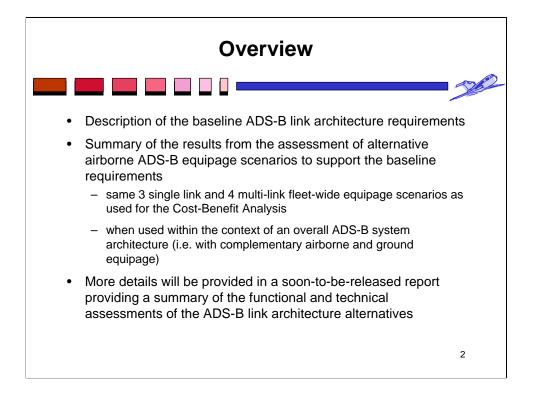
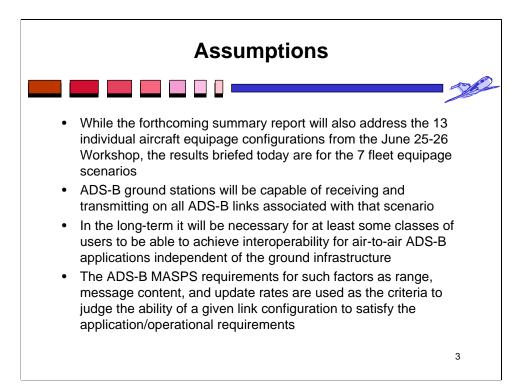


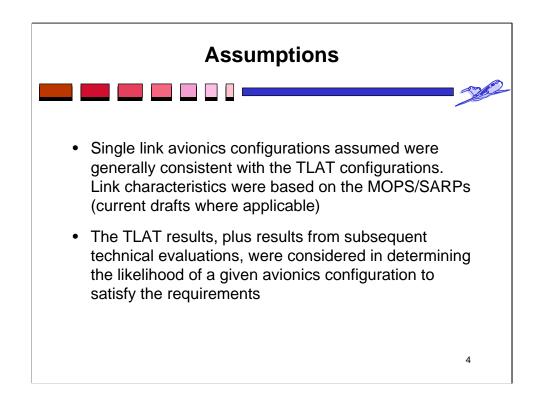
Overview of Assessment Results

October 19, 2001

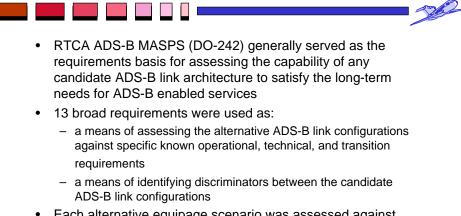
Ron Jones FAA, ASD-140 ronnie.jones@faa.gov





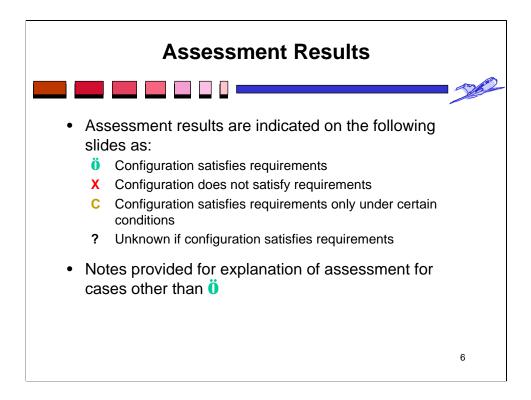


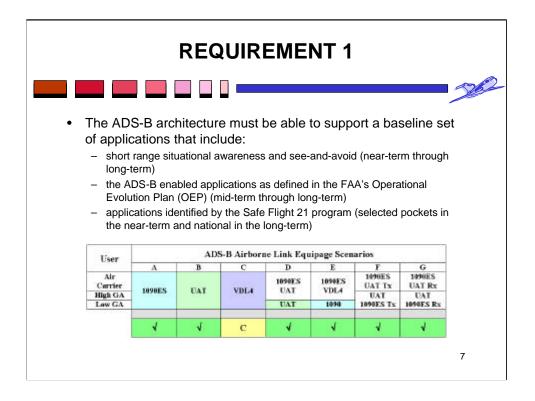




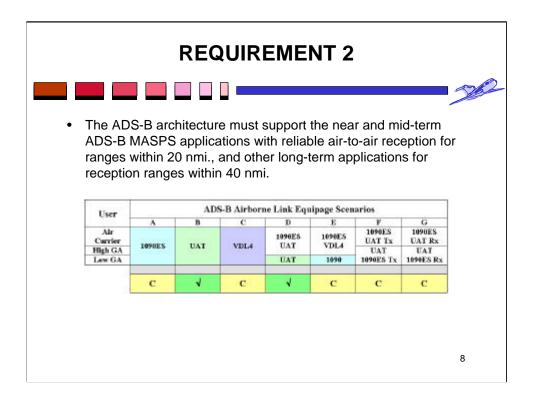
 Each alternative equipage scenario was assessed against each requirement

