Federal Aviation Administration

R&D Review

News Source for the FAA Air Traffic Organization's Operations Planning Research & Development Office

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Take to the Skies

in this issue

A Winning Investment

Research Ensures Safety and Saves Money

For an investment of approximately $150,000 in research funds, the FAA is now saving approximately $5 million in airport tower construction costs annually.

"Every year the FAA builds approximately seven new air traffic control towers. Each new tower costs millions of dollars to construct," notes Joan Bauerlein, FAA's Director of Research and Development. "To ensure that new towers not only enhance airport and air traffic safety, but also are cost effective, our human factors specialists undertook a research project to improve tower siting (height and location) procedures."

Previously, because no minimum criteria for tower height existed, controller opinions and the upper height limits imposed by terminal instrument procedures determined airport traffic control tower siting decisions. Recognizing that tower siting affects airport safety and construction costs, researchers developed a methodology to measure what improvement in controller visibility can be gained by increasing tower height at different locations on the airport surface. The approach used by the researchers capitalized upon imaging performance models from the United States Army's Night Vision and Electronic Sensors Directorate, that have evolved from extensive behavioral testing and engineering modifications during the past forty years. FAA civil engineers can now use this approach to compare multiple tower heights and locations prior to the design and construction phase to determine effective tower placement on the airport surface.

FAA human factors specialists and system analysts created and conducted tower siting simulations of different existing towers to establish a performance baseline of a controller's ability to detect and identify aircraft on the airport surface at distance points. They conducted the simulations at the FAA Airport Facilities Tower Integration Laboratory located at the William J. Hughes Technical Center in Atlantic City, NJ.

The AFTIL contains nine six-foot by eight-foot screens providing a 360-degree out-the-window display area, a control tower wrap-around console, tower support equipment, and a tower simulation system with pseudo-pilot communications. This system can provide a 3-dimensional airport display to evaluate potential tower sites and determine if clear and unobstructed views of the airport surfaces and approach paths are visible from the various tower control positions.

During the recent simulation, researchers asked tower controllers to respond to two basic airport traffic control tower tasks: distinguish the boundaries of the movement areas, and identify the position of an MD-80 aircraft relative to a runway threshold. ▶

Controller performance indicated that tower height did affect their judgments for airport traffic control tasks. From these results, researchers quantified a minimum required viewing angle of intersection from the tower observer to a point on the airport surface. Simple calculations based on this minimum angle revealed the tower height needed to ensure controllers can accurately perform basic airport ground separation tasks.

Tower siting-personnel also used the superior computer simulation capabilities of the AFTIL to improve simulations involving other airport traffic control tower environments. These simulations helped to determine visibility criteria, such as those for observer line-of-sight (look down angle) and object obscuration (such as aircraft hangers and parking garages blocking the view of taxiways). The information gathered from these simulations is now being used to develop a revised FAA siting process and standards. When issued, the new tower siting policy will establish tower visibility performance requirements and criteria.

From these tests, researchers established two metrics that specify minimum performance criteria for future tower location and height. The Object Discrimination Analysis metric quantifies the effect of observer height and distance to target on observers' ability to detect, recognize, and identify a distant ground object. The line-of-sight angle of incidence metric quantifies how much the spatial judgements of controllers can be improved by increasing observer ground slant angle for the most distant point on an airport surface. Researchers transformed these two metrics into a simple to use Internet application tool that is available from the FAA human factors home page at http://www.hf.faa.gov/visibility. This website also provides additional information on the research and project points of contact.

This research is having immediate results. According to Ms. Bauerlein, "It is not only enhancing safety by allowing researchers and engineers to find and resolve potential problems before tower construction begins, but it is also contributing to significant cost savings." She explains that "In the past, the FAA often built towers at heights exceeding those required for human visual discrimination, because, in part, no minimum human performance requirements existed. Because those requirements are now known, towers may now be built lower and the FAA will accrue a potential cost savings of approximately $5 million per year, since towers may now be built lower." This estimate is based on an average of seven new towers per year, built approximately 20 feet lower, with constructions costs of $40,000 per foot. R&D Review

For additional information on the FAA human factors research and engineering programs, please see http://www.hf.faa.gov. For additional information on the AFTIL, please see http://aftil.tc.faa.gov.

from the field

Welcome to the new manager of FAA's R&D Field Office at NASA Langley, Dr. Kelli Willshire. In a recent interview, Kelli shared her vision for her new office.

Q What is your role as manager of the FAA's R&D Field Office at NASA Langley?

A I am the FAA's representative for research and development to the NASA field center organizations east of the Mississippi River, such as NASA Langley and Glenn Research Centers. This means I am the main or sometimes initial point of contact for NASA and their research partners with respect to FAA R&D activities. In this role, my office supports FAA and NASA research to meet FAA goals in aviation safety and capacity by:

a. Coordinating with ongoing NASA programs;
b. Conducting research for both FAA and NASA programs;
c. Assisting in planning research (both NASA and FAA); and
d. Assisting in transferring NASA technology.

