

23.1447
If oxygen dispensing units are installed, the following apply:

(a) ……
(b) ……
(c) ……
(d) ……
(e) ……
(f) ……
(g) If the airplane is to be certified for operation above 40,000 feet, a quick-donning oxygen mask system, with a pressure demand, mask mounted regulator must be provided for the flight crew. This dispensing unit must be immediately available to the flight crew when seated at his station and installed so that it:

(i) Can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand, within five seconds and without disturbing eyeglasses or causing delay in proceeding with emergency duties, and

(ii) Allows while in place, the performance of normal communication functions.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets and high performance aircraft certificated under 14 CFR 23 for operation above 40,000 feet.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard normalizes the requirements for jet and propeller high performance aircraft certificated under 14 CFR 23 normal and commuter category

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety that has been applied to Part 23 jet aircraft and bring the level of safety for high performance propeller driven aircraft that could potentially be designed to operate in the same environment to the same level of safety as the jets have currently been required to meet.

10 - What other options have been considered and why were they not selected?

We considered both adopting the existing special conditions and leaving the requirements as is in current Normal Category part 23. Leaving the requirements as is would have required continuing to have special conditions for any aircraft operating above 40,000 feet. However, by incorporating the special condition into the regulations we eliminate the need to produce the special condition.

11 - Who would be affected by the proposed change?

Those affected would be manufacturers of small Part 23 high performance airplanes that operate at high altitude.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

The Regulation is self-explanatory and all existing material is adequate.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups currently working these issues although EASA is planning to restart a Part 23 Jet Group in 2005 to review the CS 23 requirements.

16 - What is the cost impact of complying with the proposed standard?

The cost for certification should be equal to or less than the current special conditions for new 14 CFR 23 jet projects. For Part 23 propeller driven aircraft operating above 40,000 feet this condition would most likely be applied as a special condition so the cost for meeting this requirement on those aircraft should be equal to or less than the current requirements if special conditions were applied.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

No advisory or interpretive material is planned to be submitted.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at “Phase 4” prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the “Fast Track” process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification and the same special condition would most likely be applied to any propeller driven aircraft operating in the same environment. Thus this would eliminate the need for both the manufacturers and the FAA to have to deal with another Special Condition on high performance Part 23 aircraft.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.1505 Airspeed Limitations

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]
The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed changes marked. The current standards were written for propeller-driven piston and turbine engine airplanes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Condition

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?
JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23 to include standards for jets and high performance propeller-driven airplanes to allow use of V_{DF}/M_{DF} for flight test activity.

6 - What should the harmonized standard be?

23.1305

(c) Paragraphs (a) and (b) of this section do not apply to turbine airplanes or the airplanes for which a design diving speed V_D/M_D is established under Sec. 23.335(b)(4). For those airplanes, a maximum operating limit speed (V_{MO}/M_{MO} airspeed or Mach number, whichever is critical at a particular altitude) must be established as a speed that may not be deliberately exceeded in any regime of flight (climb, cruise, or descent) unless a higher speed is authorized for flight test or pilot training operations. V_{MO}/M_{MO} must be established so that it is not greater than the design cruising speed V_C/M_C and so that it is sufficiently below V_D/M_D or V_{DF}/M_{DF} and the maximum speed shown under Sec. 23.251 to make it highly improbable that the latter speeds will be inadvertently exceeded in operations. The speed margin between V_{MO}/M_{MO} and V_D/M_D or V_{DF}/M_{DF} ~~or the maximum speed shown under Sec. 23.251~~ may not be less than ~~the speed margin established between V_C/M_C and V_D/M_D~~ that determined under Sec. 23.335(b), or the speed margin found necessary in the flight tests conducted under Sec. 23.253.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for ~~jets~~ high performance airplanes certificated under 14 CFR 23 normal category that is currently being met by application of a Special Condition.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the same level of safety for this rule.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the same level of safety for this rule as has been required by the Special Condition.

10 - What other options have been considered and why were they not selected?

No other options were considered. This change represents the standards established by special conditions for previous certifications.

11 - Who would be affected by the proposed change?

The manufacturers of small part high performance airplanes using any means of propulsion would be affected.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory

material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include proposed clarification

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

New 14 CFR 23 jet or high performance airplane projects should be equal or lower cost than the current special condition process. All other projects should have no cost impact.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.
Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?
No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?
Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.
This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for Part 23 jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.1545 Airspeed Indicator

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]
The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?

See question 6 for the current standard with the proposed changes marked. The current standards were written for propeller-driven piston and turbine engine airplanes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Condition

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

Not applicable.

5 – What is the proposed action?

Amend 14 CFR 23.1545(d) to exclude the requirement of (b)(4) and instead require "For those aircraft there must either be a maximum allowable airspeed indication showing the variation of V_{MO}/M_{MO} with altitude or compressibility limitations (as appropriate), or a radial red line marking for V_{MO}/M_{MO} must be made at lowest value of V_{MO}/M_{MO} established for any altitude up to the maximum operating altitude for the airplane." for jets and high performance propeller-driven airplanes as defined in the current (d).

6 - What should the harmonized standard be?

(b) The following markings must be made:

(1) For the never-exceed speed V_{NE}, a radial red line.

(2) For the caution range, a yellow arc extending from the red line specified in paragraph (b)(1) of this section to the upper limit of the green arc specified in paragraph (b)(3) of this section.

(3) For the normal operating range, a green arc with the lower limit at *V*S1 with maximum weight and with landing gear and wing flaps retracted, and the upper limit at the maximum structural cruising speed *V*NO established under §23.1505(b).

(4) For the flap operating range, a white arc with the lower limit at *V*S0 at the maximum weight, and the upper limit at the flaps-extended speed V_{FE} established under §23.1511.

(5) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the speed at which compliance has been shown with §23.69(b) relating to rate of climb at maximum weight and at sea level, a blue radial line.

(6) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the maximum value of minimum control speed, V_{MC}, (one-engine-inoperative) determined under §23.149(b), a red radial line.

(d) Paragraphs (b)(1) through (b) ~~(3)~~ *(4)* and paragraph (c) of this section do not apply to aircraft for which a maximum operating speed V_{MO}/M_{MO} is established under Sec. 23.1505(c). For those aircraft there must either be a maximum allowable airspeed indication showing the variation of V_{MO}/M_{MO} with altitude or compressibility limitations (as appropriate), or a radial red line marking for V_{MO}/M_{MO} must be made at lowest value of V_{MO}/M_{MO} established for any altitude up to the maximum operating altitude for the airplane.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets certificated under 14 CFR 23 normal category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

10 - What other options have been considered and why were they not selected?

No other options were considered. This change represents the standards established by special conditions for previous certifications.

11 - Who would be affected by the proposed change?

Manufacturers of small part high performance airplanes using any means of propulsion.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include proposed clarification

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

New 14 CFR 23 jet projects should be equal or lower cost than the current special condition process. All other projects should have no cost impact.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1555 Control Markings

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The purpose of this particular rulemaking effort is to update this regulation for improved technology fuel quantity indicating systems. See further Explanation in response to Question #5.

2 - What are the current FAR and JAR standards relative to this subject?

Reference latest amendment to Section. 23.1555(d)

Note: The current rule, with the recommended changes marked, is included in Item 6 below.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not Applicable.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are no differences between the current FAA, JAA, and EASA standards. The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

The purpose of this particular rulemaking effort is to eliminate a requirement for a redundant placard.

5 – What is the proposed action?

It is proposed that sub-paragraph (3) be added to 23.1555(d) as shown below.

6 - What should the harmonized standard be?

Section 23.1555 Control Markings

(d) Usable fuel capacity must be marked as follows:

(1) For fuel systems having no selector controls, the usable fuel capacity of the system must be indicated at the fuel quantity indicator.

(2) (2) For fuel systems having selector controls, the usable fuel capacity available at each selector control position must be indicated near the selector control.

Proposed change: add sub-paragraph (3)

(3) For fuel systems having a calibrated fuel quantity indication system complying with § 23.1337(b)(1) and accurately displaying the actual quantity of usable fuel in each selectable tank, no fuel capacity placards outside of the fuel quantity indicator are required.

Explanation: Most modern airplanes have a calibrated fuel quantity indicating system that is density compensated and very accurately indicates the actual usable fuel quantity in each tank. Many airplanes are frequently operated with less than full fuel tanks. The placards or markings required by § 23.1555(d)(1)&(2) reflect only the maximum capacity of the tank and would indicate usable fuel only if it were filled to that capacity. Further, this "capacity" is not compensated for fuel density and would indicate usable fuel only if the tank was full with standard density fuel. The placards required by § 23.1555(d)(1)&(2) are therefore redundant relative to the current industry practice and may be misleading.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

This proposal would eliminate a requirement for placards or markings that are redundant and could be misleading.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Overall safety is increased. The current rule calls for placards that indicate the maximum usable fuel for each selectable tank. Since many operations are conducted with less than full tanks, this placarded fuel quantity is misleading.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Current industry practice is to place near the fuel quantity indicator a placard indicating the maximum fuel capacity. When operations are conducted with less than full tanks, this capacity does not reflect actual usable fuel on board and can be misleading.

10 - What other options have been considered and why were they not selected?

Not Applicable.

11 - Who would be affected by the proposed change?

FAA and airframe manufacturer.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

There is currently no advisory material for this regulation. Harmonization with foreign airworthiness authorities would have to be accomplished through coordination with the appropriate authorities.

13 -Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

No advisory material would have to be revised to address these changes.

14 - How does the proposed standard compare to the current ICAO standard?

There is no current ICAO standard on this. This primarily applies to the new small jets. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are currently no harmonization working groups in session. These changes will need to be harmonized at some future date. EASA plans a CS 23 harmonization effort for small jets to start in 2005.

16 - What is the cost impact of complying with the proposed standard?

The impact of this rule change can potentially lower the cost of airplanes by eliminating the need for an unnecessary placard and the requirement to provide lighting for that placard.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

Since there are no significant changes to this regulation, and it can potentially result in less effort and cost on the applicant with improved safety, it is recommended that this be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1559 Operating Limitations Placard

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The underlying safety issue is to eliminate unnecessary lighting of placards that could create a distraction to the pilot and to update this regulation to clarify requirements for night lighting of the placard.

2 - What are the current FAR and JAR standards relative to this subject?

Reference latest amendment to Section. 23.1559

Note: The current rule, with the recommended changes marked, is included in Item 6 below.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not Applicable.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are no differences between the current FAA, JAA or EASA standards. The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

There are no differences between the current means of compliance. The purpose of this particular rulemaking effort is to eliminate unnecessary requirements for lighting the Flight Maneuver placard required by **§** 23.1559.

5 – What is the proposed action?

It is proposed that 23.1559 be revised to eliminate an unnecessary and potentially distracting light source by the addition of a clarifying subparagraph (d).

6 - What should the harmonized standard be?

Section. 23.1559 Flight Maneuver Placard

(a) There must be a placard in clear view of the pilot stating--(1) That the airplane must be operated in accordance with the Airplane Flight Manual; and(2) The certification category of the airplane to which the placards apply.
(b) For airplanes certificated in more than one category, there must be a placard in clear view of the pilot stating that other limitations are contained in the Airplane Flight Manual.
(c) There must be a placard in clear view of the pilot that specifies the kind of operations to which the operation of the airplane is limited or from which it is prohibited under Sec. 23.1525."

(d) The placard required by this section need not be lighted for night operations

Explanation: The requirements specified on this placard are relative to preflight planning and not normally referenced in flight. As long as the placard is "in clear view of the pilot" and can be viewed by the pilot at night using a flashlight or other means, the intent of the rule is met. The requirement to light the placard has not been uniformly applied. This change makes the lighting intent clear.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

This proposal would eliminate a requirement for lighting placards that are redundant and potentially distracting to the pilot.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Overall safety is increased. Overall cockpit lighting is improved by eliminating a unnecessary source of lighting glare and reflection.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Current industry practice has not been standard. Some airplanes do not light this placard. FAA policy is trending toward requiring the placard to be lighted because the term "in clear view of the pilot" has been interpreted to imply day or night operations. Overall safety would be improved by making the requirement clear and eliminating unnecessary light in the cockpit.

10 - What other options have been considered and why were they not selected?

Not applicable

11 - Who would be affected by the proposed change?

The FAA and the airframe manufacturer.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

No current advisory material would need to be included in the rule text. Harmonization with foreign airworthiness authorities would have to be accomplished.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Yes No advisory material would have to be revised to address these changes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8. There are currently no harmonization working groups in session. These changes will need to be harmonized. This proposal could be considered during the determination of the requirements for the small jets.

15 - Does the proposed standard affect other HWG's?

No There are currently no harmonization working groups in session. These changes will need to be harmonized

16 - What is the cost impact of complying with the proposed standard?

The impact of this rule change can potentially lower the cost of airplanes by eliminating the need for unnecessary placard lighting.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable

18 - Does the 23 Jet G wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

Since there are no significant changes to this regulation and it eliminates the source of an unnecessary and potentially distracting light source in the cockpit, it is recommended that this be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1563 Airspeed Placards

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The underlying issue is lighting of the placard providing airspeed limitation information. With modern flight display equipment the necessary information is now available on that equipment and is automatically illuminated as part of the display. The purpose of this particular rulemaking effort is to update this regulation to clarify requirements for night lighting of the placard.

2 - What are the current FAR and JAR standards relative to this subject?

Reference latest amendment to Section. 23.1563

Note: The current rule, with the recommended changes marked, is included in Item 6 below.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not applicable. The current FAR, JAR and CS standards require lighting of the placard.

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

Not applicable. There are no differences between the current FAR, JAR, or EASA standards. The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

There are no differences in the current means of compliance. The purpose of this particular rulemaking effort is to eliminate unnecessary requirements for lighting the Airspeed placard required by § 23.1563.

5 – What is the proposed action?

It is proposed to add sub-paragraph (d) to 23.1563 as shown below. Also, The term, V_O, used in sub-paragraph (a) of this section to refer to maneuvering speed is incorrect. According to § 1 definitions, the correct term is Va. It is proposed that this be corrected.

6 - What should the harmonized standard be?

Section. 23.1563 Airspeed Placards

"There must be an airspeed placard in clear view of the pilot and as close as practicable to the airspeed indicator. This placard must list-

(a) The operating maneuvering speed ~~V_O~~ V_A; and
(b) The maximum landing gear operating speed V_{L0}. [, and]
(c) For reciprocating multiengine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes, the maximum value of the minimum control speed, VMC (one-engine-inoperative) determined under Sec. 23.149(b)."

(d) The airspeed placard required by this section need not be lighted for night operations if the landing gear operating speed is indicated on the airspeed indicator or other lighted area such as the landing gear control and the airspeed indicator has features such as low speed awareness that provide ample warning prior to V_{MC}.

Explanation: Maneuvering speed is applicable to operations that may involve intentional large control input and is therefore not applicable to normal night operations. Many modern airplanes have means for the landing gear speed to be displayed in the airspeed indicator or on lighted portions of the landing gear control and for the airspeed indicator to display low speed awareness or other airspeed reference information to provide safety above V_{MC}. Lighting this placard is redundant and provides further source of lighting reflections in the cockpit.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

This proposal would eliminate a redundant requirement for lighting placards that is better accomplished with the current display technology and is displayed to the pilot in a better location than on placards often located out of the normal scan of the pilot.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Overall safety is increased. If the required information is provided on the gear control or airspeed indicator, it is more recognizable during day or night operations. Overall cockpit lighting is improved by eliminating a unnecessary source of lighting glare and reflection.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Current industry practice has not been standard. Some airplanes do not light this placard. FAA policy is trending toward requiring the placard to be lighted because the term "in clear view of the pilot" has been interpreted to imply day or night operations. Overall safety would be improved by making the requirement clear and eliminating unnecessary light in the cockpit.

10 - What other options have been considered and why were they not selected?

Not applicable

11 - Who would be affected by the proposed change?

The FAA and the airframe manufacturer.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

There is no advisory material that would need to be included in the text or preamble. Harmonization with foreign airworthiness authorities would have to be accomplished.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

No advisory material would have to be revised to address these changes.

14 - How does the proposed standard compare to the current ICAO standard?

There is no current ICAO standard on this. This primarily applies to the new small jets. ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8. There are currently no harmonization working groups in session. These changes will need to be harmonized.

15 - Does the proposed standard affect other HWG's?

There are currently no harmonization working groups in session. These changes will need to be harmonized

16 - What is the cost impact of complying with the proposed standard?

The impact of this rule change can potentially lower the cost of airplanes by eliminating the need for unnecessary placard lighting.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not applicable

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No.

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

Since there are no significant changes to this regulation, it is recommended that this be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 23.1567 Flight Maneuver Placard

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The purpose of this particular rulemaking effort is to update this regulation to clarify requirements for night lighting of the placard. The placard in question is for acrobatic maneuvers, which should not be conducted at night. The proposal is to eliminate the need for lighting of this placard, which could cause other unnecessary light distractions in the cockpit.

2 - What are the current FAR and JAR standards relative to this subject?

Reference latest amendment to Section. 23.1567

Note: The current rule, with the recommended changes marked, is included in Item 6 below.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Not applicable

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

There are currently no differences between the FAA, JAA, and EASA standards or policy. The proposed changes are not harmonized with JAA or EASA at this time.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]

There are no differences in the current means of compliance. The purpose of this particular rulemaking effort is to eliminate unnecessary requirements for lighting the Flight Maneuver placard required by **§** 23.1567.

5 – What is the proposed action?

It is proposed to add subparagraph (3) to 23.1567 to eliminate the need for lighting of this particular placard.
Section. 23.1567 Flight Maneuver Placard

6 - What should the harmonized standard be?

23.1567
"(a) For normal category airplanes, there must be a placard in front of and in clear view of the pilot stating: "No acrobatic maneuvers, including spins, approved."
(b) For utility category airplanes, there must be- (1) A placard in clear view of the pilot stating: "Acrobatic maneuvers are limited to the following ________" (list approved maneuvers and the recommended entry airspeed for each); and (2) For those airplanes that do not meet the spin requirements for acrobatic category airplanes, an additional placard in clear view of the pilot stating: "Spins Prohibited."
(c) For acrobatic category airplanes, there must be a placard in clear view of the pilot listing the approved acrobatic maneuvers and the recommended entry airspeed for each. If inverted flight maneuvers are not approved, the placard must bear a notation to this effect.
(d) For acrobatic category airplanes and utility category airplanes approved for spinning, there must be a placard in clear view of the pilot-- (1) Listing the control action for recovery from spinning maneuvers; and (2) Stating that recovery must be initiated when spiral characteristics appear, or after not more than six turns or not more than any greater number of turns for which the airplane has been certificated."