5





VDL Mode 4 MOPS/SARPs does not provide a state vector update rate high enough to support the tactical applications of terminal approach and departure spacing in low visibility, defined by SF21 when used at air-to-air ranges of less then 3 nmi. Thus VDL-M4 could partially support such baseline application requirements. This configuration would only be acceptable on the condition these limitations can be accommodated.



The 20 nmi. air-to-air reception requirement for near and mid-term applications are expected to be satisfied with the 1090ES system. In the longer term the 40 nmi. air-to-air reception requirement is expected to be satisfied in all but potentially the highest traffic density environments (e.g., LA or NE corridor). Enhancements to the first generation simulation model (the results of which were reviewed by the TLAT) are needed to better estimate the performance of 1090 MHz ES in the highest traffic density future U.S. environments.

Notes for Scenario C

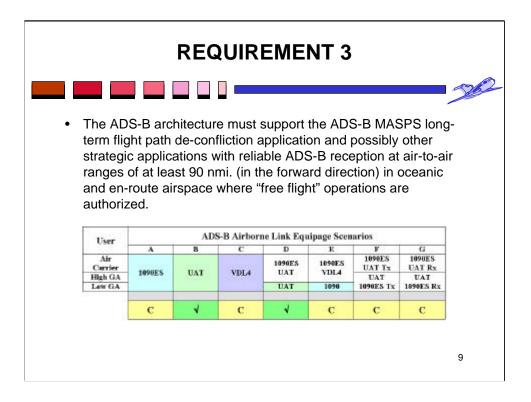
The VDL-M4 system could generally support the 20 nmi. air-to-air range requirement for the near/mid-term application and 40 nmi. for long-term applications. With the TLAT configuration the rate at which certain information (e.g., intent) is transmitted is not consistent with the ADS-B MASPS requirements.

Notes for Scenario E

The concerns for Scenarios A and C also apply to this case.

Notes for Scenarios F and G

The concerns express for Scenario A apply for this scenario for the case of the 1090ES path



The flight path de-confliction application, as defined by the ADS-B MASPS (DO-242) applies in low density en route and oceanic airspace. The findings of the TLAT also considered this application in the context of a LA2020 high density environment. Both limited flight measurements and analysis for a low traffic density environment indicate that 1090 MHz ES may be able to satisfy the 90 mile range ADS-B MASPs requirement. The current simulations indicate that it is unlikely that 1090 MHz ES would be able to support this application in the highest interference environments, such as LA, at the full 90 nmi. range.

Notes for Scenario C

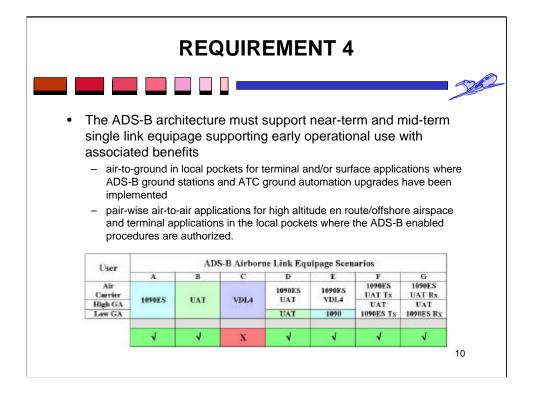
Limiting consideration to just the use in low density airspace, the nominal characteristics/performance for the VDL-M4 system as defined in the MOPS/SARPs (and the TLAT configuration) would support the 90 nmi. air-to-air range requirement, but the TLAT configuration would not support the update rate requirements. This is a result of the defined transmission rate of the intent information not being sufficient to satisfy the ADS-B MASPS requirements for the de-confliction application.