Part of my role is to provide for the Field Office employees and tenant colleagues from the FAA Aviation Safety Office a work environment and opportunities that allow them to conduct and support high quality collaborative research and development. I'm very fortunate to have come into an established team of researchers, managers, and support personnel who are already operating at a high level of productivity.

Q What is your vision for your organization?

A As part of the FAA R&D vision to provide world leadership in aviation research, my vision for our office is to provide a seamless transfer of NASA and FAA technology and research products into the aviation system. We help NASA understand the needs of the aviation transportation system and explain how the FAA implements research and technology to meet those needs. This means that we often actively participate in the NASA research programs to facilitate this understanding and the transfer of technology.

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Field Offices

Creating Partnerships

The FAA and NASA are working jointly on efficient and economical research efforts with significant potential to enhance the safety of the flying public. FAA personnel assigned to R&D Field Offices at two of NASA's Research Centers are helping to coordinate aviation-related NASA work in support of these joint FAA/NASA programs. In these field locations, they work closely with their NASA counterparts complementing the resources that NASA is able to assign to its ongoing aviation research projects. Also, in cases where interagency research programs are not yet fully defined, FAA researchers frequently serve in NASA's unique facilities as principal investigators. Often they are in a position to help the agencies agree more quickly and effectively on how to proceed.

The unique relationship between the FAA and NASA dates back to 1971, when the FAA opened its first R&D Field Office at NASA's Ames Research Center at Moffett Field, Ca. The FAA was facing strong pressure at that time to develop airworthiness criteria for the supersonic transport aircraft, and the new office was established to facilitate this needed research in NASA's specialized facilities. The result benefited both agencies by pooling skills and economic resources, reducing duplication of facilities and research efforts.

Research activities in the early years of the FAA/NASA partnership at the Ames Research Center focused primarily on developing airworthiness criteria for new vehicle concepts (SST, powered-lifts, tilt-rotor). As the national airspace system became more complex, however, research began in new areas, such as head-up displays, wind shear alerting devices, and a wide variety of human factors projects.

In the past decade, FAA/NASA research activities at Ames have become much more focused on the development of air traffic management decision support tools, such as Center TRACON automation system, surface movement system, and multi-center traffic management advisor. New efforts will ▶

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support the Next Generation Air Transportation System Integrated Plan and efforts to design the future air transportation system. Barry Scott manages the FAA Field Office at NASA Ames. He can be contacted at bscott@mail.arc.nasa.gov.

In 1978, FAA opened its second field office at NASA's Langley Research Center in Hampton, Va. The work of this office includes: providing technical coordination for many cooperative research projects being conducted at the NASA centers; participating in and conducting joint and individual research activities; and identifying and facilitating the transfer of significant NASA research and technology to meet FAA's operational needs.

Current cooperative efforts at NASA Langley include the development of advanced technologies to improve aviation safety and capacity, such as weather information presentation, noise and wake vortex mitigation, and communications, navigation, and surveillance architectures and systems technologies for surface and enroute applications. To facilitate this work, the FAA's Langley office has also established a position at the NASA Glenn Research Center. Dr. Kelli Willshire manages this FAA office. She can be contacted at k.f.willshire@nasa.gov.

Both agencies continue to benefit from their collaborative research activities. All of these efforts are made possible under the auspices of various Memorandums of Understandings (MOU) and Memorandums of Agreements (MOA), which establish guidelines for cooperative projects and the direction of related research. R&D Review

For more information on the FAA Field Offices and the cooperative efforts with NASA, please visit http://faa-www.larc.nasa.gov.

The Field Office is also an integral part of the FAA's Aviation Research and Development office based in Washington, DC.. As part of that team, we actively contribute to the R&D mission to plan, conduct, and integrate domestic and international research and development products and services that will ensure a safe, efficient, and environmentally compatible global air transportation system.

What are your immediate priorities for the office?

Our immediate priorities include:

- Assessing the status of all ongoing research, including financial and human resources;
- Determining the immediate and future plans of NASA research in aviation safety and capacity; and
- Identifying research gaps and formulating plans to fill them, which may require coordination outside of our immediate organization.

Where do you see the office 5 years from now?

In 5 years, I see the office as still being a very robust and busy place. I see NASA and FAA people coming in and out of our doors performing exciting joint research. The office already has been in existence for almost 20 years, and I see us as getting bigger, not necessarily in terms of space or people, but in terms of its impact on the aviation system.

What role does your organization play in strengthening the FAA/NASA relationship?

Because of changing priorities and budget limitations, NASA's future in aeronautics is uncertain at this time - what resources NASA will have to contribute to aviation research or what form those resources will take is unknown. To help NASA maximize the effectiveness of its research, our office plays a large role for NASA, especially the managers and researchers at the Langley and Glenn Research Centers, in helping to understand FAA's research and development requirements, particularly as the nation moves toward the Next Generation Air Traffic System. We already are participating with the interagency Joint Planning and Development Office in discussions and planning for future NASA programs. Being on site at the NASA facilities makes it very easy for our NASA partners to contact us and to include us earlier in their planning and research activities as well as in facilitating the transfer of the NASA technologies.

Why do you think the FAA/NASA partnership is important?