(e) The placard required by this section need not be lighted for night operations

Explanation: The requirements specified on this placard are relative to acrobatic maneuvers and spin information related to preflight planning. Since these maneuvers are not normally conducted during night operations, the placard information is not relevant for reference in night flight. As long as the placard is "in clear view of the pilot" and can be viewed by the pilot at night using a flashlight or other means, the intent of the rule is met. The requirement to light the placard has not been uniformly applied. This change makes the lighting intent clear.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

This proposal would eliminate a requirement for lighting placards that are redundant and potentially distracting during night flight.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Overall safety is increased. Overall cockpit lighting is improved by eliminating a unnecessary source of lighting glare and reflection.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

Current industry practice has not been standard. Some airplanes do not light this placard. FAA policy is trending toward requiring the placard to be lighted because the term "in clear view of the pilot" has been interpreted to imply day or night operations. Overall safety would be improved by making the requirement clear and eliminating unnecessary light in the cockpit.

10 - What other options have been considered and why were they not selected?

Not applicable.

11 - Who would be affected by the proposed change?

The FAA and the airframe manufacturers.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

No additional information needs to be included in the rule text. Harmonization with foreign airworthiness authorities would have to be accomplished.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Yes No advisory material would have to be revised or adopted to address these changes.

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8. There are currently no harmonization working groups in session. These changes will need to be harmonized and could be considered during the requirements determination effort for the small jets.

15 - Does the proposed standard affect other HWG's?

There are currently no harmonization working groups in session. These changes will need to be harmonized

16 - What is the cost impact of complying with the proposed standard?

The impact of this rule change can potentially lower the cost of airplanes by eliminating the need for unnecessary placard lighting.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

No applicable

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

Since there are no significant changes to this regulation and there is a potential to reduce costs and eliminate the source of unnecessary light distractions in the cockpit, it is recommended that this be considered for the Fast Track.

23 Jet WG Report

Part 23 Jet / High Performance Small Airplane Working Group

Rule Section: 14 CFR 23.1583 Operating Limitations

1 - What is underlying safety issue to be addressed by the FAR/JAR? [Explain the underlying safety rationale for the requirement. Why should the requirement exist? What prompted this rulemaking activity (e.g., new technology, service history, etc.)?]

The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from Part 25, Exemptions, or Equivalent Levels of Safety.

2 - What are the current FAR and JAR standards relative to this subject?
See question 6 for the current standard with the proposed changes marked. The current standards were written for propeller-driven piston and turbine engine airplanes.

2a – If no FAR or JAR standard exists, what means have been used to ensure this safety issue is addressed?

Special Condition

3 - What are the differences in the FAA and JAA standards or policy and what do these differences result in?

JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23. However, this class of airplane isn't addressed completely in current FAA, JAA, or EASA standards.

4 - What, if any, are the differences in the current means of compliance? [Provide a brief explanation of any differences in the current compliance criteria or methodology (e.g., issue papers), including any differences in either criteria, methodology, or application that result in a difference in stringency between the standards.]
Not applicable.

5 – What is the proposed action?
Amend 14 CFR 23.1583(a)(2) to include $\underline{V_{FE}}$ to agree with current standards applied to jets by special condition. Will also be applicable to high performance propeller-driven airplanes.

6 - What should the harmonized standard be?

The proposed standard

The Airplane Flight Manual must contain operating limitations determined under this part 23, including the following--
(a) *Airspeed limitations.* The following information must be furnished:
(1) ……
(2) the speeds V_{MC}, V_O, V_{FE}, V_{LE}, and V_{LO}, if established, and their significance.

7 - How does this proposed standard address the underlying safety issue (identified under #1)?

Provides an appropriate level of safety for jets certificated under 14 CFR 23 normal category.

8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.

The proposed standard will maintain the level of safety for this rule.

10 - What other options have been considered and why were they not selected?

No other options were considered. This change represents the standards established by special conditions for previous certifications.

11 - Who would be affected by the proposed change?

Manufacturers of small Part 23 high performance airplanes using any means of propulsion.

12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble? [Does any existing advisory material include substantive requirements that should be contained in the regulation? This may occur because the regulation itself is vague, or if the advisory material is interpreted as providing the only acceptable means of compliance.]

None.

13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?

Current AC 23-8B, Flight Test Guide, should be updated to include proposed clarification

14 - How does the proposed standard compare to the current ICAO standard?

ICAO does not currently address Part 23 jets but is contemplating the addition of small jets in Annex 8.

15 - Does the proposed standard affect other HWG's?

There are no Part 23 Harmonization Working Groups.

16 - What is the cost impact of complying with the proposed standard?

New 14 CFR 23 jet projects should be equal or lower cost than the current special condition process. All other projects should have no cost impact.

17 - If advisory or interpretive material is to be submitted, document the advisory or interpretive guidelines. If disagreement exists, document the disagreement.

Not Applicable.

18 - Does the 23 Jet WG wish to answer any supplementary questions specific to this project?

No

19 - Does the 23 Jet WG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?

Yes

20 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process? Explain.

This should be considered for the fastrack rulemaking process because manufacturers are already complying with the special conditions for jet certification.

Background

Order 1110.135 established the part 135/125 Aviation Rulemaking Committee (ARC). Aviation industry dynamics, new technology, new aircraft types and configurations, and current operating issues and environment mandate a comprehensive review and rewrite of parts 135 and 125. The general objectives and scope of the committee's work are to complete a comprehensive review and rewrite of parts 135 and 125 and related regulations to:

a. Resolve current issues affecting this part of the industry.
b. Enable new aircraft types, size and design and new technologies in air transportation operations.
c. Provide safety and applicability standards that reflect the current industry, industry trends and emerging technologies and operations.
d. Address international harmonization and ICAO standards.
e. Potentially, rescind part 125 from 14 Code of Federal Regulations.

The part 135/125 ARC tasked a working group to review part 23 for small jets and high performance airplanes expected to operate in part 135. The working group determined that in general, for small jets under 12,500 pounds, the current amendment (23-51) of part 23 is an acceptable minimum standard after incorporating the recommended changes of this rulemaking proposal. Most of the recommended changes are based on the current special conditions being levied against part 23 jets.

The working group recommended that the FAA immediately adopt the new standards outlined in this proposal as special conditions for use on new part 23 turbine projects. They also recommended that the FAA proceed with concurrent rulemaking action to incorporate these rulemaking recommendations as soon as practical. Commuter category was included in the working group's review. They determined that the existing requirements including the proposed requirements provided an appropriate level of safety for jets between 12,500 pounds and 19,000 pounds. This determination was based on a comparison to existing business jets and commuter category turboprops.

The recommendations are based on a review of the existing part 23 requirements. These requirements were compared to the current set of special conditions used for all previous part 23 jet certification programs. The existing and proposed requirements were also compared with an extensive review of all business jet, turboprop, and popular high-performance piston twin accidents for the past 10 (12 for jets) years.

The working group reviewed the following group of accidents:

- 251 business jet accidents (from the May 2004 Flight Safety Digest),
- 145 part 23 turboprop, and
- 254 popular high-performance light twins weighing under 6000 pounds

The working group based its recommendations on the following philosophy; given that all requirements are equal, a near-centerline-thrust jet will offer more safety than a wing-mounted, turboprop or recip. There are numerous safety reasons for supporting this philosophy. Primarily the safety benefits come from a reduced pilot workload and guaranteed performance required of all turbine airplanes following an engine failure. Engine reliability for turbines was also considered a significant factor.

The current special conditions drive the certification standards to higher performance levels that serve as an economic impediment to the development of technically safer airplanes. The working group considered the FAA's goal to reduce accidents and believes that, in the interest of safety, the working group should promote this new class of smaller jets to gradually replace the propeller driven twins.

Numerous manufacturers are developing light jets to replace small reciprocating engine and turboprop airplanes so our efforts also included trying to level the playing field between reciprocating, turboprop, and jet requirements. Where possible, our recommended rule changes are phrased to include all turbines because part 23 requirements should not differentiate between propulsion types unless there is a technical limit forcing this situation. Passengers on a part 23 turboprop or reciprocating engine airplane should have the same safety as those in similar sized jets.

The working group used the following considerations or assumptions relating to the certification of small part 23 jets. Any high performance part 23 airplane applying for certification with performance, flight characteristics, and/or features beyond those considered in this study should expect an FAA evaluation for special conditions.

- Lower wing loadings than are typical for transports or bizjets - results in lower stall speeds that are more comparable to high performance reciprocating and turboprop airplanes. The stall speeds relate directly to takeoff and landing distances and therefore the criticality of those phases of flight.
- Turbine engine reliability. This is an important safety consideration because piston engine twins have a high percentage of accidents originating from the loss of one engine. Moreover, many of these are fatal. The percentage of engine failures for turboprop and turbojets is lower.
- New, small turbofan engines with faster spool-up times than older turbojet engines. This is important because historically there have been landing and go-around accidents where pilots may have failed to account for the spool-up time of their engines resulting in impact with the ground.
- Disking drag from turboprops verses very little drag from the jet. This is consideration for landing and rejected takeoff. While there were runway overrun accidents during takeoff and landing for turboprops, these accidents dominated the non-fatal category for jets.
- This class of small jet will not incorporate complex features more typical in large jets. For example, the working group expect this class of airplane to use trimmable elevators, plain flaps or simple fowler flaps, reversible flight controls, independent spoilers not integrated into flight control systems. In other words, the working group expects the level of complexity to be equivalent to the current fleet of small turboprop airplanes. Our assumption relates directly to the need for a takeoff configuration warning system. Airplanes with a trimmable horizontal tail may be critical for rotation and therefore takeoff distance. This configuration should have a takeoff configuration warning system as required in the commuter category.

These recommendations do not include accelerate/stop and takeoff path requirements for small jets under 12,500 pounds. Takeoff performance will be based on two-engine operation and not single-engine performance as done with jets today. Additionally, normal category doesn't require engine compartment fire extinguishers for the piston and turboprop engines and therefore they aren't proposed here. All existing part 23 jets currently are TC'd with engine compartment fire extinguishers, but the accident study doesn't support the need for fire extinguishers in turbine aircraft.

Preamble

General Discussion of the Proposals and Changes to the Aircraft Regulations

23.3 Airplane categories - The FAA has already granted exemptions for certifying business jets weighing more than 12,500 pounds in part 23. These exemptions restricted the operational use to part 91 and 135 only. The working group didn't see any reason to limit operations if a manufacturer wanted to introduce a 19-seat commuter jet. The only condition is that the manufacturer would need to comply with certain additional part 121 requirements.

The working group also recommends that the FAA delete the term "commuter" in part 23 to eliminate the confusion of the term with commuter operations. Commuter is also an inaccurate term considering the current regulations because there aren't any markets today for commuter category airplanes because all scheduled operations with 10 or more passengers requires a part 25 airplane. The working group proposes that all references to "commuter" category be replaced with the term "normal over 12,500 lbs."

23.49 Stalling Speed – The working group recommended adding language to clarify that V_{SO} relates to maximum landing flap position for stall speed determination. Current part 23 needs amending to clarify the traditional small airplane definition of landing configuration stall speed, V_{SO}. The current FAR and JAR standards read the same and have been amended to look more like the part 25 language. Consequently, this requirement is being interpreted by certification personnel similar to what part 25 has done for the past 5 decades.

23.67 Climb: One Engine Inoperative – The part 23 jets have had special conditions applied that increase the climb gradient above that required by the current regulations. The working group discussed One Engine Inoperative (OEI) performance and reached consensus that improved performance was desirable for all airplanes weighing more than 6000 pounds, not just jets. The accidents studies clearly support better single engine performance for all propulsion types. Because the accidents supported improved OEI performance, the working group recommends that the FAA improve OEI requirements. The working group strongly believed that all airplanes should meet the same climb gradients, not just jets. Consequently, the discussion centered on what would be acceptable for all airplanes. The working group recommended a requirement halfway between current requirements and the commuter category. The working group thinks that 1 percent will offer a significant safety benefit for all turbines and reciprocating powered airplanes over 6000 pounds without having a negative market impact. The third segment climb may also need to be increased accordingly, so the working group recommended that the FAA ask for comments from the manufacturers addressing not only the second, but the third segment climb requirements.

23.73 Reference Landing approach speed – The working group recommended that a V-speed reference mistake be corrected. Reference to V_{SO} should be reference to $V_{S1.}$ The standards need amending to address airplanes being certified under 14 CFR 23 that may have more than one landing flap setting. The V_{REF} speed should be based on 1.3 times the stall speed in the appropriate landing flap configuration, V_{S1}. V_{SO} is by definition the stall speed in the maximum landing flap configuration and is not applicable to other flap configurations.

23.177 Static directional and lateral stability – The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from part 25. part 23 needs to add specific criteria to flight test high-speed flight characteristics that are conservative for high-speed airplane operations. The working group recommended adding specific criteria to subparagraphs (a) and (b) ("V_{FE}, V_{LE}, or V_{FC}/M_{FC} as appropriate") to define original paragraph's "maximum allowable speed" from the special conditions.

23.181 Dynamic stability – The working group recommended that the FAA add current special conditions for jets to 23.181. This section was originally developed for small airplanes without yaw dampers and isn't appropriate for larger airplanes that do typically use yaw dampers.

23.201 Wings level stall – The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from part 25. part 23 needs to amend the current requirements to incorporate additional configurations for all airplanes and a different trim speed for turbines.

23.203 Turning flight and accelerated turning stalls - The standards need amending to address a new class of airplane that up until now has been addressed using special conditions from part 25. part 23 needs to amend the current requirements to incorporate additional configurations for all airplanes and a different trim speed for turbines. The current requirements were written around lower performance reciprocating powered aircraft that typically do not reach the altitudes of the current high performance turbine powered aircraft. The proposed change brings the requirement more in line with the current part 25 requirements and accommodates the differences between the part 23 reciprocating powered aircraft and the turbine powered aircraft.

23.251 Vibration and buffeting - The working group discussed how this rule relates to part 25 and how it was weight driven. Also pointed out that there is a JAR OPS factor associated with this issue. part 25 only requires this for above 25K and M_D>.6 Mach. The working group proposed that the FAA add part 25.251(d) and (e) but limit the requirements to airplanes that fly over 25K and have an M_d faster than 0.6. The working group recommended that the FAA include the reference to V_{DF}/M_{DF}. The proposed additional requirements add paragraphs to 23.251 and 23.253 that should be met if the airplane is faster and higher than 0.6 M and 25,000ft

23.253 High speed characteristics – Same as for 23.251.

23.255 Out of Trim Characteristics – The working group recommended that the FAA add new requirements to consider potential high-speed Mach effects for airplanes with M_{MO} greater than M 0.6 and that incorporate a trimmable horizontal stabilizer.

23.571 Metallic pressurized cabin structures - The working group recommends the FAA amend current part 23 to provide additional pressurized fuselage damage tolerance requirements for high performance aircraft certified for operations above 41,000 feet

23.573 Damage tolerance and fatigue evaluation of structure - The working group recommends the FAA amend current part 23 to provide additional fuselage pressurization damage tolerance requirements for high performance aircraft operating above 41,000 feet

23.574 Metallic damage tolerance and fatigue evaluation of commuter category airplanes - The working group recommends the FAA amend current part 23 to provide additional fuselage pressurization damage tolerance requirements for high performance aircraft operating above 41,000 feet

23.629 Flutter – This standard needs amending to reflect FAA and industry interpretation of the regulation for high speed aircraft. Include in V_{DF}/M_{DF} language from special conditions.

23.703 Takeoff Warning System – The working group recommended that the FAA amends 23.703 to address a new class of airplane that up until now has been addressed using special conditions from part 25. The current part 23 requirements need to be amended to make takeoff warning systems applicable to all part 23 airplanes over 6000 pounds. Airplanes targeted incorporate a trimmable horizontal stabilizer or other features that could affect lift generation in a way that could cause an unsafe condition if not set in a manner approved for takeoff.

23.777 Powerplant controls – The current requirement provides specific cockpit powerplant controls location and height requirements. The last amendment to 23.777 was incorporated to standardize these controls due to operational problems with using the wrong controls on propeller driven aircraft. This requirement, however, didn't envision single power levers or controls that do not have the separate, distinct controls located in the same areas (such as typical turbojet installations). The FAA currently issues an equivalent level of safety (ELOS) for each single power lever project not withstanding the jet engine operation issues. The working group proposed to amend section 23.777 so that ELOS documents are not needed for future projects.

23.807 Emergency exits –Amend part 23 to provide an alternate means for meeting the requirement for an emergency exit on both sides of multi-engine airplanes that would be above the waterline in the event of a water ditching. For most of the small part 23 jets this creates significant cost and weight impact to add a second emergency exit either in the side of the aircraft or overhead in addition to the main door. The proposed alternative will allow the use of a water barrier to be placed in the door opening prior to opening the door to slow the inflow of water in a manner that would be similar to what would be accomplished with the emergency exit. This has already been approved by means of an Equivalent Level of Safety on several airplanes and the proposal would be to include that option in the rule so that an ELOS is not required for new small airplanes.

23.831 Ventilation – The working group proposed § 23.831(c) and (d) to ensure that in the event of ventilation system failure in turbine powered pressurized airplanes, the temperature and humidity within the airplane shall not exceed values hazardous to the occupants or that affect crew performance

Existing special conditions that have been levied on part 23 jets are equivalent to the requirements in 25.831(g), Amendment 25-87. The special condition requires that any failure or combination of failures that could lead to temperature exposures that would cause undue discomfort must be shown to be improbable. Minor corrective actions (e.g., selection of alternate equipment or procedures) would be allowed if necessary for probable failures. The special condition also requires that any failure or combination of failures that could lead to intolerable temperature exposures must be extremely improbable. Major corrective actions (e.g., emergency descent, configuration changes) would be allowed for an improbable failure condition.

The part 23 special conditions have a time-temperature relationship containing a single-point humidity requirement. It is difficult or impossible to comply with this humidity limit under the assumption of loss of all conditioned airflow for flight following failure, including descent and landing, because this humidity level is often exceeded at lower altitudes at and near sea level for airport ambient conditions. Thus, this requirement would prohibit the use of outside air to ventilate the aircraft during high humidity conditions above 27 mBar.

This proposal is to use different language in the regulation that will specify a more performance-based criteria in that failures cannot hazardously affect crew performance or result in permanent physiological damage to passengers (note that it is a different standard for the crew than the passengers). Associated guidance material would have an acceptable means of compliance that would consider a combination of temperature, humidity, time exposure, and activity level. This standard is a closer approximation of human tolerance to adverse environments than the single point humidity requirement in the existing special conditions.

23.841 Pressurized Cabins – To provide adequate standards for safe operation of part 23 aircraft up to 51,000 feet, the standards need amending to address a new class of airplane that, until now, has been addressed using Special Conditions and grants of Equivalent Level of Safety based on 14 CFR part 25 aircraft Special Conditions and Equivalent Levels of Safety.

The intent of 14 CFR 23.841 is to prevent exposure of the occupants to cabin pressure altitudes that could prevent the flight crew from safely flying and landing the aircraft, or cause permanent physiological injury to the occupants. The intent of the proposed changes to § 23.841 is to provide airworthiness standards that allow subsonic turbine powered pressurized airplanes to operate at their maximum achievable altitudes. This is the highest altitude an applicant chooses to demonstrate that, after decompression: (1) the flight crew will remain alert and be able to fly the airplane; (2) the cabin occupants will be protected from the effects of hypoxia; and (3) in the event some occupants do not receive supplemental oxygen, they will be protected against permanent physiological harm.