Notes for Scenario E

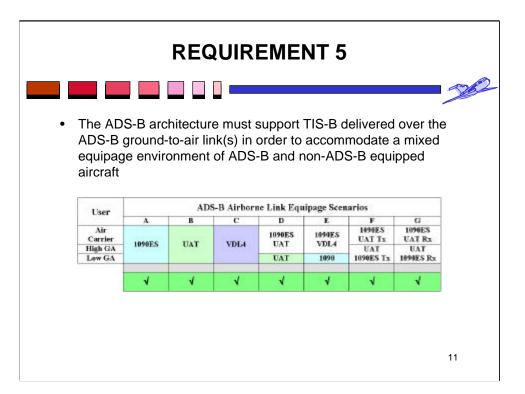
The concerns for Scenarios A and C also apply to this case.

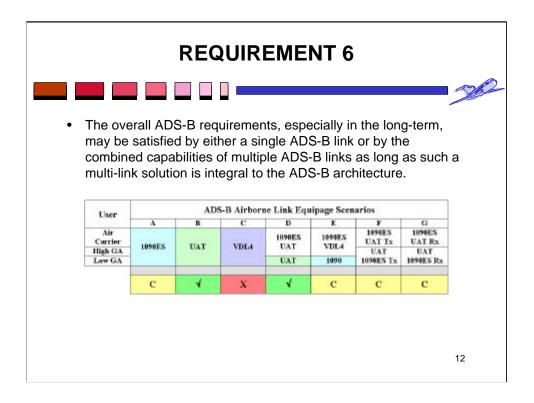
Notes for Scenarios F and G

The concerns express for Scenario A apply for this scenario for the case of the 1090ES path



Near-term, and perhaps mid-term, use of VDL-M4 in the U.S. appears unlikely due to the lack of available VHF channels that could be assigned for exclusive use by VDL-M4.





Same concerns as previously described above for requirements 2 & 3 apply. These relate to the ability of 1090ES to satisfy the long term requirements for ADS-B at the maximum required air-to-air ranges especially if a applied in high density airspace (beyond that required by the current ADS-B MASPS).

Notes for Scenario C

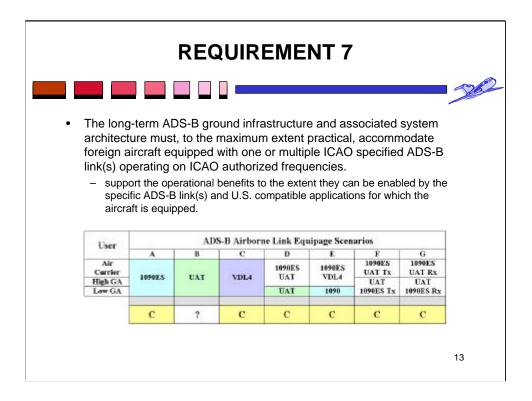
As configured by the VDL M4 TLAT Subject Matter Experts, the system does not fully support the requirements for long-term ADS-B applications requiring intent information, particularly in terms of the required update rates.

Notes for Scenario E

In general the same issues as for Requirements 1 and 2, scenarios A and C apply. Note there is a potential that an optimally configured 1090ES plus VDL-M4 combination (not constrained by the TLAT configurations) could perhaps satisfy the long-term requirements for those users so equipped. However, defining and assessing such a configuration was beyond the scope of the efforts to date.

Notes for Scenarios F and G

In general the same issues as for Scenario A above. These relate to configurations where only a 1090ES air-to-air path is provided. In this case the ability of 1090ES to satisfy the long term requirements for ADS-B at the maximum required air-to-air ranges especially if applied in high density airspace (beyond that required by the current ADS-B MASPS).



Since 1090 MHz ES is one of the two ICAO approved ADS-B links, any NAS ground infrastructure supporting 1090 MHz ES would accommodate foreign aircraft equipped for this ADS-B link. Accommodation of aircraft equipped with VDL-M4 only, the other ICAO ADS-B link, would not be provided.

Notes for Scenario B

RTCA MOPS for UAT will be completed in 2002. However, the role of UAT is currently under review within ICAO, and a decision on the international role of UAT is expected during 2002 at the earliest. Lacking an ICAO decision to develop standards for UAT, a UAT single link decision in the U.S. would not directly support foreign aircraft equipped with either of the ICAO already approved ADS-B solutions. Thus for the moment this requirement is not satisfied, but this could change if ICAO ultimately decides to move forward with SARPs for UAT and approves an operating frequency.