In my short time at the FAA, I have realized how much the FAA depends on NASA and its other research partners to conduct research necessary for improved aviation safety and capacity, especially at the more basic or lower levels of research. For the FAA to do this research itself, or to contract with others, would require much larger amounts of human capital, facilities, and money than is currently in the FAA R&D budget. NASA is already set up to do this research and it makes sense to have them continue to perform this higher risk research.

From your perspective, what are the research challenges ahead and how can your office help meet them?

I think the research challenges ahead are to provide secure information intensive technologies that will allow pilots and air traffic operators to operate in nearly all weather conditions. Clearly, the future aerospace system will be reliant on smart avionics and ground systems to track, fly, and coordinate the air vehicles in the system. How all this information is collected, transferred, and presented in a safe and secure manner is extremely challenging.

Additional challenges include providing aircraft designs and takeoff/landing capabilities and facilities that fit the diverse range of air vehicles to minimize impact on the environment and yet increase capacity. Our office, in participation with NASA, already has experience in working on technology programs related to enhancing communication, surveillance, and navigation technologies, understanding human factors, improving weather products, mitigating noise exposure, reducing the effects of wake vortices, and designing new, more powerful information systems. All of these areas will continue to be important in addressing future needs.

Prior to coming to the FAA, what did you do?

Prior to joining the FAA, I worked for NASA Langley Research Center for almost 26 years in a variety of research or advanced technology development and management positions. I have an educational background in industrial and systems engineering with specialties in human factors and acoustics. My projects have included airport community noise, space vehicle design for human habitability, space automation and robotics, and more recently, aviation capacity and safety. I have also done a variety of activities to support organizational needs for NASA at all levels from Agency-wide to local teams.

What else would I like our readers to know about you?

I have a wonderful husband, Bill, who is the Deputy Director for the Aeronautics Research Mission Office at NASA Langley. We are blessed with an eight-year old son, Paul, who is all boy! And, for fun, we like to sail on the Chesapeake Bay and elsewhere. R&D Review

Producing the Future

Aerospace Vehicle Systems Institute

The FAA is partnering with the Aerospace Vehicle Systems Institute (AVSI), supporting its work to:

- reduce duplication in R&D efforts by leveraging and collaborating where possible;
- deliver application-ready systems and integrated packages;
- create responsive R&D teams that make real progress on schedule;
- encourage open communication between industry, government and universities; and
- achieve a profitable but safe balance between meeting the commercial needs of the aviation industry in a global market and the regulatory requirements of the government.

The AVSI, founded in 1998, is currently comprised of 8 industry and 2 government organizations, the FAA and the Department of Defense. The industry partners are BAE Systems, Boeing, Goodrich, Honeywell International, Inc., Lockheed Martin, Rockwell Collins, Science Applications International Corporation, and Smiths Aerospace. It is managed by both the Texas A&M University and Texas Engineering Experiment Station, and is located at Texas A& M University in College Station, Texas.

The AVSI mission is to reduce the aerospace vehicle systems life-cycle cost and accelerate development of systems, architectures, tools, and processes through cooperation among industry, government, and universities.

Chuck Kilgore is the manager of the Software and Digital Systems Safety project and serves as the FAA's R&D community's representative to AVSI. According to him, "The Aerospace Vehicle Systems Institute works with academic institutions, industry, and government to improve and to reduce the costs of complex subsystems in aerospace vehicle systems, architectures, and tools and processes."

Developing better airplanes is the goal of the institute. The FAA's work with AVSI encompasses a wide array of activities, including the effects of cosmic radiation on avionics systems, and flight safety and certification issues for software and hardware component integration, and aircraft semiconductor life.

The purpose of the AVSI project "Microprocessor Evaluations" is to investigate microprocessor use in the industry, to document assessment criteria for microprocessors, and to document safety concerns. The primary objectives are: to provide input for FAA policy and guidance development regarding microprocessors; and to provide practical evaluation criteria for industry to use in developing systems that use microprocessors. *continued on page 25* ▶

Blanket Protection

Fire Research Leads to New Regulations

The FAA recently proposed an Airworthiness Directive (AD) that would require U.S. airlines to remove thermal acoustic insulation blankets made of a Mylar® film called AN-26 from over 800 of their transport aircraft. Service experience and tests conducted by FAA fire safety researchers prompted the proposed AD. The tests demonstrated that the film consistently could be ignited by an electrical arc and could cause a fire aboard an aircraft.

Aircraft insulation blankets are used primarily to protect passengers and crew from engine noise and, at high altitudes, from frigid temperatures. The material used in these aviation devices is similar to the silver-lined insulation found in houses. It is typically composed of a batting material, generically referred to as fiberglass, with a covering of film that both contains the batting and resists the penetration of moisture. The resulting appearance accounts for the common use of the term "blanket." Metallized polyethyleneteraphthalate (MPET) and AN-26 are specific choices of films that aviation manufacturers have used as coverings.

Based on in-service experience in the mid-1990s, FAA researchers started investigating the adequacy of the existing Bunsen burner flammability criteria for testing thermal/acoustic insulation. "Our investigation included large-scale fire testing, as well as tests for ignitability, of a broad range of materials," explains FAA fire safety research manager, Gus Sarkos. "By the late 1990s, we had concluded that the Bunsen burner test method required by the existing rules failed, under realistic in-service conditions, to separate materials with acceptable flammability characteristics from unacceptable materials."