Existing rules require the cabin pressure control system to be able to maintain a cabin altitude of not more than 15,000 feet in event of any probable failure or malfunction in the pressurization system. Cabin pressure control systems on 14 CFR part 23 airplanes frequently exhibit a slight and brief overshoot above 15,000 feet cabin altitude before stabilizing below 15,000 feet. Existing technology for cabin pressure control systems on 14 CFR part 23 cannot prevent this momentary exceedance, which prevents strict compliance with the rule. Findings of Equivalent Level of Safety have been previously granted for this characteristic, because physiological data shows the brief duration of the overshoot will have no significant effect on the airplane occupants.

Existing Special Conditions that have been levied on 14 CFR part 23 jets are similar and, for operating altitudes above 45,000 feet, equivalent to the requirements in § 25.841, Amendment 25-87. The Special Conditions required consideration of specific failures. Subsequent to the issuance of the Special Conditions, reliability, probability, and damage tolerance concepts addressing other failures and methods of analysis were incorporated into 14 CFR 25. This proposal recommends the use of these additional methods of analysis.

This proposal is to use language in the regulation that will specify a more performance-based criterion such that failures cannot hazardously affect crew performance or result in permanent physiological harm to passengers (note that it is a different standard for the crew than the passengers). Associated guidance material based on prior special conditions would provide an acceptable means of compliance for showing compliance to the amended standards.

Existing part 23 and part 25 regulations require warning of excessive cabin altitude at 10,000 Ft and do not adequately address airfield operation above 10,000 Ft. Rather than disable the cabin altitude warning to prevent nuisance annunciations, grants of Equivalent Level of Safety have been issued that allow the warning altitude setting to be shifted above the maximum approved field elevation, not exceeding 15,000 Ft. This proposal incorporates language from existing Equivalent Levels of Safety into the regulation.

23.853 Passenger and crew compartment interiors – The working group recommended that the FAA delete the requirement for lettering size of “No Smoking” or “No Smoking in Lavatory” placards. Currently, 23.853(d)(2) specifies that placards are required to have red letters at least ½ inch high on a white background at least 1 inch high. The letter size is currently not a requirement for part 23 normal category nor for part 25 transport category aircraft. This requirement for lettering size is unique to part 23 commuter category. “No Smoking” lettering size in part 25 was deleted at amendment 25-72 when the requirements where moved from part 25.853 to part 25.791, effective Aug 20, 1990.

23.1141 Powerplant controls – The language in this section is difficult to define in (e) because it came from the part 33 rules but isn’t complete. The working group noted that there aren’t any of the single engine manufacturer’s really analyzing the criticality of their control system to the limit that could be applied from this rule? Therefore, the working group recommended a fundamental change that will make the “engine control system” come under 1309. The recommended rule change is mainly so the applicant will consider environmental effects of integration of the control design scheme into the airplane. The working group was very clear that this recommended requirement is not intended to invalidate or overrule the part 33 certification but to consider the airframe/engine interface.

23.1165 Engine ignition systems – Propose to eliminate the term "turboprop."

23.1301 Function and installation - The purpose of this particular rulemaking effort is to update this regulation to what is considered a more reasonable approach to certification of equipment standards. The proposed change would require certificating only the equipment required for type certification and/or operations rules to "perform their intended function". The proposed change is deleting to § 23.1301(d) " Function properly when installed". Paragraph (d) of the current § 23.1301 ("Function and installation") states that each item of installed equipment must "function properly when installed." This rule applies to all equipment installed in the airplane whether if required or not required. The new rule would reduce the burden since it would be required only on equipment required for type certification or operating rules. The FAA proposes to delete this paragraph, because it would be redundant to the proposed revision to § 23.1309(a).

23.1305 Powerplant instruments – Currently the FAA grants an ELOS to applicants for direct-reading, digital powerplant instruments. The working group recommended that the FAA codify requirements based on these ELOS grants. The language should be similar to that provided in AC 23-1311-1A for direct-reading, digital powerplants.

Regulation requires that powerplant displays referred to as "indicators" in 23.1305 provide trend or rate-of-change information. AC 23.1311-1A provides basis for Equivalent Safety Finding when the indicators don't have trend information. The items in the AC should be codified into part 23 because this has become a "generic" Equivalent Safety Finding for many electronic display systems.

23.1309 Equipment, Systems, and installations - The working group recommended that this rulemaking effort update section 23.1309 to what is currently being accomplished for this class of airplane. Some of the major issues being addressed and are summarized as follows:

- Applying clarification to 23.1309 that is currently cited in Advisory Circular (AC) 23.1309-1C.
- Adding electronic engine controls to be applicable in section 23.1309 to eliminate the requirement for special conditions.
- Deleting unnecessary and redundant requirements.
- Incorporating probability values and software and hardware assurance levels for the four classes of airplanes that are currently in AC 23.1309-1C.
- Replacing outdated failure conditions terminology with the updated/current terminology.
- Warning for unsafe conditions would not have to be provided if the airplane has adequate inherent characteristics
- Moving the power source capacity and distribution requirements from section 23.1309 to a new section.

The introduction provides a clarification of applicability: The FAA's historical policy in applying the requirements of § 23.1309 has been to consider that the rule is one of general applicability. This change is reducing the burden by applying § 23.1309 of the current rule to only certain sections. This means that the requirements of the § 23.1309 are not applicable to any specific requirements contained in another section of part 23. Since software or hardware development assurance levels are not addressed elsewhere in part 23, the development assurance criteria by the use of this section with AC 23.1309-1C or later version are applicable. Subpart E, powerplant systems are added for electronic engine control (EEC) systems for only their installation effects. The evaluation should be limited to only the interfaces of the engine control system and verify the installation does not invalidate any of the assumptions made for part 33 certification of the engine. The analysis should not extend into data submitted and approved as part of the engine certification program. Currently, special conditions have been applied to electronic engine controls. The functions of the EEC may be considered critical. Additionally, the EEC system may be susceptible to disruption of both command/response/engine health-monitoring signals as a result of electrical and magnetic interference. This disruption of signals could result in the loss of critical engine functions, flight displays and annunciations, or present misleading information, including the health of the engine, to the pilot.

DELETE;

(a) Each item of equipment, each system, and each installation:

(1) When performing its intended function, may not adversely affect the response, operation, or accuracy of any--

(i) Equipment essential to safe operation; or

(ii) Other equipment unless there is a means to inform the pilot of the effect.

(2) In a single-engine airplane, must be designed to minimize hazards to the airplane in the event of a probable malfunction or failure.

(3) In a multiengine airplane, must be designed to prevent hazards to the airplane in the event of a probable malfunction or failure.

(4) In a commuter category airplane, must be designed to safeguard against hazards to the airplane in the event of their malfunction or failure.

Explanation: Delete 23.1309(a). This section is not needed with the new 23.1309(a) and current 23.1309(b) and AC 23.1309-1C/D that developed four classes of airplanes and with various probability ranges. It is a duplication of requirements with paragraphs (a) and (b). AC 23.1309-1C/D allows a much better approach to safety assessment when qualitative analysis and engineering judgment are encouraged. Originally most of 23.1309 (a) requirements were for older airplanes that were developed by amendment 23-14. These airplanes can use the older certification basis when applicable. Also, with 23.1309 (b) an evaluation is required even on airplanes without complex systems. If the systems are not complex, the AC 23.1309-1C/D does not require a quantitative assessment.

ADD.

(a) The airplane equipment and systems must be designed and installed so that:

(1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the airplane operating and environmental conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes.

(2) Other equipment and systems do not adversely affect the safety of the airplane or its occupants, or the proper functioning of those covered by sub-paragraph (a)(1) of this paragraph.

Explanation: The FAA proposes to revise § 23.1309(a) to specify that, with certain exceptions, the airplane equipment and systems must be designed and installed so that they "perform as intended" under the airplane's operating and environmental conditions. The proposed change broadens the scope of existing paragraph 23.1309(a) to all installed airplane equipment and systems whose improper functioning would reduce safety regardless of whether required by type certification rules, operating rules, or not required. The phrase "improper functioning" is intended to identify equipment and system failures that have an effect on airplane safety and are therefore failure conditions. Any installed equipment or system, the failure or malfunction of which results in a minor or more severe failure, that is, catastrophic, hazardous, and major. (I'm not clear on this use of the term "minor or more severe". It seems to me that people could interpret the "more severe differently. Is there some way we can clarify this? If you change it you need to change the next page also.) condition is considered to have an effect on the safe operation of the airplane.

Paragraph 23.1309(a) would have requirements for two different classes of equipment and systems installed in the airplane. Paragraph 23.1309(a)(1) covers the equipment and systems that have a safety effect, or are installed in order to meet regulatory requirement. This class of equipment and systems are required to "perform as intended under the airplane operating and environmental conditions." Paragraph 23.1309(a)(2) requires all other equipment and systems to not have an effect on the safe operation of the airplane. Consequently these equipment and systems are not required to "perform as intended."

Clarification of "Perform as Intended":

The FAA sometimes finds type designs subject to such failures acceptable if these failures are judged to not significantly contribute to the risks already accepted under § 23.1309(b). For example, some degradation in functionality and capability are routinely allowed during some environmental qualifications, such as HIRF and lightning testing. In fact, paragraph (d) of § 23.1309 (System lightning protection") specifically allows the functionality and capabilities of some electrical/electronic systems to be lost when the airplane is exposed to lightning, provided that "these functions can be recovered in a timely manner."

Clarification of "Under the Airplane Operating and Environmental Conditions":

With this proposed revision to § 23.1309(a), the conditional qualifiers of "when installed" and "under any foreseeable operating condition," contained in the current §§ 23.1301(d) and 23.1309(b)(1), would be replaced by:

"... under the airplane operating and environmental conditions ..."

The proposed phrase is intended to mean:

- throughout the full normal operating envelope of the airplane, as defined by the Airplane Flight Manual, together with any modification to that envelope associated with abnormal or emergency procedures and any anticipated crew action; and
- under the anticipated external and internal airplane environmental conditions, as well as any additional conditions where equipment and systems are assumed to "perform as intended".

This change was made in response to the observation that although certain operating conditions are foreseeable, achieving normal performance when they exist is not always possible. For example, ash clouds from volcanic eruptions are foreseeable, but airplanes with current technology cannot safely fly in such clouds.

Provisions for Equipment and Systems with No Safety Effect on the Operation of the Airplane:

Modern airplanes contain equipment that is not intended to have an effect on the safe operation of the airplane. Typically, this equipment is associated with amenities for the passengers and includes such items as:

- entertainment displays,
- audio systems,
- in-flight telephones,
- non-emergency lighting, and
- equipment for food storage and preparation.

A problem for airplane manufacturers arises when certification authorities have questioned installations of this type when the equipment does not perform in accordance with its system specifications and, therefore, is "not functioning properly when installed." This poses a non-compliance issue because the regulations require that all equipment, systems, and installations function properly when installed.

However, the proper functioning of "amenities," such as those items listed above, is not necessary for the safe operation of the airplane. The only safety issues associated with this type of equipment and systems are the possibility that, as a result of its normal operation or in the event of its failure, it could directly injure someone or adversely affect the functioning of the crew or other equipment and systems. Accordingly, the provision for exceptions in the proposed § 23.1309(a)(2) allows these types of "amenities" to be approved even if they frequently do not perform as intended.

Under proposed § 23.1309(a)(2), any frequent failure of amenities to "perform as intended" must not adversely affect the safety of the airplane or its occupants, or the proper functioning of the equipment and systems that do have a safety impact. That is, they must not directly injure persons or adversely affect the crew or other equipment and systems. The intent of this accommodation is to reduce the cost of certification to airplane and equipment manufacturers without reducing the level of safety provided by part 23. No safety benefit is derived from demonstrating that equipment performs as intended, if failing to perform as intended would not result in a "minor" or more severe failure condition that is, catastrophic, hazardous, and major. Instead, as a minimum, the FAA would require that a qualitative evaluation of the design and installation of such equipment and systems as installed in the airplane be performed to determine that neither their normal operation nor their failure will adversely affect crew workload, the operation of other systems, or the safety of persons.

The FAA expects that, in most cases, normal installation practices will result in sufficiently obvious isolation of the impacts of such equipment on safety that substantiation can be based on a relatively simple qualitative installation evaluation. If the possible impacts, including failure modes or effects, are questionable or isolation between systems is provided by complex means, more formal structured evaluation methods or a design change may be necessary.

Environmental Qualification of "Amenities": In accordance with the proposed revision to § 23.1309, the environmental qualification requirements for certification of the airplane equipment and systems that are not associated with any functional hazard would be reduced to those tests necessary only to verify that their presence, operation, or failure does not:

- interfere with the proper operation of other equipment,
- directly injure anyone, or
- increase the flightcrew's workload unreasonably.

Although these types of equipment and systems are not required to function properly when installed, they would be required to be functioning when they are tested to verify that they do not interfere with the operation of other airplane equipment and systems and do not pose a hazard in and of themselves. Other environmental testing for this type of equipment is no longer required.

DELETE:

(b) The design of each item of equipment, each system, and each installation must be examined separately and in relationship to other airplane systems and installations to determine if the airplane is dependent upon its function for continued safe flight and landing and, for airplanes not limited to VFR conditions, if failure of a system would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions. Each item of equipment, each system, and each installation identified by this examination as one upon which the airplane is dependent for proper functioning to ensure continued safe flight and landing, or whose failure would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions, must be designed to comply with the following additional requirements:

(1) It must perform its intended function under any foreseeable operating condition.

(2) When systems and associated components are considered separately and in relation to other systems--

(i) The occurrence of any failure condition that would prevent the continued safe flight and landing of the airplane must be extremely improbable; and

(ii) The occurrence of any other failure condition that would significantly reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions must be improbable.

(4) Compliance with the requirements of paragraph (b)(2) of this section may be shown by analysis and, where necessary, by appropriate ground, flight, or simulator test. The analysis must consider--

(i) Possible modes of failure, including malfunctions and damage from external sources;
(ii) The probability of multiple failures and the probability or undetected faults;

ADD:

(b) The airplane systems and associated components for the appropriate classes of airplane, considered separately and in relation to other systems, must be designed and installed so that:

(1) Each catastrophic failure condition
(i) is extremely improbable; and
(ii) does not result from a single failure; and

(2) Each hazardous failure condition is extremely remote; and

(3) Each major failure condition is remote.

Explanation. The FAA proposes to revise § 23.1309(b) to reduce the certification burden by dividing the small airplanes into four classes of airplanes, to require that the airplane systems and associated components considered separately and in relation to other systems must be designed and installed so that the requirements would be the same as AC 23.1309-1C/D. It updates the terminology and adds the classes airplanes as defined in AC 23.1309-1C/D, uses the later terms, and makes it read much easier to determine compliance.

Since their adoption by the FAA, these probability guidelines and their role in demonstrating and finding compliance with §23.1309(b) have been a source of misinterpretation, confusion, and controversy. The FAA intends the numerical values in AC 23.1309-1C/D associated with the probabilistic terms in §23.1309(b) to be used as acceptable risk guidelines in those cases where the effect of system failures are examined by quantitative probability methods of analysis. The use of numerical probability analysis and these guidelines is simply intended to supplement, but not replace, qualitative methods based on engineering and operational judgments. Whether a design meets these guidelines simply provides some evidence to support an informed finding by the FAA as to whether or not the design complies with the intent of the rule.

The Intent of the Term “Extremely Improbable”:

The objective of using this term in the regulations has been to describe a condition (usually a failure condition) that has a probability of occurrence so remote that it is not anticipated to occur in service on any commuter category airplane to which the standard applies. For other classes of airplanes, likelihood of occurrence may be greater. However, while a rule sets a minimum standard for all the airplanes to which it applies, compliance determinations are limited to individual type designs. Experience indicates that the level of conservatism traditionally provided in proper safety assessments more than compensates for the cumulative risk effects across airplane types.

The means of demonstrating that the occurrence of an event is “extremely improbable” varies widely, depending on the type of system, component, or situation that must be assessed. Failure conditions arising from a single failure are not considered “extremely improbable;” thus, probability assessments normally involve failure conditions arising from multiple failures. Both qualitative and quantitative assessments are used in practice, and both are often necessary to some degree to support a conclusion that an event is “extremely improbable.” Generally, performing only a quantitative analysis to demonstrate that a failure condition is extremely improbable is insufficient due to the variability and uncertainty in the analytical process. Any analysis used as evidence that a failure condition is extremely improbable should include justification of any assumptions made, data sources and analytical techniques to account for the variability and uncertainty in the analytical process. Refer to AC23.1309-1C/D, or later revision, for acceptable means of compliance. In short, wherever part 23 requires that a condition be “extremely improbable,” the compliance method -- whether qualitative, quantitative, or a combination of the two -- along with engineering judgment, must provide convincing evidence that the condition should not occur in service.

Inclusion of Specific Failure Condition Categories and Probabilities:

The proposed § 23.1309(b) would include specific terms to describe failure condition categories and probabilities that are in current usage within the aviation industry. It is recognized that some of these terms may be used elsewhere within 14 CFR with different meanings. The FAA may consider issuing a miscellaneous regulatory amendment in the future to standardize the use of these terms to classify failure conditions. However, for the purposes of this proposed regulation, these terms are defined in AC 23.1309-1C/D.

Although the terminology in § 23.1309(b) would be changed from the current regulation, the intent would not be changed. The new text of the rule would serve to "document" and formally institute the current interpretation and application of these terms.

Prohibiting Catastrophic Single Failures:

The proposed text of § 23.1309(b) would explicitly include a fail-safe design requirement that single failures must not result in catastrophic failure conditions, regardless of their probability. This has been the FAA's practice and, in fact, was the only requirement of this sort under the FAA's early Civil Air Regulations (CAR) and the earliest version of part 23. Further guidance concerning § 23.1309(b) has been made part of the new proposed Advisory Circular (AC) 25.1309-1C/D.

Additional Explanation taken from AC 23.1309-1C. The safety objective is to ensure an acceptable safety level for equipment and systems installed on the airplane. A logical and acceptable inverse relationship should exist between the Average Probability Per Flight Hour and the severity of Failure Conditions effects (as shown in the Figure 2 of AC 23.1309-1C/D). This figure defines the appropriate airplane systems probability standards for four certification classes of airplanes designed to 14 CFR part 23 standards. The relationship between probability and severity of Failure Condition Effects is as follows:

- Failure Conditions with No Safety Effect have no probability requirement.
- Minor Failure Conditions may be Probable.
- Major Failure Conditions must be no more frequent than Remote.
- Hazardous Failure Conditions must be no more frequent than Extremely Remote.
- Catastrophic Failure Conditions must be Extremely Improbable.

(1) The four certification classes of airplanes in Figure 2 are as follows: Class I (Typically SRE under 6,000 pounds (#)), Class II (Typically MRE and STE under 6,000 pounds), Class III (Typically SRE, STE, MRE, and MTE equal or over 6,000 pounds), and Class IV (Typically Commuter Category). The acronyms for these airplanes in the four classes of part 23 airplanes are Single Reciprocating Engine (SRE), Multiple Reciprocating Engine (MRE), Single Turbine Engine (STE), and Multiple Turbine Engine (MTE).