Notes for Scenario C

Since VDL-M4 is one of the two ICAO approved ADS-B links, any NAS ground infrastructure supporting VDL-M4 would accommodate foreign aircraft equipped for this ADS-B link. Accommodation of aircraft equipped with 1090ES only, the other ICAO ADS-B link, would not be provided.

Notes for Scenarios D

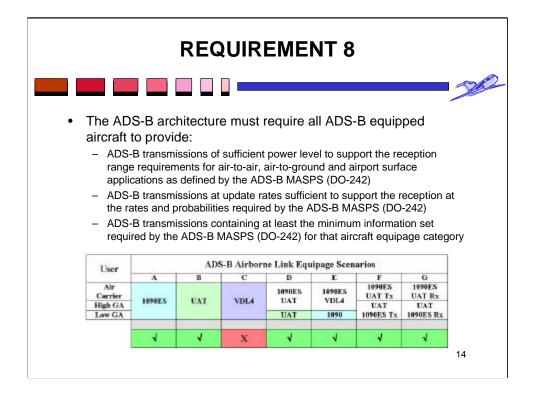
Although foreign aircraft equipped with the ICAO approved 1090ES would be accommodated, aircraft equipped with VDL-M4 only, the other ICAO ADS-B link, would not be provided.

Notes for Scenario E

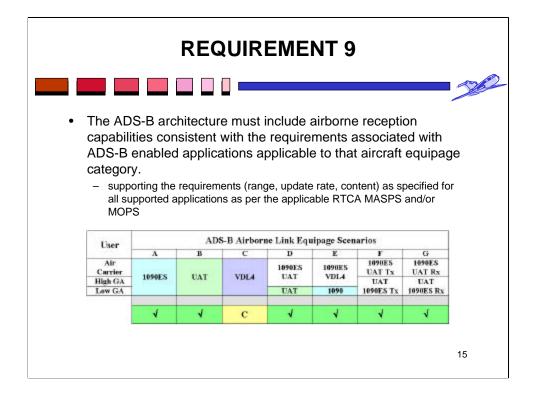
Although both of the currently approved ICAO ADS-B link are accommodated, since ICAO is currently considering UAT and if UAT ICAO standards are forthcoming then this scenario would not accommodate aircraft equipped with only UAT.

Notes for Scenarios F and G

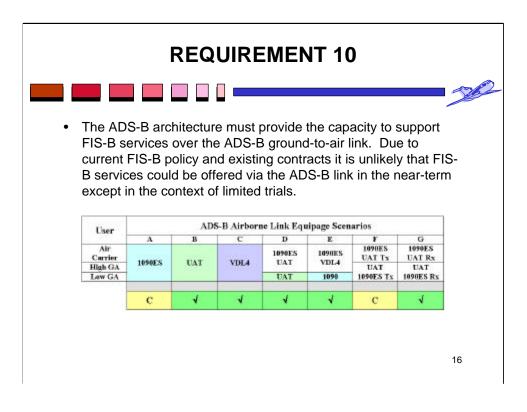
Neither of these scenarios would accommodate foreign aircraft equipped with only VDL-M4. Also Low/Mid GA equipage would not support fully 2-way 1090ES capability.



VDL-M4 configuration defined by the TLAT, does not provide sufficient rates of transmission to satisfy the requirements of the ADS-B MASPS for the applications currently under consideration. Specifically, certain of the short-range tactical applications are not supported due to insufficient state vector update rates. Also certain of the longer-range applications require intent information that is not provided with a sufficient update rate.



The VDL-M4 could satisfy the reception requirements on the condition that the VHF channel loading be kept to a moderate level and the airborne installation includes the capability to simultaneously receive on all channels serving the airspace. However, the concerns noted for requirement 8, scenario C would prevent the reception at an adequate update rate to satisfy the ADS-B MASPS requirements for certain applications (i.e., using the TLAT configuration).



1090 MHz ES will have a limited capacity to support FIS-B services. It may be able to support a basic set of FIS-B services but probably not the more real-time or high update rate services. In the highest interference environments (e.g. LA) and in the long-term, the capacity limitations may result in a reduced service volume or reduced update rates for the FIS-B services. Also the Class A0 and A1 1090ES receivers as defined by the DO-260 may not have sufficient sensitivity to provide adequate reception range to permit continuos FIS-B coverage.