The tests just described alerted the FAA to the need for a new certification standard, but any new certification standards must be based on a test method capable of screening out materials considered too hazardous for future installation. The Agency's researchers first had to establish an adequate, reliable means to quantify each potential hazard. "This work," according to Sarkos, "involved additional large scale fire testing and tests to correlate the large scale tests with a laboratory scale test method."

The FAA adopted the "Improved Flammability Standards for Thermal/Acoustic Insulation Materials Used in Transport Category Airplanes" test standard 2 years ago. (Its official designation is: 68 FR 45046, July 31, 2003.) The resulting operating rule changes will go into effect in September of this year.

While developing the new test standard, FAA fire researchers also established criteria to determine whether or not existing materials could safely remain in service. A review of the service history, and subjecting AN-26 to a variety of tests, revealed that even though the material met the standards in place at the time of original certification in 1981, this type of insulation material could result in a fire when subjected to electrical arcing and sparks. In cooperation with industry, the FAA used the insulation blankets' response to electrical arcing and spark testing as the basis for identifying the unsafe condition with MPET and determined that these same safety criteria were applicable to AN-26. Additional research data have shown that contamination, such as dust, lint, grease, corrosion-inhibiting compounds, can increase susceptibility to ignition and flame propagation.

Insulation blankets made of AN-26 installed throughout the fuselage, if not corrected, could propagate a fire from an electrical arc or spark. As a result of this research, the FAA has proposed to adopt the new airworthiness directive for certain Boeing transport category airplanes. The proposed AD would require replacing any insulation blanket constructed of polyethyleneteraphthalate (PET) film, ORCON Orcofilm, AN-26 with a new insulation blanket.

The estimated cost of replacing the blankets on the U.S. fleet is approximately $330 million. As an alternative to replacing the insulation, Boeing is developing a spray-on ▶

The primary purpose of aircraft insulation blankets is to protect passengers and crew from engine noise and frigid temperatures at high altitudes.

Blanket Protection

barrier that, if proven effective, would correct the problem and meet the requirements of the proposed directive. If Boeing's alternate spray-on method could be used, replacing the blankets on a Boeing 737 would require about 4,200 labor hours, and 16,000 labor hours on a Boeing 747. The total cost of refitting the fleet might be less than $200 million. Boeing expects to have the product ready by April 2006. The proposed directive appeared in the Federal Register on April 4.

Published FAA research results include:

Development of Improved Flammability Criteria for Aircraft Thermal Acoustic Insulation (DOT/FAA/AR-99/44, http://www.fire.tc.faa.gov/pdf/99-44.pdf)

Flammability of Aircraft Insulation Blankets Subjected to electrical Arc Ignition Sources (DOT/FAA/AR-TN00/20, http://www.fire.tc.faa.gov/pdf/tn00-20.pdf)

The Effects of Angular Orientation on Flame Spread Over Thin Materials (COT/FAA/AR-99-86, http://www.tc.faa.gov/pdf/99-86.pdf)

Fire-Safe Polymers and Polymer Composites (DOT/FAA/AR-04-11, http://fire.tc.faa.gov/pdf/04-11.pdf) R&D Review

For additional information on FAA fire safety research, please see http://fire.tc.faa.gov/index.html.

Lighting the Way

Runway Hold Line Enhancements

FAA Advisory Circular AC 150/5340-30, "Design and Installation Details for Airport Visual Aids," requires airports to mark exit taxiways with color-coded alternating yellow and green lighting to warn pilots and vehicle drivers that they are within the runway environment or within the "critical area" for the Instrument Landing System/Microwave Landing System (ILS/MLS). Current regulations state that coded lights must face towards the runway side of the hold position and be directly in line from the runway centerline on the curve to the limit of the runway environment or ILS/MLS Critical Area.

The current regulations have saved many lives, but it may still be possible to improve upon their safety provisions and cost effectiveness. Acting on suggestions from industry, researchers recently looked into the feasibility of reversing established yellow and green lighting configurations to warn pilots they either are on a taxiway approaching an intersecting runway environment or on a taxiway exiting an intersection. It may also be possible with the new reversible patterns to mark hold position areas more efficiently, potentially reducing runway incursions. The configurations being studied could be applied to any airport currently equipped with taxiway centerline fixtures, at only the cost of replacing a limited number of colored filters in existing fixtures.

For testing purposes, researchers temporarily constructed a curved taxiway entrance lighting configuration, using standard FAA approved taxiway lighting fixtures, at the FAA's William J. Hughes Technical Center. All features of the simulated taxiway lighting configuration were installed in accordance with the spacing, alignment, and equipment requirements of the appropriate FAA Advisory Circular. The installation included:

A 200-foot lead-in segment of solid-green-colored centerline lights marking the start of the hold line location (the beginning of the runway environment).

A continuing segment of alternating yellow and green taxiway lights along the straight and curved section of the taxiway/runway entrance to the point of tangency with the runway centerline.