(2) Numerical values are assigned for use in those cases where the impact of system failures is examined by quantitative methods of analysis. Also, the related new Software Development Assurance Levels for the various Failure Conditions are part of the matrix. The new probability standards are based on historical accident data, systems analyses, and engineering judgment for each class of airplane.

(3) In assessing the acceptability of a design, the FAA recognized the need to establish rational probability values. Historically, failures in GA airplanes that might result in Catastrophic Failure Conditions are predominately associated with the primary flight instruments in Instrument Meteorological Conditions (IMC). Historical evidence indicates that the probability of a fatal accident in restricted visibility due to operational and airframe-related causes is approximately one per ten thousand hours of flight for single-engine airplanes under 6,000 pounds. Furthermore, from accident data bases, it appears that about 10 percent of the total were attributed to Failure Conditions caused by the airplane's systems. It is reasonable to expect that the probability of a fatal accident from all such Failure Conditions would not be greater than one per one hundred thousand flight hours or 1×10^{-5} per flight hour for a newly designed airplane. It is also assumed, arbitrarily, that there are about ten potential Failure Conditions in an airplane that could be catastrophic. The allowable target Average Probability Per Flight Hour of 1×10^{-5} was thus apportioned equally among these Failure Conditions, which resulted in an allocation of not greater than 1×10^{-6} to each. The upper limit for the Average Probability per Flight Hour for Catastrophic Failure Conditions would be 1×10^{-6}, which establishes an approximate probability value for the term "Extremely Improbable." Failure Conditions having less severe effects could be relatively more likely to occur. Similarly, airplanes over 6,000 pounds have a lower fatal accident rate; therefore, they have a lower probability value for Catastrophic Failure Conditions.

c. Acceptable criteria for Software and Hardware Development Assurance Levels of part 23 airplanes are shown in Figure 2.

(1) The criteria shown in Figure 2 directly reflect the historical accident and equipment probability of failure data in the Civil Air Regulations (CAR) 3 and 14 CFR part 23 airplane fleet. Characteristics of the airplane, such as stall speed, handling characteristics, cruise altitude, ease of recognizing system failures, recognition of entry into stall, pilot workload, and other factors (which include pilot training and experience) affect the ability of the pilot to safely handle various types of system failures in small airplanes. The criteria considered over all airplanes' Failure Conditions is based on service experience, operational exposure rates, and total airplane system reliability. The values for individual system probability of failure could be higher than probability values shown in Figure 2 for specific Failure Conditions since it considers the installed airplane systems, events, and factors.

(2) These classes were defined based on the way accident and safety statistics are currently collected. Generally, the classes deal with airplanes of historically equivalent levels of system complexity, type of use, system reliability, and historical divisions of airplanes according to these characteristics. However, these classes could change because of new technologies and the placement of a specific airplane in a class must be done in reference to all the airplane's missions and performance characteristics. The applicant should have the cognizant certification authority concurrence on the applicable airplane class early in the program. When unusual situations develop, consult the Small Airplane Directorate to obtain specific policy guidance or approval.

(3) For example, multi-turbine-engine airplanes traditionally have been subject to more stringent requirements than a single-engine reciprocating airplane, with the fuel consumption of a reciprocating engine, which permits a wider stall-cruise speed ratio than traditional turbine-engine airplanes. Such an airplane with a stall speed under 61 knots with simple systems, and with otherwise similar characteristics to a traditional single-engine reciprocating airplane (except for a higher cruise speed and a more reliable engine that is simpler to operate), can be treated as a Class I airplane under this analysis. Conversely, if a single-engine reciprocating airplane has the performance, mission capability, and system complexity of a higher class (such as cabin pressurization, high cruise altitude, and extended range), then that type of airplane design may align itself with the safety requirements of a higher class (for example, Class II airplane). These determinations should be made during the development of the certification basis.

DELETE:

(b) (3) Warning information must be provided to alert the crew to unsafe system operating conditions and to enable them to take appropriate corrective action. Systems, controls, and associated monitoring and warning means must be designed to minimize crew errors that could create additional hazards.

ADD:
(c) Information concerning unsafe system operating conditions must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimize crew errors which could create additional hazards.

Explanation:
Description of the Specific Changes:
The FAA proposes to revise the text of § 23.1309(b)(3) to continue to require that:

- information concerning unsafe system operating conditions be provided to the crew to enable them to take appropriate corrective action, and
- systems and controls, including indications and annunciation, be designed to minimize crew errors that could create additional hazards.
- The proposed revised paragraph § 23.1309(c) would also require that a warning indication be provided if immediate corrective action is required.

Categorization of Required Flightcrew Information:
Proposed § 23.1309(c) would be compatible with the requirements of the current § 23.1322 ("Warning, caution, and advisory lights"), which distinguishes between caution, warning, and advisory lights installed on the flight deck. Rather than only providing a warning to the flightcrew, which is required by the current rule, the proposed § 23.1309(c) would require that information concerning unsafe system operating conditions be provided to the flightcrew.

A warning indication would still be required if immediate action by a flightcrew member were required. However, the particular method of indication would depend on the urgency and need for flightcrew awareness or action that is necessary for the particular failure. Inherent airplane characteristics may be used in lieu of dedicated indications and annunciations if they can be shown to be timely and effective. However, the use of periodic maintenance or flightcrew checks to detect significant latent failures when they occur is undesirable and should not be used in lieu of practical and reliable failure monitoring and indications.

Minimization of Crew Errors:
The proposed wording of § 23.1309(c) is intended to clarify the current rule by specifying that the design of systems and controls, including indications and annunciations, must minimize crew errors that could create additional hazards. The additional hazards to be minimized are those that could occur after a failure and are caused by inappropriate actions made by a crew member in response to the failure. Unless they are accepted as part of normal aviation abilities, any procedures for the flightcrew to follow after the occurrence of a failure indication or annunciation should be described in the approved Airplane Flight Manual (AFM), AFM revision, or AFM supplement.

Interpretation of Unsafe System Operating Conditions:
The following interpretive material provides guidance to aid in making determinations as to whether a given system operating condition is "unsafe". It is not intended to be the only way to define an unsafe condition.

Any system operating condition which, if not detected and properly accommodated by crew action, would significantly contribute to or cause one or more serious injuries is an "unsafe system operating condition" for the purposes of this regulation. Even if airplane operation or performance is unaffected or insignificantly affected at the time of a failure, information to the flightcrew is required if it is considered necessary for the flightcrew to take any action or observe any precautions. If operation or performance is unaffected or insignificantly affected, information and alerting indications may be inhibited during specific phases of flight where informing the flightcrew is considered more hazardous than not informing them.

DELETE:

(c) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:

(1) Loads connected to the power distribution system with the system functioning normally.

(2) Essential loads after failure of--

(i) Any one engine on two-engine airplanes; or

(ii) Any two engines on an airplane with three or more engines; or

(iii) Any power converter or energy storage device.

(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.

(d) In determining compliance with paragraph (c)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

Explanation: The FAA proposes to remove the current paragraphs (c) and (d) from § 23.1309 and include them as a new § 23.1310. These requirements are not directly related to the other safety and analysis requirements of § 23.1309, and the FAA considers it appropriate to state them separately for the purpose of clarity. There would be no change to these requirements, other than their new section number. The addition of proposed § 23.1310 would entail no significant change to the current requirements, and there would be no increase in costs associated with it.

DELETE AND CHANGE

(e) In showing compliance with this section with regard to the electrical power system and to equipment design and installation, critical environmental and atmospheric conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered. For electrical generation, distribution, and utilization equipment required by or used in complying with this chapter, the ability to provide continuous, safe service under foreseeable to the airplane operating and environmental conditions may be shown by environmental tests, design analysis, or reference to previous comparable service experience on other airplanes.

Explanation: Current paragraph (e) is being deleted since it is redundant to proposed paragraph (a). Except the words "including radio frequency energy and the effects (both direct and indirect) of lightning strikes, must be considered" are being retained and moved to propose paragraph (a) with the environmental conditions.

CHANGE and DELETE

(<u>d</u>) As used in this section, "systems" refers to all pneumatic systems, fluid systems, electrical systems, mechanical systems, and powerplant systems. Included in the airplane design, except for the following:

(1) Powerplant systems provided as part of the certificated engine.

(2) The flight structure (such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments) whose requirements are specific in subparts C and D of this part.

Explanation: Paragraph identification is changed from (f) to (d). Deleted the exceptions. The exceptions and applicability were added to the introductory paragraphs. The words "The flight structure such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments" are being retained and moved to the introductory paragraphs.

23.1310 Power Source capacity and distribution - The working group proposes to remove the current paragraphs (c) and (d) from § 23.1309 and include them as a new § 23.1310. These requirements are not directly related to the other safety and analysis requirements of § 23.1309, and the working group considers it appropriate to state them separately for the purpose of clarity. There would be no change to these requirements, other than their new section number. The addition of proposed § 23.1310 would entail no significant change to the current requirements, and there would be no increase in costs associated with it.

23.1311 Electronic display instrument systems - The working group recommended that this rulemaking effort update section 23.1311 to what is currently being accomplished for this class of airplane.

In paragraph (a) (5), replace "individual electronic display indicators" with "electronic display parameters" for clarification that has caused confusion. These electronic display parameters could be integrated on one electronic display that is independent from the primary flight display. In paragraph (a) (6), after the word cues add "that provides a quick glance sense of rate and when appropriate trend information" for clarification of sensory cue that has caused confusion.

In paragraph (a) (7), the word equivalent was added after incorporate to allow instrument markings on electronic displays that are equivalent to those instrument markings on conventional mechanical and electromechanical instruments.
In paragraph (b), After the word will replace "remain available to the crew without need for immediate action" with "be available within one second to the crew with a single pilot action or by automatic means."

These changes would allow reversionary flight displays as additional displays such as secondary primary flight display (PFD) or a Multifunction Display (MFD) that can provide a secondary means to provide primary flight information (PFI). The function of a MFD system is to provide the crew access to a variety of data, or combinations of data, used to fly the aircraft, to navigate, to communicate, and to manage aircraft systems. MFD"s may also display PFI as needed to ensure continuity of operations. MFD's are designed to depict PFI, navigation, communication, aircraft state, aircraft system management, terrain, weather, traffic, and/or other information used by the flight crew for command and control of the aircraft. Display of PFI on reversionary (secondary) displays should be arranged in the basic T-configuration. However, the displays should be legible and usable from the pilot's position with minimal head movement. The reversionary (secondary) guidance display, if required, may be outside the pilot's primary field-of-view, if it is usable from the pilot's position with minimum head movement. There would be three acceptable methods.

1. Reversionary flight information should be presented by an independent source and display to prevent complete loss of PFI due to a single failure. Reversionary flight information need not be continuously displayed as long as the information is available without crewmember action for any single failure or probable combination of failures.

2. Primary information displayed continuously on the reversionary displays could be available during critical phases of flight (e.g., takeoff, landing, and missed or final approach) is

acceptable. Manual activation of reversionary displays through single action by the pilot is acceptable when procedures to activate them are accomplished prior to entering critical phases of flight.

3. Another acceptable method is automatic selection and with a single pilot action to restore information essential for continued safe flight and landing via duplicate displays on the PFD and MFD. Most all detectable faults involving display of essential information (attitude, altitude, and airspeed) should result in an automatic selection of secondary information or reversion of the PFD to the MFD.

The electronic display system for this configuration should have a two-display system that incorporates dual, independently powered Attitude Heading Reference (AHRS) and dual Air Data Computer (ADC) sub-systems that provide primary flight parameters. This configuration is significantly more reliable than presently certified mechanical systems, and the skills required while flying in reversionary mode are identical to those used when flying in primary mode.

The configuration provides backup information essential to continued safe flight and landing by the use of an intuitive control that allows instant, simultaneous access to reversionary mode on both the PFD and MFD displays. The single pilot action would force both the PFD and MFD displays into reversionary mode operation. The system response time should provide flight critical information on the MFD in less than one second after switch operation.

The single pilot action should be within easy reach of the pilot and is quickly and positively identified by the red color and the lighted red “halo” ring that announces its position on the panel. The proposed design should incorporate an automatic reversion capability that provides a complete display of all intended flight, navigation, communication, and engine information on the remaining display within one second in the event a fault is detected. A majority of possible faults are covered by this capability. Only a total loss of the display is presently identified as not capable of being reliably detected automatically, but such a failure condition would be obvious to the pilot. In the event of such a malfunction, a single pilot action by the pilot should provide a full display of all information on the remaining display within one second of the button being pushed. All modes, sources, frequencies, flight plan data, etc. would be exactly as they were on the PFD prior to the failure. The availability of a nearly identical display of all flight information in the same format as normally shown on the PFD provides a significant safety enhancement over reversion to external standby instruments, especially when the size, location, arrangement, and information provided by the standby instruments is significantly different from that on the PFD. Traditional external standby flight instruments (either electronic or mechanical) offer potential safety problems associated with 1) delay in pilot determination of the need to transition to standby instruments, and 2) transition to partial panel techniques as opposed to a simple action to switch displays.

23.1317 High Intensity Radiated Field (HIRF) Protection

The purpose of this particular rulemaking effort is to update this regulation with the standard High Intensity Radio Field (HIRF) requirements that have been imposed on applicants for many years by FAA and JAA Special Conditions, however, this proposal includes the harmonized requirements that were developed by the JAA and FAA within the ARAC Process for part 23/25/27/29.

There is no current codified standard relative to this subject except as applied through Special Conditions. Current standards were written for aircraft having systems that were less susceptible to High Intensity Radiation Fields than are some of the systems currently being installed on modern aircraft.

The proposed addition will incorporate Special Conditions that have been levied to applicants for this requirement to include the JAA requirement. The standards for these HIRF requirements have been harmonized with the JAA though the ARAC process for part 23/25/27/29. It is specifically noted that these requirements have a higher level of certitude in comparison to the standard FAA Special Conditions that have been issued for U.S. type certificate projects.

Current FAA and JAA special conditions differ greatly in the application of Special Conditions; Current FAA Special Conditions are written around standard DO-160 Equipment Qualification testing and only address Critical System Functions. Current JAA Special Conditions are written around the Proposed ARAC EHWG Proposed NPRM/NPA and address Critical, Hazardous, and Major Functions. JAR 23 has not been updated to incorporate the latest 14 CFR 23 amendments. EASA CS 23 is very nearly identical to the current 14 CFR 23.

Having two different requirements results in having to certify to meet the U.S. Special Conditions and then having to repeat the effort to meet the JAA requirements with the resulting added costs of doing the job twice. Accepting the JAA requirements will eliminate this duplicate effort.

Due to the differences in requirements between the two special conditions, completely different compliance methods are required. JAA compliance methods require means of requirements driven by the proposed AC/AMJ. This requires the OEM to address them differently.

The intent of this regulatory change is to update the regulations to the current practices, to include the JAA standards, used for this class of airplane.

Note: The proposed change to 23.1321 was deleted, It is a duplication of 23.1305. Also, this concept was incorporated in revised section 23.1311.

23.1331 – The working group made recommendations that are meant to apply to those instruments that rely on a power source and provide required flight information. Such instruments are those that provide information for direct control of flight that are required by the “kinds of operation” for which the airplane has been approved. Consequently, this section applies to all flight instruments required by 14 CFR part 23, § 23.1303 and part 91, § 91.205. Therefore, instruments in airplanes limited to VFR operations that are not required for VFR would not have to comply with the requirements of § 23.1331.

Each independent power source must provide sufficient power for normal operations throughout the approved flight envelope of the airplane and for any operations for which the airplane is approved. For example, an IFR approved airplane must have independent power sources for the display of attitude that are not limited to altitudes below the approved service ceiling of the airplane.

Section 23.1331(c) does not require the installation of dual alternators or vacuum systems on single engine airplanes. Typically these single engine airplanes used one of each system, effectively meeting the independent power requirement. Other options include a dedicated battery with a 30 minute capacity for electrical instrument loads essential to continued safe flight and landing, use of differently powered types of instruments for primary and standby, or verifying the aircraft battery used for starting by a system safety analysis per § 23.1309.

23.1443 Minimum mass flow of supplemental oxygen – The standards need amending to address a new class of airplane that can operate at higher altitudes than originally anticipated for part 23 aircraft. Up until now very high altitudes have been addressed using special conditions derived from part 25. The working group recommended this amendment because there are a number of new jet and high performance aircraft that can operate at higher altitudes than previously envisioned for part 23 aircraft.

23.1447 Equipment standards for oxygen dispensing units – The standards need amending to address a new class of airplane that can operate at higher altitudes than originally anticipated for part 23 aircraft. Up until now very high altitudes have been addressed using special conditions derived from part 25. The working group recommended this amendment because there are a number of new jet and high performance aircraft that can operate at higher altitudes than previously envisioned for part 23 aircraft.

23.1505 Airspeed Limitations – The working group proposed this amendment because it has been standard practice for jets for many years and included on all part 23 jet special conditions. This amendment acknowledges that airspeed limits should be based on a combination of theoretical (V_D/M_D) and demonstrated (V_{DF}/M_{DF}) dive speeds.

23.1545 Airspeed Indicator – The working group recommended that the FAA amend the regulatory language in 23.1545 to limit the white flap arc/band to reciprocating engine airplanes. This reflects standard practice for jet for many years and included on all part 23 jet special conditions.

23.1555 Control markings – Most modern turbine powered airplanes have a calibrated fuel quantity indicating system that is density compensated and very accurately indicates the actual usable fuel quantity in each tank. Many airplanes are frequently operated with less than full fuel tanks. The placards or markings required by § 23.1555(d)(1)&(2) reflect only the maximum capacity of the tank and would indicate usable fuel only if it were filled to that capacity. Further, this "capacity" is not compensated for fuel density and would indicate usable fuel only if the tank was full with standard density fuel. The placards required by § 23.1555(d)(1)&(2) are therefore redundant relative to the current industry practice and may be misleading. The working group recommends that the requirements be amended to reflect current industry practice.

23.1559 Operating limitations placard - The requirements specified on this placard are relative to preflight planning and not normally referenced in flight. As long as the placard is "in clear view of the pilot" and can be viewed by the pilot at night using a flashlight or other means, the intent of the rule is met. The requirement to light the placard has not been uniformly applied. This change makes the lighting intent clear.

23.1567 Flight maneuver placard – The working group recommended that the FAA clarify the lighting requirements for the maneuvering speed placard. Maneuvering speed is applicable to operations that may involve intentional large control input and is therefore not applicable to normal night operations. Many modern airplanes have means for the landing gear speed to be displayed in the airspeed indicator or on lighted portions of the landing gear control and for the airspeed indicator to display low speed awareness or other airspeed reference information to provide safety above V_{MC}. Lighting this placard is redundant and provides further source of lighting reflections in the cockpit.