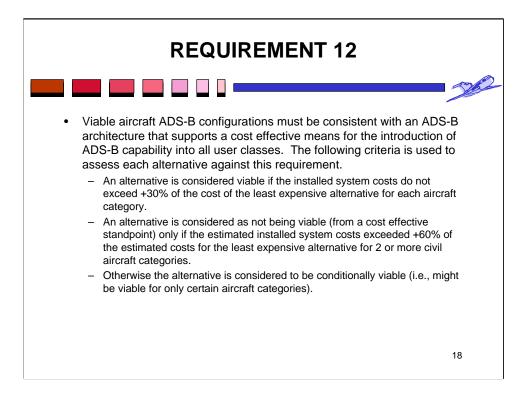
Notes for Scenario F

Same issues as described above for scenario A for those aircraft equipped with only 1090ES reception capability (High GA and Air Carrier).

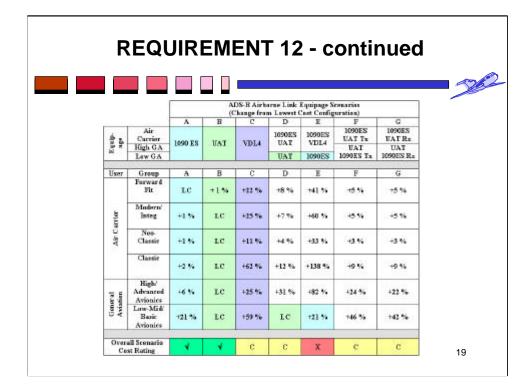
The ADS-B link(s) must be functionally consistent with the neutron long term evolution of the NAS architecture. User ADS-B Airborne Link Equipage Scenarios Alr D F G Alr D F G Air 1090ES 1090ES Carrier 1090ES 1090ES 1090ES High GA Lew GA 1 VDL4 UAT VDL4 UAT 2 <th col<="" th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th>	<th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>											
Air Carrier High GA A B C D E F G Low GA 1090ES UAT VDL4 1090ES			• •		-			n the ne				
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Notes for Scenarios C and E

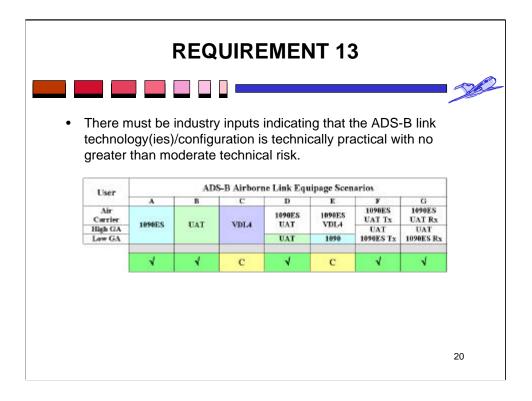
It is currently unclear if VDL-M4 would fit into the evolution of the NAS surveillance architecture. The requirements for the VDL-M4 systems management including the associated ground network and management requirements are not clear.



See details of cost deltas (on the next slide) vs. the above assessment criteria defined for this requirement



Overall assessment results for requirement 12 shown on the bottom of the above table.



Notes for Scenarios C and E

The technical risks associated with a fully MOPS/SARPs compliant and certifiable VDL-M4 airborne installation are considered moderate (as compared to low for the other ADS-B link alternatives). This could be considered acceptable. However, when considered in the context of the overall system, the VDL-M4 can be considered to have acceptable technical risk on the condition that an acceptable system management scheme, involving both the aircraft and the VDL-M4 ground infrastructure, could be fully defined and validated via modeling.

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3. Support Flight Path Decenfliction.	с	4	с	A.	с	с	с
 Support Near/Mid- Tenno Single-Link Equip 	۰.	1	x	٧.	4	1	1
5. Support TIS-B	N.	4	4	A.	1	v	4
6. Support NAS-wide Multi-Link	с	4	x	×	с	с	с
7. Arconondate Foreign Aircraft	с	7	с	с	с	с	с
 Support ADS-B Transmissions 	1	4	x	4	4	4	4
9. Support Airborne Reception	1	- 4	С	1	- A	4	4
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11. Consistent with NAS Architecture	×	- 4	.7	4	7	4	4
12. Supports Cost- Effective Implement	*	4	с	с	X	с	с
13. Configuration is Technically Practical	V	1	С	V	С	V	*

Above a summary of the results reported on the previous slides.