All spacing and alignment was in accordance with the appropriate FAA Advisory Circular.

All fixtures were standard FAA approved L-852 taxiway lights, with standard lamps and filters.

Researchers thoroughly briefed the test subjects before they viewed the newly coded lighting configuration under existing weather and ambient light conditions. Test subjects then drove in ground vehicles at typical aircraft taxi speeds through the display. The vehicle stopped at the simulated hold position, as though waiting for a clearance, and then drove along the curved, color-coded taxiway lights.

In the tests conducted thus far, the concept of illuminating the runway environment area with alternating yellow and green centerline fixtures has proved to be a cost-efficient, easy to deploy tool that could well have a positive impact on reducing runway incursions at airports with existing taxiway centerline lights. R&D Review

A technical note, describing this research will soon be on-line at http://www.airtech.tc.faa.gov/safety/downloads/.

2006 Aging Aircraft Conference

The Ninth Joint FAA/DoD/NASA Conference on Aging Aircraft will bring together members of the military and commercial aviation communities for the purpose of disseminating information relevant to maintaining the airworthiness and sustainability of aging aircraft. Presentations will analyze emerging issues and discuss technical and managerial solutions to age-related problems. Conference participation is unrestricted.

2006 FAA/DoD/NASA Conference on Aging Aircraft

March 6-9, 2006
Atlanta, Georgia

For complete information on the 2006 Aging Aircraft Conference please visit,
http://www.agingaircraftconference.org.

A Quiet Neighbor

Developing Tools to Evaluate Aviation Noise & Emissions

"Despite the great strides in technology and operations in the past 50 years that have dramatically reduced the noise and emissions that aircraft generate, the growth of aviation - more flights, more aircraft, and more airport capacity - has led to increased environmental concerns," explains Dr. Lourdes Maurice, FAA's Chief Scientist for Environment and Energy. "The very success of aviation in reshaping the nature and expectations of travel and the economy have produced large, and growing, environmental challenges. Public interest in environmental quality and local political pressure make the growth of airline operations and airport capacity more difficult. If we do not develop new models, advanced technologies, operational concepts, and programs to mitigate environmental impacts, the environmental effects associated with commercial aviation will hamper the ability of the national aviation system to grow."

Aviation's environmental challenge is only likely to increase, requiring researchers to address new noise and emission issues that will be created by a new commercial fleet comprising supersonic business jets, uninhabited air vehicles, large air transport vehicles with over 500 passengers, and micro jets operating in the national airspace system. More and new types of operations combined with public expectations for a quieter and cleaner environment will increase the pressure and scrutiny of aviation and environmental issues.

Success requires an interdependent approach to aviation environmental regulation. Aerospace systems have historically been designed - and regulations for their certification and use have been written - as though aviation noise and various emissions had nothing to do with one another. But aviation noise and emissions are actually highly interdependent phenomena. Future environmentally responsible aviation policy and rulemaking has to be based on a new, interdisciplinary approach. Furthermore, this approach must be made as affordable as it is effective.

Existing analytical tools were not designed to assess interdependencies between noise and emissions or analyze the cost/benefit of proposed actions. To address this interdependency, in 2004, the FAA, in collaboration with NASA, initiated a long term, strategic effort to develop analytical tools to address the relationship between noise and emissions and different types of emissions. According to Dr. Maurice, "The goal of this research is to develop comprehensive, transparent aviation environmental analytical▶

A Quiet Neighbor

tools to enable an interdisciplinary approach to assessing impacts and interrelationships between noise and emissions and among different types of emissions in a regulatory environment."

The new suite of tools will provide an interactive decision-making environment and encompasses the Environmental Design Space (EDS), Aviation Environmental Design Tool (AEDT), and the Aviation environmental Portfolio Management Tool (APMT). EDS will generate source noise, exhaust emissions and performance data, including cost, for existing and new aircraft. AEDT will provide a common, integrated capability for computing and identifying interrelationships between noise and emissions and among emissions at the aircraft, local, regional, and global levels. APMT will evaluate the micro and macro economic impacts of environmental impact mitigation strategies. The tools will ultimately help government agencies to understand how proposed actions and policy decisions impact and are impacted by aviation noise and emissions. The tools also will help industry understand how operational decisions impact and are affected by proposed projects affecting aviation noise and emissions. And, they will help the aviation community better explain to the public how aviation noise and emissions could affect their neighborhoods.

Research began in 2004 with the National Research Council's Transportation Research Board (TRB), on behalf of the FAA and NASA, conducting a study to assess the proposed tool suite. A TRB committee analyzed the EDS, AEDT, and APMT requirements and conducted three workshops between March 2004 and February 2005. At these workshops, nearly 80 stakeholders (including manufacturers, airlines, airports, academia, and the international community) actively engaged in refining the processes and requirements for the tool suite. The FAA and NASA received substantial input to guide development of the tools, and they used the comments to refine the conceptual foundation and to formulate a comprehensive work plan. The FAA is now fully engaged in developing AEDT and APMT.