Proposed Rule

23.3 Airplane categories - proposed change:

> (d) The commuter category is limited to, multiengine airplanes that have a seating configuration, excluding pilot seats, of 19 or less, and a maximum certificated takeoff weight of 19,000 pounds or less. The commuter category operation is limited to any maneuver incident to normal flying, stalls (except whip stalls), and steep turns, in which the angle of bank is not more than 60 degrees.

23.49 Stalling Speed - proposed change

> (a) V_{SO} <u>(landing configuration is full flaps)</u> and V_{S1} are the stalling speeds or the minimum steady flight speeds, in knots (CAS), at which the airplane is controllable with…

23.67 Climb: One Engine Inoperative – proposed change:

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category--
(1) The steady gradient of climb at an altitude of 400 feet above the takeoff surface must be not less than 1% with the-
(i) Critical engine inoperative and its propeller (if applicable) in the minimum drag position;
(ii) Remaining engine(s) at takeoff power;
(iii) Landing gear retracted;
(iv) Wing flaps in the takeoff position(s); and
(v) Climb speed equal to that achieved at 50 feet in the demonstration of Sec. 23.53.

23.73 Reference Landing approach speed – proposed change:

(b) For normal, utility, and acrobatic category reciprocating engine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes in the normal, utility, and acrobatic category, the reference landing approach speed, V_{REF}, must not be less than the greater of V_{MC}, determined in Sec. 23.149(c), and 1.3 V_{S1}.
(c) For commuter category airplanes, the reference landing approach speed, VREF, must not be less than the greater of 1.05 V_{MC}, determined in Sec. 23.149(c), and 1.3 V_{S1}.

23.177 Static directional and lateral stability – proposed change:

(a) The static directional stability, as shown by the tendency to recover from a wings level sideslip with the rudder free, must be positive for any landing gear and flap position appropriate to the takeoff, climb, cruise, approach, and landing configurations. This must be shown with symmetrical power up to maximum continuous power, and at speeds from $1.2V_{S1}$ up to the landing gear or wing flap operating limit speeds, or V_{NO} or V_{FC} / M_{FC} , whichever is appropriate. The angle of sideslip for these tests must be appropriate to the type of airplane. At larger angles of sideslip, up to that at which full rudder is used or a control force limit in Sec. 23.143 is reached, whichever occurs first, and at speeds from $1.2V_{S1}$ to V_O, the rudder pedal force must not reverse.
(b) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip with the aileron controls free, may not be negative for all landing gear and flap positions. This must be shown with symmetrical power from idle up to 75 percent of maximum continuous power at speeds from $1.2V_{S1}$ in the takeoff configuration(s) and at speeds from $1.3V_{S1}$ in other configurations, up to the maximum allowable airspeed for the configuration being investigated, (V_{fe}, V_{le}, V_{N0}, V_{FC} / $M_{FC,}$ whichever is appropriate) in the takeoff, climb, cruise, descent, and approach configurations. For the landing configuration, the power is that required to maintain a 3-degree angle of descent in coordinated flight. The angle of sideslip for these tests must be appropriate to the type of airplane, but in no case may the constant heading sideslip angle be less than that obtainable with a 10 degree bank, or if less, the maximum bank angle obtainable with full rudder deflection or 150 pound rudder force.
(c) For airplanes with V_{MO}/M_{MO} established under 23.1505(c), the rudder gradients must meet the requirements of paragraph (b) at speeds between V_{MO}/M_{MO} and V_{FC}/M_{FC} except that the dihedral effect (aileron deflection opposite the corresponding rudder input) may be negative provided the divergence is gradual, easily recognized, and easily controlled by the pilot.
(d) Paragraph (b) of this section does not apply to acrobatic category airplanes certificated for inverted flight.

(e) In straight, steady slips at 1.2 V_{S1} for any landing gear and flap positions, and for any symmetrical power conditions up to 50 percent of maximum continuous power, the aileron type of airplane. At larger slip angles, up to the angle at which full rudder or aileron control is used or a control force limit contained in §23.143 is reached, the aileron and rudder control movements and forces must not reverse as the angle of sideslip is increased. Rapid entry into, and recovery from, a maximum sideslip considered appropriate for the airplane must not result in uncontrollable flight characteristics.

23.181 Dynamic stability – proposed change:

…and rudder control movements and forces must increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased up to the maximum appropriate to the (b) Any combined lateral-directional oscillations ("Dutch roll") occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane must be damped to $1/10$ amplitude in 1) 7 cycles below 18,000 ft, and 2) 13 cycles from 18,000 ft to the certified maximum altitude with the primary controls--

(1) Free; and
(2) In a fixed position.

23.201 Wings level stall – proposed change

(d) During the entry into and the recovery from the maneuver, it must be possible to prevent more than 15 degrees of roll or yaw by the normal use of controls except as provided for in paragraph (e).
(e) For airplanes approved for operations above 25,000 feet, during the entry into and the recovery from stalls performed above 25,000 feet, it must be possible to prevent more than 25 degrees of roll or yaw by the normal use of controls.
(f) Compliance with the requirements of this section must be shown under the following conditions:
(1) Wing Flaps: Retracted, fully extended, and each intermediate normal operating position as appropriate for the altitude.
(2) Landing Gear: Retracted and extended as appropriate for the altitude.
(3) Cowl Flaps: Appropriate to configuration.
(4) Spoilers/speedbrakes: Retracted and extended unless they have little to no effect at low speeds
(5) Power:
(i) Power / Thrust off; and
(ii) For Reciprocating Engine Powered Airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power result in extreme nose-high attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of $1.4V_{SO}$, except that the power may not be less than 50 percent of maximum continuous power; or
(iii) For Turbine Engine Powered Airplanes: The maximum engine thrust except that it need not exceed the thrust necessary to maintain level flight at $1.6V_{S1}$ (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

23.203 Turning flight and accelerated turning stalls – proposed changes:
(c) Compliance with the requirements of this section must be shown under the following conditions:
(1) Wings Flaps: Retracted, fully extended, and each intermediate normal operating position as appropriate for the altitude:
(2) Landing Gear: Retracted and extended as appropriate for the altitude;
(3) Cowl Flaps: Appropriate to configuration;
(4) Spoilers/speedbrakes: Retracted and extended unless they have little to no effect at low speeds;
(5) Power:
(i) Power / Thrust off; and

(ii) For Reciprocating Engine Powered Airplanes: 75 percent maximum continuous power. However, if the power-to-weight ratio at 75 percent of maximum continuous power result in extreme nose-high attitudes, the test may be carried out with the power required for level flight in the landing configuration at maximum landing weight and a speed of $1.4V_{SO}$, except that the power may not be less than 50 percent of maximum continuous power; or

(iii) For Turbine Engine Powered Airplanes: The maximum engine thrust except that it need not exceed the thrust necessary to maintain level flight at $1.6V_{S1}$ (where V_{S1} corresponds to the stalling speed with flaps in the approach position, the landing gear retracted, and maximum landing weight).

23.251 Vibration and buffeting – proposed change:

(a) There must be no vibration or buffeting severe enough to result in structural damage, and each part of the airplane must be free from excessive vibration, under any appropriate speed and power conditions up to V_{DF}/M_{DF}. In addition, there must be no buffeting in any normal flight condition severe enough to interfere with the satisfactory control of the airplane or cause excessive fatigue to the flight crew. Stall warning buffeting within these limits is allowable.

(b) For an airplane with M_D greater than .6 or with a maximum operating altitude greater than 25,000 feet, the positive maneuvering load factors at which the onset of perceptible buffeting occurs must be determined with the airplane in the cruise configuration for the ranges of airspeed or Mach number, weight, and altitude for which the airplane is to be certificated. The envelopes of load factor, speed, altitude, and weight must provide a sufficient range of speeds and load factors for normal operations. Probable inadvertent excursions beyond the boundaries of the buffet onset envelopes may not result in unsafe conditions.

23.253 High speed characteristics – proposed changes:

(b) Allowing for pilot reaction time after occurrence of the effective inherent or artificial speed warning specified in Sec. 23.1303, it must be shown that the airplane can be recovered to a normal attitude and its speed reduced to V_{MO}/M_{MO}, without—

(1) Exceptional piloting strength or skill.

(2) Exceeding V_D/M_D, V_{DF}/M_{DF}, the maximum speed shown under Sec. 23.251, or the structural limitations; or

(3) Buffeting that would impair the pilot's ability to read the instruments or to control the airplane for recovery.

23.255 Out of Trim Characteristics – proposed change:

(a) From an initial condition with the airplane trimmed at cruise speeds up to V_{MO}/M_{MO}, the airplane must have satisfactory maneuvering stability and controllability with the degree of out-of-trim in both the airplane nose-up and nose-down directions, which results from the greater of--

(1) A three-second movement of the longitudinal trim system at its normal rate for the particular flight condition with no aerodynamic load, except as limited by stops in the trim system, including those required by Sec. 23.655(b); or

(2) The maximum mistrim that can be sustained by the autopilot while maintaining level flight in the high-speed cruising condition.

(b) In the out-of-trim condition specified in paragraph (a) of this section, when the normal acceleration is varied from +1g to the positive and negative values specified in paragraph (c) of this section--

(1) The stick force vs. g curve must have a positive slope at any speed up to and including V_{FC}/M_{FC} ; and

(2) At speeds between V_{FC}/M_{FC} and V_{DF}/M_{DF} the direction of the primary longitudinal control force may not reverse.

(c) Except as provided in paragraphs (d) and (e) of this section, compliance with the provisions of paragraph (a) of this section must be demonstrated in flight over the acceleration range--

(1) -1g to +2.5g; or

(2) 0 g to 2.0 g, and extrapolating by an acceptable method to -1g and +2.5g

(d) If the procedure set forth in paragraph (c)(2) of this section is used to demonstrate compliance and marginal conditions exist during flight test with regard to reversal of primary longitudinal control force, flight tests must be accomplished from the normal acceleration at which a marginal condition is found to exist to the applicable limit specified in paragraph (b)(1) of this section.

(e) During flight tests required by paragraph (a) of this section, the limit maneuvering load factors prescribed in Secs. 23.333(b) and 23.337 need not be exceeded. In addition, the entry speeds for flight test demonstrations at normal acceleration values less than 1 g must be limited to the extent necessary to accomplish a recovery, without exceeding V_{DF}/M_{DF}.

(f) In the out-of-trim condition specified in paragraph (a) of this section, it must be possible from an overspeed condition at V_{DF}/M_{DF} to produce at least 1.5g for recovery by applying not more than 125 pounds of longitudinal control force using either the primary longitudinal control alone or the primary longitudinal control and the longitudinal trim system. If the longitudinal trim is used to assist in producing the required load factor, it must be shown at V_{DF}/M_{DF} that the longitudinal trim can be actuated in the airplane nose-up direction with primary surface loaded to correspond to the least of the following airplane nose-up control forces:

(1) The maximum control forces expected in service as specified in Secs. 23.301 and 23.397.

(2) The control force required to produce 1.5g.

(3) The control force corresponding to buffeting or other phenomena of such intensity that it is a strong deterrent to further application of primary longitudinal control force

23.571 Metallic pressurized cabin structures – proposed changes:

For normal, utility, and acrobatic category airplanes, the strength, detail design, and fabrication of the metallic structure of the pressure cabin must be evaluated under one of the following:

(a) A fatigue strength investigation in which the structure is shown by tests, or by analysis supported by test evidence, to be able to withstand the repeated loads of variable magnitude expected in service; or

(b) A fail safe strength investigation, in which it is shown by analysis, tests, or both that catastrophic failure of the structure is not probable after fatigue failure, or obvious partial failure, of a principal structural element, and that the remaining structures are able to withstand a static ultimate load factor of 75 percent of the limit load factor at V_C, considering the combined effects of normal operating pressures, expected external aerodynamic pressures, and flight loads. These loads must be multiplied by a factor of 1.15 unless the dynamic effects of failure under static load are otherwise considered.

(c) The damage tolerance evaluation of §23.573(b).

(d) If certification for operation above 41,000 feet is requested, a damage tolerance evaluation of the fuselage pressure boundary per §23.573(b) must be conducted and the evaluation must account for the requirements of paragraph (c) of section 23.841.

23.573 Damage tolerance and fatigue evaluation of structure

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must account for the requirements of paragraph (c) of section 23.841.

23.574 Metallic damage tolerance and fatigue evaluation of commuter category airplanes

(c) If certification for operation above 41,000 feet is requested, the damage tolerance evaluation of this paragraph for the fuselage pressure boundary must account for the requirements of paragraph (c) of section 23.841.

23.629 Flutter

(b) Flight flutter tests must be made to show that the airplane is free from flutter, control reversal and divergence and to show that—

(1) Proper and adequate attempts to induce flutter have been made within the speed range up to V_D;

(2) The vibratory response of the structure during the test indicates freedom from flutter;

(3) A proper margin of damping exists at V_{DF}/M_{DF} ; and

(4) There is no large and rapid reduction in damping as V_D or V_{DF}/M_{DF} , as appropriate, is approached.

(c) Any rational analysis used to predict freedom from flutter, control reversal and divergence must cover all speeds up to 1.2 V_D or V_{DF}/M_{DF}, as appropriate.

23.703 Takeoff Warning System

(a) The system must provide to the pilots an aural warning that is automatically activated during the initial portion of the takeoff role if the airplane is in a configuration that would not allow a safe takeoff. The warning must continue until--

(1) The configuration is changed to allow safe takeoff, or

(2) Action is taken by the pilot to abandon the takeoff roll.

(b) The means used to activate the system must function properly for all authorized takeoff power settings and procedures and throughout the ranges of takeoff weights, altitudes, and temperatures for which certification is requested

23.777 Powerplant controls

(d) When separate and distinct control levers are co-located (such as located together on the pedestal), the control location order … and mixture control (condition lever and fuel cut-off for turbopropeller-powered airplanes).

23.807 Emergency exits

(e) For multiengine airplanes, ditching emergency exits must be provided in accordance with the following requirements, unless the emergency exits required by paragraph (a) or (d) of this section already comply with them:

(1) One exit above the waterline on each side of the airplane having the dimensions specified in paragraph (b) or (d) of this section, as applicable; and

(2) If side exits cannot be above the waterline, there must be a readily accessible overhead hatch emergency exit that has a rectangular opening measuring not less than 20 inches wide by 36 inches long, with corner radii not greater than one-third the width of the exit, or

(3) In lieu of paragraph (e)(2) of this section, if any side exit or exits cannot be above the waterline, a device must be placed at each of such exit or exits prior to ditching, to slow the inflow of water when such exit is, or such exits are, opened with the airplane in a ditching emergency. For commuter category airplanes, the clear opening of such exit or exits must meet the requirements defined in paragraph (d) of this section.

23.831 Ventilation – proposed changes

(e) each passenger and crew compartment must be suitably ventilated. Carbon monoxide concentration may not exceed one part in 20,000 parts of air.

(f) For pressurized airplanes, the ventilating air in the flightcrew and passenger compartments must be free of harmful or hazardous concentrations of gases and vapors in normal operations and in the event of reasonably probable failures or malfunctioning of the ventilating, heating, pressurization, or other systems and equipment. If accumulation of hazardous quantities of smoke in the cockpit area is reasonably probable, smoke evacuation must be readily accomplished starting with full pressurization and without depressurizing beyond safe limits.

(g) For turbine powered pressurized airplanes, under normal operating conditions and in the event of any probable failure conditions of any system which would adversely affect the ventilating air, the ventilation system must provide a sufficient amount of uncontaminated air to enable the crew members to perform their duties without undue discomfort or fatigue and to provide reasonable passenger comfort. For normal operating conditions, the ventilation system must be designed to provide each occupant with at least 0.55 pounds of fresh air per minute. In the event of the loss of one source of fresh air, the supply of fresh airflow must not be less than 0.4 pounds per minute for any period exceeding five minutes.

(h) Other probable and improbable Environmental Control System failure conditions that adversely affect the passenger and crew compartment environmental conditions must not affect crew performance that would result in a hazardous condition and no occupant shall sustain permanent physiological harm.

23.841 Pressurized Cabins

(b) If certification for operation above 25,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet, in event of any probable failure condition in the pressurization system. During the decompression, the cabin altitude shall not exceed 15,000 feet for more than 10 seconds and not exceed 25,000 feet for any duration.

(b) Pressurized cabins must have at least the following valves, controls, and indicators for controlling cabin pressure:

(1) Two pressure relief valves to automatically limit the positive pressure differential to a predetermined value at the maximum rate of flow delivered by the pressure source. The combined capacity of the relief valves must be large enough so that the failure of any one valve would not cause an appreciable rise in the pressure differential. The pressure differential is positive when the internal pressure is greater than the external.

(2) Two reverse pressure differential relief valves (or their equivalent) to automatically prevent a negative pressure differential that would damage the structure. However, one valve is enough if it is of a design that reasonably precludes its malfunctioning.

(3) A means by which the pressure differential can be rapidly equalized.

(4) An automatic or manual regulator for controlling the intake or exhaust airflow, or both, for maintaining the required internal pressures and airflow rates.

(5) Instruments to indicate to the pilot the pressure differential, the cabin pressure altitude, and the rate of change of cabin pressure altitude.

(6) Warning indication at the pilot station to indicate when the safe or preset pressure differential is exceeded and when a cabin pressure altitude of 10,000 feet is exceeded. The 10,000 foot cabin altitude warning can be increased up to 15,000 feet for operations from high altitude airfields provided:

(v) The landing or the take off modes (normal or high altitude) shall be clearly indicated to the flight crew.
(vi) Selection of normal or high altitude airfield mode shall require no crew action beyond normal pressurization system operation.
(vii) The pressurization system shall be designed to ensure cabin altitude does not exceed 10,000 feet when in flight above FL250.
(viii) The pressurization system and cabin altitude warning system shall be designed to ensure cabin altitude warning at 10,000 feet when in flight above FL250.

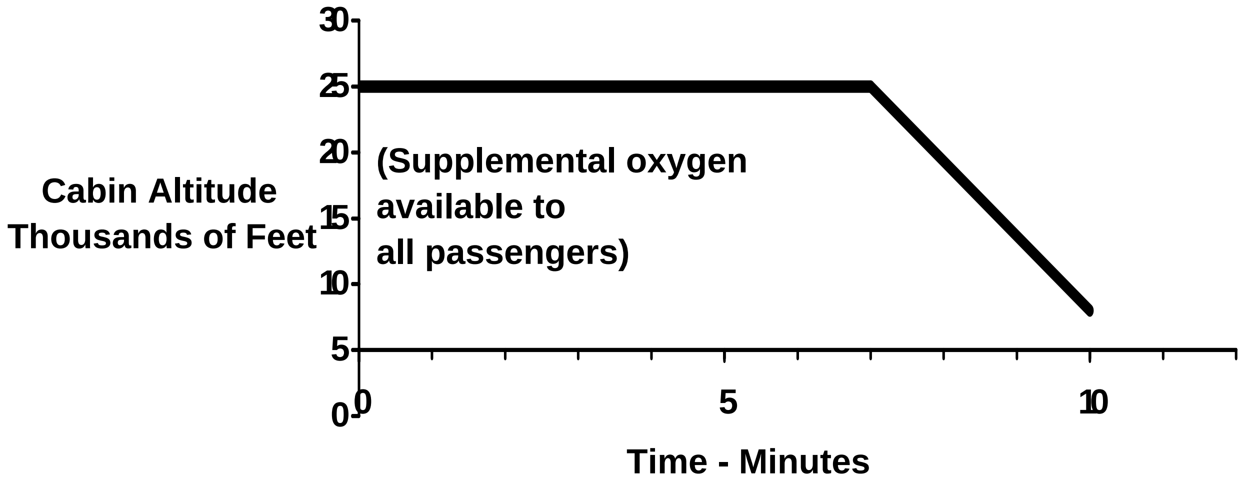
7) A warning placard for the pilot if the structure is not designed for pressure differentials up to the maximum relief valve setting in combination with landing loads.