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The FAA/NASA/Transport Canada-sponsored Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) is currently developing the EDS module. PARTNER, an Air Transportation Center of Excellence, is lead by the Massachusetts Institute of Technology and comprises seven other universities and 29 other partners representing a broad cross-section of industrial, governmental, and professional aviation organizations. (For additional information, see http://web.mit.edu/aeroastro/www/partner/index.html.)

Development of these tools is one of the key environmental initiatives of the *FAA Flight Plan*. Although a long-term enterprise, expected to last 10 years, some capabilities will come on-line between 2006 and 2009, in time to provide valuable input to the International Civil Aviation Organization (ICAO) 7th meeting of the Committee on Aviation Environmental Protection (CAEP). R&D Review

A New Face in Human Factors

Welcoming Our Newest Chief Scientific and Technical Advisor to Human Factors Aircraft Maintenance Systems

Dr. William B. Johnson has joined the ranks of the FAA's cadre of Chief Scientific and Technical Advisors (CSTAs). His position is CSTA for Human Factors in Aircraft Maintenance Systems. Dr. Johnson has over 30 years applied research and development experience with a focus on human performance in maintenance and repair of complex systems. He has conducted research and development in training, job aiding, safety, and other human factors in a variety of domains including, but not limited to, Navy helicopters, civil aircraft, NASA orbiter, Army electronics, and FAA inspector support. His research has concentrated on everyday solutions that affect human behavior and performance.

For 12 years, from 1989 through 2001, he served as a contractor whose work included managing research on human factors in aircraft maintenance and inspection. In that capacity, he was the initial manager of the team that conceptualized and delivered the Online Aviation Safety Information System (OASIS) used by all FAA inspectors today. Recently, from 2001-2004, as the Director for the Americas for Lufthansa Technical Training, he managed the development of web-based maintenance human factors blended-training for Lufthansa Technik, a system being widely adopted throughout the world.

Dr. Johnson is a private pilot (licensed in 1966) and an airframe and powerplant mechanic (certified in 1969). He has served as a FAA Designated Mechanic Examiner. With aviation-related career employment in universities, private research laboratories and consulting firms, and publicly traded airline companies, Dr. Johnson offers a broad understanding of the many technical, financial, and human-centered challenges associated with aircraft maintenance, repair and overhaul.

Dr. Johnson earned his Ph.D. in Education from the University of Illinois. He has an extensive publication record. He is a long-standing member of the Human Factors and Ergonomics Society and the International Society of Air Safety Investigators. He is also a member of the Royal Aeronautical Society.

Renewed FAA Commitment to Maintenance HF

Dr. Johnson's appointment marks an important new era for FAA and particularly the Flight Standards Service. "By creating the CSTA position, dedicated to Human Factors in Maintenance, the FAA is demonstrating an increased commitment to maintenance issues," Johnson explains. "The FAA intends to increase the regulatory push towards improved attention to human factors in maintenance. That emphasis will be accompanied by the development of appropriate guidance materials and training. Such human factors maintenance programs will not only guide industry, but also help the FAA aviation safety inspectors, who are instrumental in approving the variety of organization-specific human factors implementations in airlines and maintenance providers."

The FAA is a world leader in research and development related to human factors in aircraft maintenance and inspection. Deliverables from that long-term research include *The Human Factors Guide for Aviation Maintenance and Inspection* and the website: http://hfskyway.faa.gov. The website is particularly significant because it includes about 15,000 pages of reports completed since the inception of the program in 1988. It also includes proceedings from 15 international meetings jointly hosted by FAA, Transport Canada, and the Civil Aeronautics Authority of the United Kingdom. The U.S. aviation industry welcomes and voluntarily uses the human factors maintenance research results. However, over the past 4 years, Canadian and European regulations have increasingly mandated human factors training and supporting programs. ▶

"By creating the CSTA position, dedicated to Human Factors in Maintenance, the FAA is demonstrating a renewed and long-term commitment to maintenance issues."

A New Face in Human Factors

The FAA's Flight Standards organization, specifically the Air Carrier Branch (AFS-330), has further proven its commitment to Human Factors in maintenance with the appointment of John (Jay) J. Hiles to manage all of the issues associated with maintenance human factors. Hiles, who has been with the FAA for nearly two years as an aviation safety inspector, came from US Airways where he had 25 years experience as an aviation maintenance technician. During his tenure at US Airways he also served as the Director of Flight Safety for the International Association of Machinists. Working with former NTSB Board Member John Goglia, Hiles helped create the human factors training program at US Airways. It was one of the first such programs in the world and affected thousands of US Airways technicians.

Johnson and Hiles are teaming together to re-energize the role of human factors in aircraft maintenance. The combined experience and capability in R&D and in applied maintenance ensures that FAA is ready to re-elevate attention to the high-value human factors issues.

Immediate Redirection and Renewed FAA Cooperation

Approximately a year ago, the FAA undertook a major reorganization of its research and acquisitions and air traffic organizations, combining them into the new Air Traffic Organization (ATO). As part of that reorganization, FAA's research and development office became part of the new Air Traffic Organizations Operations Planning (ATO-P) organization. Within the new organization, researchers continue their role supporting the FAA's goals and mission, but also are involved in the long-term planning for the Agency's future needs.

The first item of business for the new Johnson-led Flight Standards maintenance team was to meet with key personnel in ATO-P's R&D office to understand roles and responsibilities. This facilitated clear communication and teamwork to ensure that ATO-P supports the research requirements. In those initial meetings, Dr. Johnson recognized that the ATO-P's human factors research and engineering program is ideally suited to provide program management and professional technical guidance to all parties that are conducting human factors maintenance R&D. The close working relationship between the sponsor and the R&D program management ensures effective, efficient, and timely delivery of R&D.

The key ATO-P research personnel working with Dr. Johnson are Dr. William (Kip) Krebs and Dr. Tom McCloy. Both McCloy and Krebs have worked closely with Flight Standards in past Human Factors maintenance R&D. In fact, both have expressed high satisfaction with the positive collaboration, already in progress, and the high potential for the future.

Another example of the renewed cooperation within FAA is the working relationship among the inter-disciplinary CSTAs. Already Dr. Johnson and Dr. Kathy Abbott, CSTA for Flight Deck Human Factors, have made a joint presentation at the recent World Aviation Training Symposium. Johnson and Abbott compared the human factors challenges that are shared between maintenance and flight operations. In addition Dr. Johnson and Mr. Hiles are active participants in the AFS Human Factors Coordinating Committee. R&D Review

You can contact Dr. William B. Johnson at (404) 305-6118 or via email at bill.Johnson-dr@faa.gov. John Hiles can be reached at (202) 267-8625 or at John.J.Hiles@faa.gov.
For additional information on the human factors research and engineering program, please go to http://www.hf.faa.gov.

The Bureau of Transportation Statistics, a part of DOT's Research and Innovative Technology Administration, reported that the airlines carried 47.5 million domestic passengers during January 2005, up from the 44.1 million in January 2004

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PreciousCargo

FAA Researchers Examine Infant Safety

The FAA estimates that as many as one percent of all passengers who fly each year on carriers registered in the U.S are children younger than two years old. This, however, is a difficult statistic to verify, for these infant passengers regularly fly seated on an adult's lap and require no ticket.

"Because the unique challenge of evacuating these little passengers in emergencies is less well known than we believe it should be, FAA researchers are investigating the emergency evacuation procedures best applicable to them in the event of an accident," explains Cynthia Corbett, FAA cabin safety research team at the FAA's Civil Aerospace Medical Institute (CAMI). "When an emergency evacuation is needed, passengers often have to do unfamiliar things quickly and under stressful conditions. Understandably, parents may feel more stress during an emergency than passengers without the responsibilities of caring for a child or children."

There are few recommended procedures for the emergency evacuation of infants. With the exception of airplane manufacturer demonstrations of an airplane's evacuation capability, in which infant dolls are included but not studied, evacuation research rarely includes infants and young children. Ms. Corbett considers this lack of knowledge and procedures a significant safety issue. She notes that: "Providing detailed information and instructions to people before and during an emergency has been shown to prompt action, reduce stress, and support the problem-solving process. Ensuring sufficient passenger knowledge is a key factor in determining how they will respond in an accident."

The Air Accident Investigation Branch (AAIB) of the United Kingdom Department for Transport has recommended that the FAA, the Civil Aviation Authority of the UK, and the European Joint Aviation Authorities "provide guidance as to the recommended best practice for the evacuation of infants and small children down escape slides with minimum delay" (AAIB, 2003).▶

The AAIB recommendation is based on an unfortunate experience. In its report of the 2001 accident of a Spanair McDonnell-Douglas MD-83 at Liverpool Airport, the investigative body noted some delay during the evacuation because of uncertainty about the best method for evacuating small children or infants down the escape slides. Neither the passenger safety briefing nor the safety cards provided guidance for this type of evacuation.

To address this knowledge gap, FAA researchers conducted preliminary demonstrations several years ago at the Civil Aerospace Medical Institute to gather information on safe ways to evacuate small children from a crashed airplane. Adults used a Type I floor-level exit fitted with an escape slide or a Type III overwing exit to perform simulated emergency evacuations while they carried dummies representative of six-month and two-year-old infants.

In this early study, researchers found that participants instinctively favored cradling the dummy as they climbed through the exit and then jumped onto the escape slide, while holding the dummy in an upright position with both arms around it. Evacuating this way, however, created the potential for injury to the "infants" being carried. The heads and limbs of the larger infant dummies often struck the side of the floor-level exit frames as they passed through. Worse yet, one of the participants in this study nearly dropped her precious cargo as she attempted to sit down to board the evacuation slide.

This study proved useful, but it did not adequately address the potential risks of injury to infants being carried by adults during emergency airplane evacuations. Nor did it account for the consequences of the risks that were simply noted - for example, the likelihood and extent of mild to severe head trauma as a result of impact with the exit frame or the range of possible injuries that could result from being dropped in the vicinity of an evacuation slide. The study also missed the opportunity to look into the effects other passengers might experience when called on to evacuate an airplane safely and efficiently in the presence of small children.

To understand the best means to evacuate babies, the Cabin Safety Team conducted a follow-on study to identify procedures for evacuating infants. As part of this work, researchers conducted simulated evacuations from the CAMI Aircraft Cabin Evacuation Facility in Oklahoma City, OK.