(8) A means to stop rotation of the compressor or to divert airflow from the cabin if continued rotation of an engine-driven cabin compressor or continued flow of any compressor bleed air will create a hazard if a malfunction occurs.

(c) If certification for operation above 41,000 feet and not more than 45,000 feet is requested,
(1) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any probable pressurization system failure in conjunction with any undetected, latent pressurization system failure condition:
(i) If depressurization analysis shows that the cabin altitude does not exceed 25,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 1.
(ii) Maximum cabin altitude is limited to 30,000 feet. If cabin altitude exceeds 25,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.
(2) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any single pressurization system failure in conjunction with any probable fuselage damage:
(i) If depressurization analysis shows that the cabin altitude does not exceed 37,000 feet, the pressurization system must prevent the cabin altitude from exceeding the cabin altitude-time history shown in Figure 2.

(ii) Maximum cabin altitude is limited to 40,000 feet. If cabin altitude exceeds 37,000 feet, the maximum time the cabin altitude may exceed 25,000 feet is 2 minutes; time starting when the cabin altitude exceeds 25,000 feet and ending when it returns to 25,000 feet.

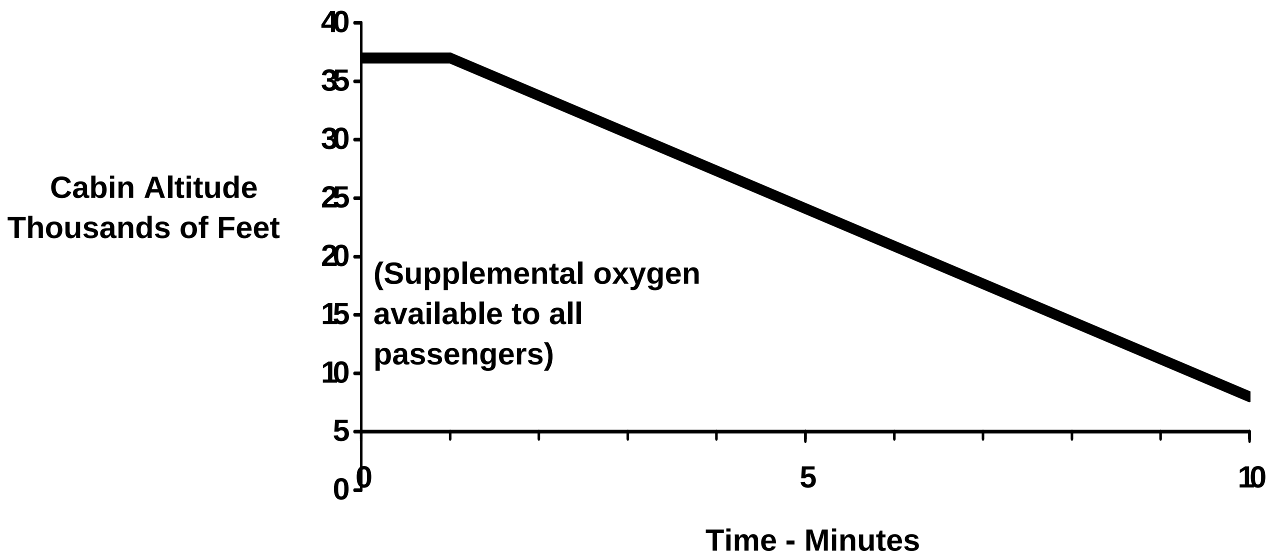
(3) In showing compliance with paragraphs (c)(1) and (c)(2) above, it may be assumed that an emergency descent is made by an approved emergency procedure. A 17-second crew recognition and reaction time must be applied between cabin altitude warning and the initiation of an emergency descent. Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.



Cabin Altitude - Time History

Figure 1

Note: For Figure 1, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.



Cabin Altitude - Time History

Figure 2

Note: For Figure 2, time starts at the moment cabin altitude exceeds 10,000 feet during decompression.

(d) If certification for operation above 45,000 feet and not more than 51,000 feet is requested,
(1) Pressurized cabins must be equipped to provide a cabin pressure altitude of not more than 8000 feet at the maximum operating altitude of the airplane under normal operating conditions.
(3) The airplane must prevent cabin pressure altitude from exceeding the following after decompression from any failure condition not shown to be extremely improbable:
(i) Twenty-five thousand (25,000) feet for more than 2 minutes: or
(ii) Forty thousand (40,000) feet for any duration.
(3) Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression.
(4) An aural or visual signal (in addition to the cabin altitude indicating means in (b)(6) above) must be provided to warn the flight crew when the cabin pressure altitude exceeds 10,000 feet.
(5) The sensing system and pressure sensors necessary to meet the requirements of (b)(5), (b)(6), and (d)(4) above and CFR14 part 23.1447 paragraphs (e) and (f), must, in the event of low cabin pressure, actuate the required warning and automatic presentation devices without any delay that would significantly increase the hazards resulting from decompression.
(e) If certification for operation above 41,000 feet is requested, additional damage-tolerance requirements are necessary to prevent fatigue damage that could result in a loss of pressure that exceeds the requirements of paragraphs (c) and (d) of this section. Sufficient full scale fatigue test evidence must be provided to demonstrate that this type of pressure loss due to fatigue cracking will not occur within the Limit of Validity of the Maintenance program for the airplane. In addition, a damage tolerance evaluation of the fuselage pressure boundary must be performed assuming visually detectable cracks and the maximum damage size for which the requirements of paragraphs (c) and (d) of this section can be met. Based on this evaluation, inspections or other procedures must be established and included in the Limitations Section of the Instructions for Continued Airworthiness required by **§** 23.1529.

23.853 Passenger and crew compartment interiors

(d) In addition, for commuter category airplanes the following requirements apply:
(2) Lavatories must have “No Smoking” or “No Smoking in Lavatory” placards located conspicuously on each side of the entry door and self-contained, removable ashtrays located conspicuously on or near the entry side of each lavatory door, except that one ashtray may serve more than one lavatory door if it can be seen from the cabin side of each lavatory door served.

23.1141 Powerplant controls

(i) The installation of electronic control systems shall meet the requirements of FAR 23.1309(a) through (e).

23.1165 Engine ignition systems

(f) In addition, for commuter category airplanes, each turbine engine ignition system must be an essential electrical load.

23.1301 Function and installation
Amend section 23.1301 by deleting paragraph (d).

Each item of installed equipment must--
(a) Be of a kind and design appropriate to its intended function;

(b) Be labeled as to its identification, function, or operating limitations, or any applicable combination of these factors; and
(c) Be installed according to limitations specified for that equipment.

23.1305 Powerplant instruments

(f) Powerplant indicators must either provide trend or rate-of change information, or have the ability to
(1) allow the pilot to assess necessary trend information quickly, including if and when this information is needed during engine restarts, and
(2) allow the pilot to assess how close the indicated parameter is relative to a limit, and
(3) forewarn the pilot prior to the parameter reaching an operating limit, and
(4) for multi-engine airplanes, allow the pilot to quickly and accurately compare engine-to-engine data..

Section 23.1309 is amended by adding the two applicability paragraphs and revising all the paragraphs as explained in the preamble.
Change 23.1309 Equipment, Systems, and installations – to read as follows:

The requirements of this section, except as identified below, are applicable, in addition to specific design requirements of part 23, to any equipment or system as installed in the airplane. This section is a regulation of general requirements. It should not be used to supersede any specific requirements contained in another section of part 23. Therefore, this section should not be used to increase or decrease the requirements except it can be used for determining the software and hardware development assurance levels.

This section does not apply to the performance, flight characteristics requirements of Subpart B, and structural loads and strength requirements of Subparts C and D, but it does apply to any system on which compliance with the requirements of Subparts B, C, D and E is based. The flight structure such as wing, empennage, control surfaces and their systems, the fuselage, engine mounting, and landing gear and their related primary attachments are excluded. Simple conventional mechanical systems are also excluded. For example, it does not apply to an airplane's inherent stall characteristics or their evaluation of § 23.201, but it does apply to a stick pusher (stall barrier) system installed to attain compliance with § 23.201.

(a) The airplane equipment and systems must be designed and installed so that:
(1) Those required for type certification or by operating rules, or whose improper functioning would reduce safety, perform as intended under the airplane operating and environmental conditions, including radio frequency energy and the effects (both direct and indirect) of lightning strikes.
(2) Other equipment and systems do not adversely affect the safety of the airplane or its occupants, or the proper functioning of those covered by sub-paragraph (a)(1) of this paragraph.

(b) The airplane systems and associated components for the appropriate classes of airplane, considered separately and in relation to other systems, must be designed and installed so that:
(1) Each catastrophic failure condition
(i) is extremely improbable; and

(ii) does not result from a single failure; and

(2) Each hazardous failure condition is extremely remote; and

(3) Each major failure condition is remote.

(c) Information concerning unsafe system operating conditions must be provided to the crew to enable them to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. Systems and controls, including indications and annunciations must be designed to minimize crew errors which could create additional hazards.

(d) As used in this section, "systems" refers to all pneumatic systems, fluid systems, electrical systems, mechanical systems, and powerplant systems.

Add New Section 23.1310

23.1310 Power Source capacity and distribution -

(a) Each item of equipment, each system, and each installation whose functioning is required by this chapter and that requires a power supply is an "essential load" on the power supply. The power sources and the system must be able to supply the following power loads in probable operating combinations and for probable durations:

(1) Loads connected to the power distribution system with the system functioning normally.

(2) Essential loads after failure of--

(i) Any one engine on two-engine airplanes; or

(ii) Any two engines on an airplane with three or more engines; or

(iii) Any power converter or energy storage device.

(3) Essential loads for which an alternate source of power is required, as applicable, by the operating rules of this chapter, after any failure or malfunction in any one power supply system, distribution system, or other utilization system.

(b) In determining compliance with paragraph (c)(2) of this section, the power loads may be assumed to be reduced under a monitoring procedure consistent with safety in the kinds of operations authorized. Loads not required in controlled flight need not be considered for the two-engine-inoperative condition on airplanes with three or more engines.

Change section 23.1311 to read as follows: Note: The changes are explained in the preamble.

(a) Electronic display indicators, including those with features that make isolation and independence between powerplant instrument systems impractical, must:

(1) Meet the arrangement and visibility requirements of Sec. 23.1321.

(2) Be easily legible under all lighting conditions encountered in the cockpit, including direct sunlight, considering the expected electronic display brightness level at the end of an electronic display indictor's useful life. Specific limitations on display system useful life must be contained in the Instructions for Continued Airworthiness required by Sec. 23.1529.

(3) Not inhibit the primary display of attitude, airspeed, altitude, or powerplant parameters needed by any pilot to set power within established limitations, in any normal mode of operation.

(4) Not inhibit the primary display of engine parameters needed by any pilot to properly set or monitor powerplant limitations during the engine-starting mode of operation.

(5) Have an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument or electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system. These secondary instruments may be installed in panel positions that are displaced from the primary positions specified by Sec. 23.1321(d), but must be located where they meet the pilot's visibility requirements of Sec. 23.1321(a).

(6) Incorporate sensory cues that provide a quick glance sense of rate and when appropriate trend information for the pilot that are equivalent to those in the instrument being replaced by the electronic display indicators.

(7) Incorporate equivalent visual displays of instrument markings, required by Secs. 23.1541 through 23.1553, or visual displays that alert the pilot to abnormal operational values or approaches to established limitation values, for each parameter required to be displayed by this part.

(b) The electronic display indicators, including their systems and installations, and considering other airplane systems, must be designed so that one display of information essential for continued safe flight and landing will be available within one second to the crew with a single pilot action by any pilot or by automatic means for continued safe operation, after any single failure or probable combination of failures.

(c) As used in this section, "instrument" includes devices that are physically contained in one unit, and devices that are composed of two or more physically separate units or components connected together (such as a remote indicating gyroscopic direction indicator that includes a magnetic sensing element, a gyroscopic unit, an amplifier, and an indicator connected together). As used in this section, "primary" display refers to the display of a parameter that is located in the instrument panel such that the pilot looks at it first when wanting to view that parameter.

Add a new section 23.1317: Note: The purpose of this addition is explained in the preamble.

23.1317 High Intensity Radiated Fields (HIRF) Protection

(a) Each electrical and electronic system that performs a function whose failure would prevent the continued safe flight and landing of the airplane must be designed and installed so that –

(1) Each function is not adversely affected during and after the time the airplane is exposed to HIRF environment I, as described in appendix J to this part;

(2) Each electrical and electronic system automatically recovers normal operation, in a timely manner, after the airplane is exposed to HIRF environment I, as described in appendix J to this part, unless the system’s recovery conflicts with other operational or functional requirements of the system; and

(3) Each electrical and electronic system is not adversely affected during and after the time the airplane is exposed to HIRF environment II, as described in appendix J to this part.

(b) Each electrical and electronic system that performs a function whose failure would significantly reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions must be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 1, 2, or 3, as described in appendix J to this part.

(c) Each electrical and electronic system that performs a function whose failure would reduce the capability of the airplane or the ability of the flightcrew to cope with adverse operating conditions must be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 4, as described in appendix J to this part.

Add new appendix J to part 23 as follows:

Appendix J to part 23-HIRF Environments and Equipment HIRF Test Levels

This appendix specifies the HIRF environments and equipment HIRF test levels for electrical and electronic systems under § 23.1317. The field strength values for the HIRF environments and equipment HIRF test levels are expressed in root-mean-square units measured during the peak of the modulation cycle.

(a) HIRF environment I is specified as follows:

Table I – HIRF Environment I

	FIELD STRENGTH	
FREQUENCY	**PEAK**	***AVERAGE***
10 kHz – 100 kHz	50	50
100 kHz – 500 kHz	50	50
500 kHz – 2 MHz	50	50
2 MHz – 30 MHz	100	100
30 MHz – 70 MHz	50	50
70 MHz – 100 MHz	50	50
100 MHz – 200 MHz	100	100
200 MHz – 400 MHz	100	100
400 MHz – 700 MHz	700	50
700 MHz – 1 GHz	700	100
1 GHz – 2 GHz	2,000	200
2 GHz – 4 GHz	3,000	200
4 GHz – 6 GHz	3,000	200
6 GHz – 8 GHz	1,000	200
8 GHz – 12 GHz	3,000	300
12 GHz – 18 GHz	2,000	200
18 GHz – 40 GHz	600	200

(b) HIRF environment II is specified as follows:

Table II – HIRF Environment II

FREQUENCY	**FIELD STRENGTH**	
	PEAK	*AVERAGE*
10 kHz – 100 kHz	20	20
100 kHz – 500 kHz	20	20
500 kHz – 2 MHz	30	30
2 MHz – 30 MHz	100	100
30 MHz – 70 MHz	10	10
70 MHz – 100 MHz	10	10
100 MHz – 200 MHz	30	10
200 MHz – 400 MHz	10	10
400 MHz – 700 MHz	700	40
700 MHz – 1 GHz	700	40
1 GHz – 2 GHz	1,300	160
2 GHz – 4 GHz	3,000	120
4 GHz – 6 GHz	3,000	160
6 GHz – 8 GHz	400	170
8 GHz – 12 GHz	1,230	230
12 GHz – 18 GHz	730	190
18 GHz – 40 GHz	600	150

(c) Equipment HIRF Test Level 1.

(1) From 10 kilohertz (kHz) to 400 megahertz (MHz), use conducted susceptibility tests with continuous wave (CW) and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current must start at a minimum of 0.6 milliamperes (mA) at 10 kHz, increasing 20 decibels (dB) per frequency decade to a minimum of 30 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, the conducted susceptibility current must be at least 30 mA.

(3) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 volts per meter (V/M) peak, with CW and 1 kHz square wave modulation with 90 percent or greater.

(4) From 400 MHz to 8 gigahertz (GHz), use radiated susceptibility tests at a minimum of 150 V/m with pulse modulation of 0.1 percent duty cycle with 1 kHz pulse repetition

frequency. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent

(5) From 400 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 28 V/m peak with 1 kHz square wave modulation with 90 percent depth or greater. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.

(d) Equipment HIRF Test Level 2.

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests with CW and 1 kHz square wave modulation with 90 percent depth or greater. The conducted susceptibility current must start at a minimum of 0.6 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 30 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, the conducted susceptibility current must be at least 30 mA.

(3) From 100 MHz to 400 MHz, use radiated susceptibility tests at a minimum of 20 V/m peak with CW and 1 kHz square wave modulation with 90 percent depth or greater.

(4) From 400 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 150 V/m peak with pulse modulation of 4 percent duty cycle with a 1 kHz pulse repetition frequency. This signal must be switched on and off at a rate of 1 Hz with a duty cycle of 50 percent.

(e) Equipment HIRF Test Level 3. Test level 3 is HIRF environment II in table II of this appendix reduced by acceptable aircraft transfer function and attenuation curves. Testing must cover the frequency band of 10 kHz to 8 GHz.

(f) Equipment HIRF Test Level 4.

(1) From 10 kHz to 400 MHz, use conducted susceptibility tests, starting at a minimum of 0.15 mA at 10 kHz, increasing 20 dB per frequency decade to a minimum of 7.5 mA at 500 kHz.

(2) From 500 kHz to 400 MHz, use conducted susceptibility tests at a minimum of 7.5 mA.

(3) From 100 MHz to 8 GHz, use radiated susceptibility tests at a minimum of 5 V/m.

Note: This is deleted, It is a duplication of 23.1305. Also, this concept was incorporated in revised section 23.1311. Section 23.1331 – is changed as follows: Note: The purpose of these changes is explained in the preamble.

For each instrument that uses a power source, the following apply:

(a) Each instrument must have an integral visual power annunciator or separate power indicator to indicate when power is not adequate to sustain proper instrument performance. If a separate indicator is used, it must be located so that the pilot using the instruments can monitor the indicator with minimum head and eye movement. The power must be sensed at or near the point where it enters the instrument. For electric and vacuum/pressure instruments, the power is considered to be adequate when the voltage or the vacuum/pressure, respectively, is within approved limits.

(b) The installation and power supply systems must be designed so that--

(1) The failure of one instrument will not interfere with the proper supply of energy to the remaining instrument; and

(2) The failure of the energy supply from one source will not interfere with the proper supply of energy from any other source.

(c) For heading, altitude, airspeed, and attitude there must be at least

(1) Two independent sources of power (not driven by the same engine on multiengine airplanes), and a manual or an automatic means to select each power source; or

(2) Have an independent magnetic direction indicator and either an independent secondary mechanical altimeter, airspeed indicator, and attitude instrument that are independent from the airplane's primary electrical power system; or

(3) Electronic display parameters for the altitude, airspeed, and attitude that are independent from the airplane's primary electrical power system.

23.1443 Minimum mass flow of supplemental oxygen

(a) If the airplane is to be certified above 40,000 feet, a continuous flow oxygen system must be provided for each passenger.

(b) If continuous flow oxygen equipment is installed, an applicant must show compliance with the requirements of either paragraphs (b)(1) and (b)(2) or paragraph (b)(3) of this Section:

(1) For each passenger, the minimum mass flow of supplemental oxygen required at various cabin pressure altitudes may not be less than the flow required to maintain, during inspiration and while using the oxygen equipment (including masks) provided, the following mean tracheal oxygen partial pressures:

Note: Paragraph (a) is added so all following paragraphs will need to be re-lettered.

23.1445 Oxygen distribution system – The standards need amending to address a new class of airplane that can operate at much higher altitudes than originally anticipated for part 23 aircraft. Up until now that capability has been addressed using special conditions derived from part 25. The large number of new jet and high performance aircraft that will be operating at higher altitudes than previously envisioned for part 23 aircraft prompted this proposal.

23.1443 Minimum mass flow of supplemental oxygen

(a) Except for flexible lines from oxygen outlets to the dispensing units, or where shown to be otherwise suitable to the installation, nonmetallic tubing must not be used for any oxygen line that is normally pressurized during flight.

(b) Nonmetallic oxygen distribution lines must not be routed where they may be subjected to elevated temperatures, electrical arcing, and released flammable fluids that might result from any probable failure.

(c) If the flight crew and passengers share a common source of oxygen, a means to separately reserve the minimum supply required by the flight crew must be provided.

23.1447 Equipment standards for oxygen dispensing units - Add the following paragraphs:

If oxygen dispensing units are installed, the following apply:

(a) ……

(b) ……

(c) ……

(d) ……

(e) ……

(f) ……

(g) If the airplane is to be certified for operation above 40,000 feet, a quick-donning oxygen mask system, with a pressure demand, mask mounted regulator must be provided for the flight crew. This dispensing unit must be immediately available to the flight crew when seated at his station and installed so that it:

(1)Can be placed on the face from its ready position, properly secured, sealed, and supplying oxygen upon demand, with one hand, within five seconds and without disturbing eyeglasses or causing delay in proceeding with emergency duties, and

(2)Allows while in place, the performance of normal communication functions.

23.1505 Airspeed Limitations

(c) Paragraphs (a) and (b) of this section do not apply to turbine airplanes or the airplanes for which a design diving speed V_D/M_D is established under Sec. 23.335(b)(4). For those airplanes, a maximum operating limit speed (V_{MO}/M_{MO} airspeed or Mach number, whichever is critical at a particular altitude) must be established as a speed that may not be deliberately exceeded in any regime of flight (climb, cruise, or descent) unless a higher speed is authorized for flight test or pilot training operations. V_{MO}/M_{MO} must be established so that it is not greater than the design cruising speed V_C/M_C and so that it is sufficiently below V_D/M_D or V_{DF}/M_{DF} and the maximum speed shown under Sec. 23.251 to make it highly improbable that the latter speeds will be inadvertently exceeded in operations. The speed margin between V_{MO}/M_{MO} and V_D/M_D or V_{DF}/M_{DF} may not be less than that determined under Sec. 23.335(b), or the speed margin found necessary in the flight tests conducted under Sec. 23.253.

23.1545 Airspeed Indicator

(b) The following markings must be made:

(1) For the never-exceed speed V_{NE}, a radial red line.

(2) For the caution range, a yellow arc extending from the red line specified in paragraph (b)(1) of this section to the upper limit of the green arc specified in paragraph (b)(3) of this section.

(3) For the normal operating range, a green arc with the lower limit at V_{S1} with maximum weight and with landing gear and wing flaps retracted, and the upper limit at the maximum structural cruising speed V_{NO} established under §23.1505(b).

(4) For the flap operating range, a white arc with the lower limit at V_{S0} at the maximum weight, and the upper limit at the flaps-extended speed V_{FE} established under §23.1511.

(5) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the speed at which compliance has been shown with §23.69(b) relating to rate of climb at maximum weight and at sea level, a blue radial line.

(6) For reciprocating multiengine-powered airplanes of 6,000 pounds or less maximum weight, for the maximum value of minimum control speed, V_{MC}, (one-engine-inoperative) determined under §23.149(b), a red radial line.

(d) Paragraphs (b)(1) through (b) (4) and paragraph (c) of this section do not apply to aircraft for which a maximum operating speed V_{MO}/M_{MO} is established under Sec. 23.1505(c). For those aircraft there must either be a maximum allowable airspeed indication showing the variation of V_{MO}/M_{MO} with altitude or compressibility limitations (as appropriate), or a radial red line marking for V_{MO}/M_{MO} must be made at lowest value of V_{MO}/M_{MO} established for any altitude up to the maximum operating altitude for the airplane.

23.1555 Control markings

(d) Usable fuel capacity must be marked as follows:

1) For fuel systems having no selector controls, the usable fuel capacity of the system must be indicated at the fuel quantity indicator.
2) For fuel systems having selector controls, the usable fuel capacity available at each selector control position must be indicated near the selector control.
3) For fuel systems having a calibrated fuel quantity indication system complying with § 23.1337(b)(1) and accurately displaying the actual quantity of usable fuel in each selectable tank, no fuel capacity placards outside of the fuel quantity indicator are required.

23.1559 Operating limitations placard

(a) There must be a placard in clear view of the pilot stating--(1) That the airplane must be operated in accordance with the Airplane Flight Manual; and(2) The certification category of the airplane to which the placards apply.
(b) For airplanes certificated in more than one category, there must be a placard in clear view of the pilot stating that other limitations are contained in the Airplane Flight Manual.
(c) There must be a placard in clear view of the pilot that specifies the kind of operations to which the operation of the airplane is limited or from which it is prohibited under Sec. 23.1525."
(d) The placard required by this section need not be lighted for night operations

23.1563 Airspeed placards

"There must be an airspeed placard in clear view of the pilot and as close as practicable to the airspeed indicator. This placard must list-
(d) The operating maneuvering speed V_A; and
(e) The maximum landing gear operating speed V_{L0}. [, and]
(f) For reciprocating multiengine-powered airplanes of more than 6,000 pounds maximum weight, and turbine engine-powered airplanes, the maximum value of the minimum control speed, V_{MC} (one-engine-inoperative) determined under Sec. 23.149(b)."
(d) The airspeed placard required by this section need not be lighted for night operations if the landing gear operating speed is indicated on the airspeed indicator or other lighted area such as the landing gear control and the airspeed indicator has features such as low speed awareness that provide ample warning prior to V_{MC}.

23.1567 Flight maneuver placard

(a) For normal category airplanes, there must be a placard in front of and in clear view of the pilot stating: "No acrobatic maneuvers, including spins, approved."
(b) For utility category airplanes, there must be- (1) A placard in clear view of the pilot stating: "Acrobatic maneuvers are limited to the following ________" (list approved maneuvers and the recommended entry airspeed for each); and (2) For those airplanes that do not meet the spin requirements for acrobatic category airplanes, an additional placard in clear view of the pilot stating: "Spins Prohibited."

(c) For acrobatic category airplanes, there must be a placard in clear view of the pilot listing the approved acrobatic maneuvers and the recommended entry airspeed for each. If inverted flight maneuvers are not approved, the placard must bear a notation to this effect.
(d) For acrobatic category airplanes and utility category airplanes approved for spinning, there must be a placard in clear view of the pilot-- (1) Listing the control action for recovery from spinning maneuvers; and (2) Stating that recovery must be initiated when spiral characteristics appear, or after not more than six turns or not more than any greater number of turns for which the airplane has been certificated."
(e) The placard required by this section need not be lighted for night operations

23.1583 Operating limitations

(a) *Airspeed limitations.* The following information must be furnished:
(1) ……
(2) the speeds V_{MC}, V_O, V_{FE}, V_{LE}, and V_{LO}, if established, and their significance.

NUMBER: AWG-23A **VERSION DATE: 07/11/2005**

ISSUE: Equipage Requirements for Aircraft with Payload in excess of 7,500 lbs

SUMMARY:

The AWG reviewed Part 135 equipment requirements and proposes recommended amendments appropriate for the introduction of new Part 135 operation of all-cargo airplanes with a payload capacity of 7,500 to 18,000 lbs. The AWG determined that turbine-powered aircraft with payload in excess of 7,500 lbs should be equipped the same as aircraft with 10-or-more passengers. This is because Part 135 10-or-more airplane equipage requirements are, for the most part, the same as Part 121. The increased payload (above 7,500 lbs) airplanes were originally operated under Part 121 and were therefore equipped accordingly. Part 135.180 TCAS equipage is an exception to this general rule because it will only be required for airplanes with MTOW of more than 33,000lbs, which is consistent with new Part 121/125 requirements effective on January 1, 2005. Changes are proposed to the following requirements:

- 135.151 Cockpit Voice Recorder
- 135.152 Flight Data Recorder
- 135.154 Terrain Awareness and Warning System
- 135.170: Materials for Compartment Interiors
- 135.175: Airborne Weather Radar Equipment
- 135.180: Traffic Alert and Collision Avoidance Systems

DISCUSSION:

During the July 2004 meeting the AWG reviewed each Part 135 regulation with equipage implications and determine how or if it should be modified to accommodate the addition of all-cargo airplane operations with over 7500 lb. payload.

SECTION-BY-SECTION REVIEW

135.87 Carriage of cargo including carry-on baggage.

AWG DISCUSSION: Included review of both the 135 and 121 rules.

Recommendation: No action needed, this subparagraph (e) is the same as 121.287 and 125.185

135.141 Applicability

AWG DISCUSSION: Philosophy for additional equipage requirements for all-cargo increased payload between 7,500 - 18,000 lbs is to equate these airplanes to turboprop with 10-19 pax seats. Add regulatory paragraph with additional requirements which specifies these additional requirements.

134.143(c) General requirements

AWG DISCUSSION: After review it was determined this regulation is satisfactory as written. It does not differentiate between type of use or size of aircraft.

135.151 Cockpit voice recorders

AWG DISCUSSION: The addition of a statement including the turbine powered over 7500 lb aircraft would be appropriate. See recommendation section.

135.152(b)(i)(j)(k) Flight recorders

AWG DISCUSSION: (b)(i)(j) will be revised to include turbine powered over 7500 lbs. See recommendation section. Paragraph (k) will be expanded to include other like aircraft already exempted.

135.154(a)(b) Terrain awareness and warning system

AWG DISCUSSION: The addition of a statement including the turbine powered over 7500 lb aircraft would be appropriate. See recommendation section. This would apply to paragraphs (a)(b).

135.158 Pitot heat indicating systems

AWG DISCUSSION: No change needed. Airplanes in the 7500 lb and up, range are Transport Category aircraft. This equipage was required at the time of certification.

135.169 Additional airworthiness requirements

AWG DISCUSSION: No change needed. Airplanes in the 7500 lb and up, range are Transport Category aircraft. This equipage was required at the time of certification.

135.170 Materials for compartment interiors

AWG DISCUSSION: Current aircraft in Part 125 are required to comply with 125.119 which are identical to 121.221. The regulation does not differentiate between passenger carrying and all-cargo operations. Consequently current 125 and 121 airplanes that may transfer over to 135 will already be compliant.

AWG RECOMMENDATION: Add new paragraph in 135.170 for additional requirement for increased payload 7,500 - 18,000 airplanes must comply with 121.221 Fire Precautions (note this is the same as 125.119)

135.173 Airborne thunderstorm detection equipment requirements

AWG DISCUSSION: No change needed as the requirement for weather radar will be addressed in 135.157.

135.175 Airborne weather radar equipment requirements

AWG: Add requirement for turbine powered increased payload 7,500+ for radar weather, consistent with 121.357 and 125.223.

135.180 Traffic alert and collision avoidance system

AWG DISCUSSION: As of January 1, 2005, 121.356 and 125.224 require TCAS equipage for all all-cargo airplanes with more than 33,000lbs maximum certificated takeoff weight. There are no current Part 135 TCAS equipage requirements for all-cargo airplanes.

The final rule for Part 121/125 TCAS equipage requirements, Federal Register: April 1, 2003 (Volume 68, Number 62), Page 15883-15904, addresses the reasoning for TCAS I versus TCAS II installations. An excerpt follows:

Statement of the Problem

Current FAA rules do not require collision avoidance systems on all-cargo airplanes. When the FAA issued the traffic alert and collision avoidance system (TCAS) rules for passenger airplanes in 1987, the overnight cargo industry expansion was in its infancy, it operated few airplanes and those were primarily at night. Congress, in its legislation directing installation of TCAS in passenger airplanes, determined that those cargo airplanes did not represent a significant risk to passenger-carrying airplanes, which operated primarily during the day.

In promulgating the rules the FAA recognized that those few cargo airplanes would benefit some from the TCAS requirement for passenger airplanes because transponder-equipped cargo airplanes are displayed to pilots of TCAS-equipped passenger airplanes. Cargo airplanes also benefit because of the large number of passenger airplanes that are equipped with TCAS. In addition, the FAA determined that the cost/benefit analysis and risk level at that time did not support requiring cargo operators to equip their airplanes with TCAS.

Since those early days of TCAS, cargo operations have grown significantly and we now believe the increase in traffic presents an increased risk of a mid-air collision involving a cargo airplane. We are issuing this amendment to use airplane weight and performance characteristics to encompass cargo as well as passenger airplanes and to standardize and clarify the collision avoidance rules in parts 121, 125, and 129. The FAA believes this would reduce the risk of midair collisions, increasing public safety in the air and on the ground.

History

On April 5, 2000, the Wendell H. Ford Aviation Investment and Reform Act (AIR-21) was enacted (Pub. L. 106-181) and later codified at 49 U.S.C. 44716(g). That section directs the FAA to require all cargo airplanes of more than 15,000 kilograms (kg.) MCTOW to be equipped with collision avoidance equipment by December 31, 2002. It also provides for an extension of up to 2 years for safety or public interest reasons.

Section 44716(g) defines collision avoidance equipment as "equipment that provides protection from mid-air collisions using technology that provides cockpit-based detection and conflict resolution guidance, including display of traffic; and a margin of safety of at least the same level as provided by the collision avoidance system known as TCAS II."

Before Congress passed AIR-21, the FAA had been working on a proposal to require collision avoidance systems on cargo airplanes. The justification for that effort was:

- *The large increases in all-cargo traffic volume (night and day operations),*
- *Two near mid-air collisions (NMACs) involving cargo airplanes,*
- *A petition for rulemaking to put TCAS on cargo airplanes from the Independent Pilots' Association (representing United Parcel Service pilots),*
- *The International Civil Aviation Organization (ICAO)'s recommendation to equip all airplanes with an airborne collision avoidance system (ACAS), which is equivalent to TCAS II, version 7.0, and*
- *The National Transportation Safety Board (NTSB)'s recommendation urging the FAA to require TCAS II and a Mode S transponder on certain airplanes.*

As a result of the TCAS equipage requirement for all-cargo airplanes in the AIR-21 legislation, FAA promulgated amendments 121-286 and 125-41, effective January 1, 2005, as follows:

121.356 Collision avoidance system.

Effective January 1, 2005, any airplane you operate under this part must be equipped and operated according to the following table:

Collision Avoidance Systems	
If you operate any . . .	Then you must operate that airplane with:
(a) Turbine-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) An appropriate class of Mode S transponder that meets Technical Standard Order (TSO) C-112, or a later version, and one of the following approved units: (i) TCAS II that meets TSO C-119b (version 7.0), or a later version. (ii) TCAS II that meets TSO C-119a (version 6.04A Enhanced) that was installed in that airplane before May 1, 2003. If that TCAS II version 6.04A Enhanced no longer can be repaired to TSO C-119a standards, it must be replaced with a TCAS II that meets TSO C-119b (version 7.0), or a later version. (iii) A collision avoidance system equivalent to TSO C-119b (version 7.0), or a later version, capable of coordinating with units that meet TSO C-119a (version 6.04A Enhanced), or a later version.
(b) Passenger or combination cargo/passenger (combi) airplane that has a passenger seat configuration of 10-30 seats.	(1) TCAS I that meets TSO C-118, or a later version, or (2) A collision avoidance system equivalent to TSO C-118, or a later version, or (3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.
(c) Piston-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) TCAS I that meets TSO C-118, or a later version, or (2) A collision avoidance system equivalent to TSO C-118, or a later version, or (1)(3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.

125.224 Collision Avoidance system.

Effective January 1, 2005, any airplane you operate under this part 125 must be equipped and operated according to the following table:

Collision Avoidance Systems	
If you operate any . . .	Then you must operate that airplane with:
(a) Turbine-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) An appropriate class of Mode S transponder that meets Technical Standard Order (TSO) C-112, or a later version, and one of the following approved units: (i) TCAS II that meets TSO C-119b (version 7.0), or a later version. (ii) TCAS II that meets TSO C-119a (version 6.04A Enhanced) that was installed in that airplane before May 1, 2003. If that TCAS II version 6.04A Enhanced no longer can be repaired to TSO C-119a standards, it must be replaced with a TCAS II that meets TSO C-119b (version 7.0), or a later version. (iii) A collision avoidance system equivalent to TSO C-119b (version 7.0), or a later version, capable of coordinating with units that meet TSO C-119a (version 6.04A Enhanced), or a later version.
(b) Piston-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) TCAS I that meets TSO C-118, or a later version, or (2) A collision avoidance system equivalent to TSO C-118, or a later version, or (1)(3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.

Summary of Current TCAS Requirements

IF YOU OPERATE ANY…	YOU MUST OPERATE THAT AIRPLANE WITH:		
	Part 121	Part 125	Part 135
Airplane configured with 10-30 passenger seats	TCAS I	TCAS I	TCAS I
Turbine-powered airplane of more than 33,000lbs MTOW (passenger and/or cargo operations)	TCAS II	TCAS II	N/A
Piston-powered airplane of more than 33,000lbs MTOW (passenger and/or cargo operations)	TCAS I	TCAS I	N/A

AWG Recommendation (based on 11-17-2004 update): For the reasons specified above it has been determined that Part 135 should also have a TCAS equipage requirement based on the same 33,000 lb. MTOW threshold applied to Parts 121/125. This recommendation will be consistent with the current 121 and 125 requirements. Proposed language to incorporate this requirement into Part 135 is contained within the recommendation section of this document.

NOTE: this recommendation would impact more than just those turbine-powered, all-cargo airplanes with payload of more than 7,500lbs. coming into part 135. EXISTING passenger/cargo operations in turbine-powered airplanes of more than 33,000lbs MTOW would be required to have TCAS II, as opposed to the current TCAS I requirement. EXISTING piston-powered airplanes of more than 33,000lbs. MTOW would be required to have TCAS I, as opposed to the existing regulation which does not require any TCAS equipage. Since this proposed TCAS equipage requirement is consistent with existing Part 121/125 requirements, those airplanes having to move operations under Part 135 as a result of the ARC recommendations will not be impacted any differently than today. However, existing airplanes currently operated under Part 135 may be impacted if they meet the requirements of this section.

OPTIONS

1. Revise each regulation affected by the AWG equipage findings/recommendations above.
2. Propose an addition to 135.411 to encompass all the equipage requirements for airplanes with payload of more than 7,500lbs. under a single amended paragraph (i.e. additional requirements for turbine-powered, all-cargo aircraft with payload of more than 7,500obs.

Based on *advice to the workgroup during discussion*, the AWG decided to amend each regulation to include the applicability to "**turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.**"

COST BENEFIT ANALYSIS

There will be a cost factor involved but not greater than the operators face now. This specifically refers to the TCAS, GPWS and RVSM. These are coming into effect regardless. Other portions of the current part 25 certifications standards are meet by operators today. The changes we propose only insure continued compliance.

The benefit resides in the public safety expected when operating airplanes of this size and complexity.

RECOMMENDATION:
Amend the Part 235 equipment requirements as follows:

§ 135.151 Cockpit voice recorders.
(a) No person may operate a multiengine, turbine powered airplane or **turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.** or rotorcraft having a passenger seating configuration of six or more and for which two pilots are required by certification or operating rules unless it is equipped with an approved cockpit voice recorder that:
…

§ 135.152 Flight recorders.
…
(b) After October 11, 1991, no person may operate a multiengine, turbine-powered airplane having a passenger seating configuration of 20 to 30 seats **or a turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.** or a multiengine, turbine-powered rotorcraft having a passenger seating configuration of 20 or more seats unless it is equipped with one or more approved flight recorders that utilize a digital method of recording and storing data, and a method of readily retrieving that data from the storage medium. The parameters in appendix D or E of this part, as applicable, that are set forth below, must be recorded within the ranges, accuracies, resolutions, and sampling intervals as specified.
…
(i) For all turbine-engine powered airplanes with a seating configuration, excluding any required crewmember seat, of 10 to 30 passenger seats **or a turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.**, manufactured after August 18, 2000—

(1) The parameters listed in paragraphs (h)(1) through (h)(57) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix F of this part.

(2) Commensurate with the capacity of the recording system, all additional parameters for which information sources are installed and which are connected to the recording system must be recorded within the ranges, accuracies, resolutions, and sampling intervals specified in Appendix F of this part.

(j) For all turbine-engine-powered airplanes with a seating configuration, excluding any required crewmember seat, of 10 to 30 passenger seats **or a turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.**, that are manufactured after August 19, 2002 the parameters listed in paragraph (a)(1) through (a)(88) of this section must be recorded within the ranges, accuracies, resolutions, and recording intervals specified in Appendix F of this part.

(k) For aircraft manufactured before August 18, 1997, the following aircraft types need not comply with this section: Bell 212, Bell 214ST, Bell 412, Bell 412SP, Boeing Chinook (BV–234), Boeing/Kawasaki Vertol 107 (BV/KV–107–II), deHavilland DHC–6, Eurocopter Puma 330J, Sikorsky 58, Sikorsky 61N, Sikorsky 76A.

NOTE: *Due consideration should be given to the make/model airplanes expected to operate under Part 135 all-cargo with payload of more than 7,500 lbs to determine if there are any specific airplanes for which it would be impracticable (technical feasibility or economically reasonable) to modify for compliance with the above DFDR requirement. If so, 135.152(k) should also be amended to reflect these make/model aircraft manufactured before August 18, 1997 that need not comply with this section.*

135.154 Terrain awareness and warning system.

(a) Airplanes manufactured after March 29, 2002:

(1) No person may operate a turbine-powered airplane configured with 10 or more passenger seats, excluding any pilot seat, **or a turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.** unless that airplane is equipped with an approved terrain awareness and warning system that meets the requirements for Class A equipment in Technical Standard Order (TSO)-C151. The airplane must also include an approved terrain situational awareness display.

(2) No person may operate a turbine-powered airplane configured with 6 to 9 passenger seats, excluding any pilot seat, unless that airplane is equipped with an approved terrain awareness and warning system that meets as a minimum the requirements for Class B equipment in Technical Standard Order (TSO)-C151.

(b) Airplanes manufactured on or before March 29, 2002:

(1) No person may operate a turbine-powered airplane configured with 10 or more passenger seats, excluding any pilot seat **or a turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.** after March 29, 2005, unless that airplane is equipped with an approved terrain awareness and warning system that meets the requirements for Class A equipment in Technical Standard Order (TSO)-C151. The airplane must also include an approved terrain situational awareness display.

(2) No person may operate a turbine-powered airplane configured with 6 to 9 passenger seats, excluding any pilot seat, after March 29, 2005, unless that airplane is equipped with an approved terrain awareness and warning system that meets as a minimum the requirements for Class B equipment in Technical Standard Order (TSO)-C151.

(Approved by the Office of Management and Budget under control number 2120-0631)

…

§ 135.170 Materials for compartment interiors.

(a) No person may operate an airplane that conforms to an amended or supplemental type certificate issued in accordance with SFAR No. 41 for a maximum certificated takeoff weight in excess of 12,500 pounds unless within one year after issuance of the initial airworthiness certificate under that SFAR, the airplane meets the compartment interior requirements set forth in §25.853(a) in effect March 6, 1995 (formerly §25.853 (a), (b), (b–1), (b–2), and (b–3) of this chapter in effect on September 26, 1978).

(b) Except for commuter category airplanes and airplanes certificated under Special Federal Aviation Regulation No. 41, no person may operate a large airplane unless it meets the following additional airworthiness requirements:

(1) Except for those materials covered by paragraph (b)(2) of this section, all materials in each compartment used by the crewmembers or passengers must meet the requirements of §25.853 of this chapter in effect as follows or later amendment thereto:

…

(2) For airplanes type certificated after January 1, 1958, seat cushions, except those on flight crewmember seats, in any compartment occupied by crew or passengers must

comply with the requirements pertaining to fire protection of seat cushions in §25.853(c) effective November 26, 1984.

(3) For turbine-powered, all-cargo airplane with a payload of more than 7500 lbs., each compartment must be designed so that, when used for storing cargo or baggage, it meets the requirements of §121.221 of this chapter.

…

§ 135.175 Airborne weather radar equipment requirements.

(a) No person may operate a large, transport category aircraft in passenger carrying operations **or a turbine-powered, all-cargo airplane with a payload of more than 7500 lbs.** unless approved airborne weather radar equipment is installed in the aircraft.

…

§ 135.180 Traffic Alert and Collision Avoidance System.

(a) Unless otherwise authorized by the Administrator, after December 31, 1995, no person may operate a turbine powered airplane that has a passenger seat configuration, excluding any pilot seat, of 10 to 30 seats unless it is equipped with an approved traffic alert and collision avoidance system. If a TCAS II system is installed, it must be capable of coordinating with TCAS units that meet TSO C-119.

(b) The airplane flight manual required by § 135.21 of this part shall contain the following information on the TCAS I system required by this section:

(1) Appropriate procedures for -

(i) The use of the equipment; and

(ii) Proper flightcrew action with respect to the equipment operation.

(2) An outline of all input sources that must be operating for the TCAS to function properly.

(c) Effective January 1, 2005, any airplane you operate under this part 135 must be equipped and operated according to the following table:

Collision Avoidance Systems	
If you operate any . . .	**Then you must operate that airplane with:**
(a) Turbine-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) An appropriate class of Mode S transponder that meets Technical Standard Order (TSO) C-112, or a later version, and one of the following approved units: (i) TCAS II that meets TSO C-119b (version 7.0), or a later version. (ii) TCAS II that meets TSO C-119a (version 6.04A Enhanced) that was installed in that airplane before May 1, 2003. If that TCAS II version 6.04A Enhanced no longer can be repaired to TSO C-119a standards, it must be replaced with a TCAS II that meets TSO C-119b (version 7.0), or a later version. (iii) A collision avoidance system equivalent to TSO C-119b (version 7.0), or a later version, capable of coordinating with units that meet TSO C-119a (version 6.04A Enhanced), or a later version.

(b) Piston-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) TCAS I that meets TSO C-118, or a later version, or (2) A collision avoidance system equivalent to TSO C-118, or a later version, or (1)(3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.

STEERING COMMITTEE REVIEW:

Summary of discussion with steering committee and recommended actions

FINAL ACTION:

Final recommended action by Steering Committee

NOTES:

Additional notes.

NUMBER: AWG-23B **VERSION DATE: 02/24/2005**

ISSUE: Equipage Requirements for Turbojet-Powered Airplanes in Commuter Operation

SUMMARY:

The AWG reviewed Part 135 equipment requirements and proposes recommended amendments appropriate for the introduction of new Part 135 operation of turbojet-powered airplanes in commuter operation. The AWG determined that turbine-powered airplanes in commuter operation should be equipped the same as aircraft with 10-or-more passengers. Changes are proposed to the following requirements:

- 135.154 Terrain Awareness and Warning System
- 135.175: Airborne Weather Radar Equipment
- 135.180: Traffic Alert and Collision Avoidance Systems

DISCUSSION:

1. Review of FAA Regulations

1.1 Review of Part 121
Sec. 121.2 Compliance schedule for operators that transition to part 121; certain new entrant operators.
(a) *Applicability*. This section applies to the following:
(1) Each certificate holder that was issued an air carrier or operating certificate and operations specifications under the requirements of part 135 of this chapter or under SFAR No. 38-2 of 14 CFR part 121 before January 19, 1996, and that conducts scheduled passenger-carrying operations with:
(i) Nontransport category turbopropeller powered airplanes type certificated after December 31, 1964, that have a passenger seat configuration of 10-19 seats;
(ii) Transport category turbopropeller powered airplanes that have a passenger seat configuration of 20-30 seats; or
(iii) Turbojet engine powered airplanes having a passenger seat configuration of 1-30 seats.
2) Each person who, after January 19, 1996, applies for or obtains an initial air carrier or operating certificate and operations specifications to conduct scheduled passenger-carrying operations in the kinds of airplanes described in paragraphs (a)(1)(iii) of this section.
b) Obtaining operations specifications. A certificate holder described in paragraph (a)(1) of this section may not, after March 20, 1997, operate an airplane described in paragraphs (a)(1)(i), (a)(1)(ii), or (a)(1)(iii) of this section in scheduled passenger-carrying operations, unless it obtains operations specifications to conduct its scheduled operations under part 121 of this chapter on or before March 20, 1997.
(f) "*New type certification requirements.* No person may operate an airplane for which the application for a type certificate was filed after March 29, 1995, in 14 CFR part 121 operations unless that airplane is type certificated under part 25 of this chapter."

Summary of Part 121

1. Equipage of Part 25 Turbojets operating in scheduled service is adequately covered by existing Part 121 rules.
2. Part 23 Turbojets in scheduled (commuter) operation, type certificated after March 29, 1995 must operate to Part 135 rules.

1.2. Review of Part 135 and Part 23

Sec. 135.2

(a) *Applicability*. This section applies to the following:

(1) Each certificate holder that was issued an air carrier or operating certificate and operations specifications under the requirements of part 135 of this chapter or under SFAR No. 38-2 of 14 CFR part 121 before January 19, 1996, and that conducts scheduled passenger-carrying operations with:

(i) Nontransport category turbopropeller powered airplanes type certificated after December 31, 1964, that have a passenger seat configuration of 10-19 seats;

(ii) Transport category turbopropeller powered airplanes that have a passenger seat configuration of 20-30 seats; or

(iii); "Turbojet powered airplanes having a passenger seating configuration of 1-30 seats."

(2) Each person who, after January 19, 1996, applies for or obtains an initial air carrier or operating certificate and operations specifications to conduct scheduled passenger-carrying operations in the kinds of airplanes described in paragraphs (a)(1)(i), (a)(1)(ii), or paragraph (a)(1)(iii) of this section.

b) Obtaining operations specifications. A certificate holder described in paragraph (a)(1) of this section may not, after March 20, 1997, operate an airplane described in paragraphs (a)(1)(i), (a)(1)(ii), or (a)(1)(iii) of this section in scheduled passenger-carrying operations, unless it obtains operations specifications to conduct its scheduled operations under part 121 of this chapter on or before March 20, 1997.

f) New type certification requirements. No person may operate an airplane for which the application for a type certificate was filed after March 29, 1995, in 14 CFR part 121 operations unless that airplane is type certificated under part 25 of this chapter.

Sec. 23.3 Airplane categories.

(a) The normal category is limited to airplanes that have a seating configuration, excluding pilot seats, of nine or less, a maximum certificated takeoff of 12,500 pounds or less, and intended for nonacrobatic operation.

Summary of Part 135 and Part 23

1. Part 23 Turbojets in scheduled (commuter) operation, type certificated after March 29, 1995 must operate to Part 135 rules.
2. Part 23 or Part 25 Turbojets cannot operate in commuter operation unless equipped with less than 9 seats.
3. Part 23 Commuter Category airplanes equipped with 10 or more passenger seats must operate to Part 121.

Proposed Regulations Changes **(Changes in bold print)**

Sec. 135.154 Terrain awareness and warning system.

(a) Airplanes manufactured after March 29, 2002:
(1) No person may operate a turbine-powered airplane configured with 10 or more passenger seats, excluding any pilot seat, unless that airplane is equipped with an approved terrain awareness and warning system that meets the requirements for Class A equipment in Technical Standard Order (TSO)-C151. The airplane must also include an approved terrain situational awareness display.
(2) No person may operate a turbine-powered airplane configured with 6 to 9 passenger seats, excluding any pilot seat, unless that airplane is equipped with an approved terrain awareness and warning system that meets as a minimum the requirements for Class B equipment in Technical Standard Order (TSO)-C151.
(3) No person may operate a turbojet powered airplane in commuter operation configured with 9 or less passenger seats, excluding any pilot seat after March 29, 2005, unless that airplane is equipped with an approved terrain awareness and warning system that meets the requirements for Class A equipment in Technical Standard Order (TSO)-C151.

(b) Airplanes manufactured on or before March 29, 2002:
(1) No person may operate a turbine-powered airplane configured with 10 or more passenger seats, excluding any pilot seat, after March 29, 2005, unless that airplane is equipped with an approved terrain awareness and warning system that meets the requirements for Class A equipment in Technical Standard Order (TSO)-C151. The airplane must also include an approved terrain situational awareness display.
(2) No person may operate a turbine-powered airplane configured with 6 to 9 passenger seats, excluding any pilot seat, after March 29, 2005, unless that airplane is equipped with an approved terrain awareness and warning system that meets as a minimum the requirements for Class B equipment in Technical Standard Order (TSO)-C151.
(3) No person may operate a turbojet powered airplane in commuter operation configured with 9 or less passenger seats, excluding any pilot seat after March 29, 2005, unless that airplane is equipped with an approved terrain awareness and warning system that meets the requirements for Class A equipment in Technical Standard Order (TSO)-C151.

(c) Airplane Flight Manual. The Airplane Flight Manual shall contain appropriate procedures for-
(1) The use of the terrain awareness and warning system; and
(2) Proper flight crew reaction in response to the terrain awareness and warning system audio and visual warnings.

Justification - AWG is of the opinion that this class of airplane should be equipped with a Class A TAWS system installed when in commuter operation. AWG is aware that newer aircraft, manufactured after March 29, 2002, will typically be equipped this system as standard equipment.

135.175 Airborne weather radar equipment requirements.

(a) No person may operate a:
(Add)(1) large transport category aircraft in passenger-carrying operations unless approved airborne weather radar equipment is installed in the aircraft.
(add) (2) Part 23 turbojet powered airplane in commuter operation after (effective date of rule change) unless approved airborne weather radar equipment is installed in the aircraft.

(b) No person may begin a flight under IFR or night VFR conditions when current weather reports indicate that thunderstorms, or other potentially hazardous weather conditions that can be detected with airborne weather radar equipment, may reasonably be expected along the route to be flown, unless the airborne weather radar equipment required by paragraph (a) of this section is in satisfactory operating condition.
(c) If the airborne weather radar equipment becomes inoperative en route, the aircraft must be operated under the instructions and procedures specified for that event in the manual required by Sec. 135.21.
(d) This section does not apply to aircraft used solely within the State of Hawaii, within the State of Alaska, within that part of Canada west of longitude 130 degrees W, between latitude 70 degrees N, and latitude 53 degrees N, or during any training, test, or ferry flight.
(e) Without regard to any other provision of this part, an alternate electrical power supply is not required for airborne weather radar equipment.

Justification -AWG is of the opinion that this class of airplane operating in commuter operation should have an approved radar system installed. This class of airplane will typically provide the system as standard or as optional equipment.

135.180 Traffic Alert and Collision Avoidance System.

(a) Unless otherwise authorized by the Administrator, after December 31, 1995, no person may operate a turbine powered airplane that has a passenger seat configuration, excluding any pilot seat, of 10 to 30 seats unless it is equipped with an approved traffic alert and collision avoidance system. If a TCAS II system is installed, it must be capable of coordinating with TCAS units that meet TSO C-119.

(Add) New (b) Unless otherwise authorized by the Administrator, after (effective date of rule change), no person may operate a Part 23 turbojet powered airplane in commuter operation, unless it is equipped with an approved traffic alert and collision avoidance system. If a TCAS II system is installed, it must be capable of coordinating with TCAS units that meet TSO C-119.

(now) (c) The airplane flight manual required by Sec. 135.21 of this part shall contain the following information on the TCAS I system required by this section:
(1) Appropriate procedures for--
(i) The use of the equipment; and
(ii) Proper flightcrew action with respect to the equipment operation.

(2) An outline of all input sources that must be operating for the TCAS to function properly.

Justification -AWG is of the opinion that this class of airplane operating in commuter operation should have a TCAS II system installed. AWG is aware that newer aircraft will typically be equipped with this system as standard equipment or as optional equipment.

Through extensive discussion the AWG working group has identified the following issues and recommendations.

What is wrong with the old rule?
The change to Part 121.2 moved the Part 23 turbojet aircraft out of Part 121 to Part 135 with no specific equipment requirements for Part 23 turbojets.

How do you propose to change the rule?
By adding any additional rule changes described above.

Why do you think the change is justified?
The change is justified by the fact that there were no rules in place and the changes mirror what is currently in Part 121 for Part 23 turbojet powered airplanes in commuter operations.

Who will be affected and how?
Owners/operators of Part 23 jets operating in commuter operation.

What will be the "spillover" affect.
No significant impact expected as Part 23 turbojets are not generally operating in commuter operation at this time. As more of this class of airplane enters the market, more of this type of operation is anticipated.

Economics.
No significant impact is expected.

STEERING COMMITTEE REVIEW:

Summary of discussion with steering committee and recommended actions

FINAL ACTION:

Final recommended action by Steering Committee

NOTES:

Additional notes.