In the first study, six groups of 32 adults took part in five simulated airplane evacuations. Eight evacuees from each group carried dummies representative of infants from two months to two years old. For the first and last tests, evacuees received no instructions on how to carry the dummies. In the intervening tests, researchers told the adults to carry their "children" either horizontally or vertically, or to pass the infants to another adult who had already left the airplane. For the final test, the researchers introduced theatrical smoke to simulate fire - a frequent evacuation element - to further confuse the participants.

The results of this research show that how an adult carries an "infant," coupled with the infant's size, greatly affects the speed of the airplane evacuation. Carrying the infant, whether horizontally or vertically, gives faster egress than passing the infant through the exit. This is especially true with the smaller infants. Overall, carriers rated carrying most of the dummies vertically as both easier and safer, but they still preferred to pass the larger dummies, those representing two-year-old children, to another adult. ▶

Demonstrations at the Civil Aerospace Medical Institute of an infant evacuation through the exit frame of the aircraft

Precious Cargo

The carriers seemed to prefer carrying their precious cargo in the upright position - apparently out of a concern for the child's safety. Post-test comments revealed that the participants feared they would strike some part of an infant dummy, particularly a larger one, on the exit frame if they carried it horizontally. In some cases, the participants said this actually happened in the tests. The ability to hold the dummy against themselves and to enfold and protect its head, arms, and legs was also of critical concern to the adult participants.

Results suggest that the best carrying orientation depends on the size of the infant. Infant carrier performance on the final trial demonstrates the beneficial effects of education and "hands on" experience in airplane evacuations. Some implications of the results are especially revealing. For example, because there is little guarantee that someone will be available to receive a child at an airplane exit, waiting for someone to help takes more time than simply climbing through the exit together with the child. Thus, in an actual emergency, a delay caused by a parent waiting for help might mean that other passengers still in the airplane would not survive. R&D Review

Research results can be found on-line: *Caring for Precious Cargo, Part II: Behavioral Techniques for Emergency Evacuations with Infants Through Type III Overwing Exit* (DOT/FAA/AM-05-2, http://www.cami.jccbi.gov/aam-400A/Abstracts/Tech_Rep.htm)
More information on CAMI's cabin safety research can be found at http://www.cami.jccbi.gov/AAM-600/CabinSafety/600CAB.html.

Great Things in Space

Commercial Space Research Raising the Safety Bar

These are exciting times for the emerging commercial space transportation industry. Last summer, Mike Melville piloted SpaceShipOne above the 62 mile threshold altitude of space to become the first commercial astronaut. On October 4th, 2004, Brian Binnie flew SpaceShipOne to an altitude of 69 miles above the Earth to capture the $10 million Ansari X-Prize for the Scaled Composites Team. Patti Grace Smith, the FAA Associate Administrator for Commercial Space Transportation, awarded Mike Melville and Brian Binnie their commercial astronaut wings. Paul Allen, co-founder of Microsoft, Burt Rutan, founder of Scaled Composites, and Richard Branson, Virgin Atlantic Airways founder, announced a partnership to operate the world's first commercial space tourism flights in 2007. These entrepreneurs share a common vision that sees commercial space transportation as a potentially profitable venture, and the planning and efforts of the FAA are helping the industry to realize that vision. ▶

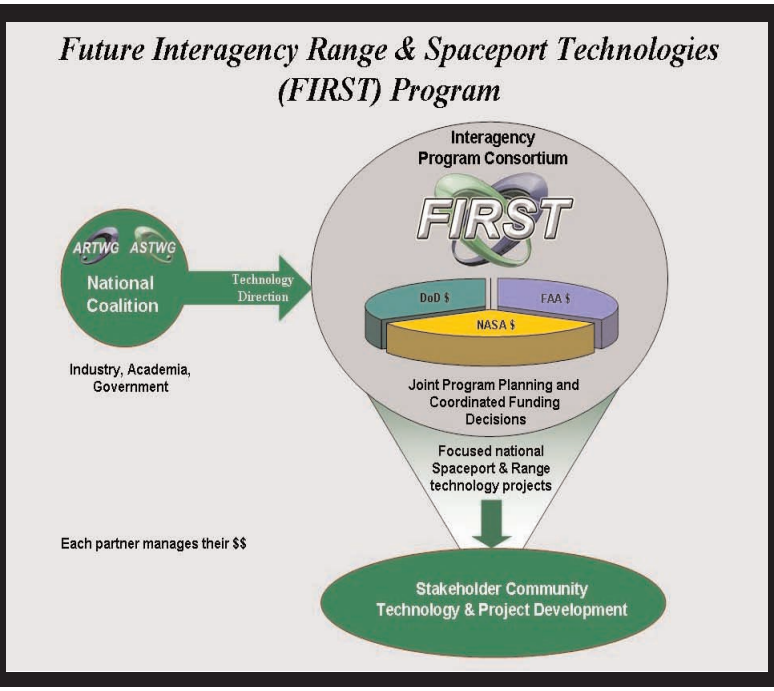


Figure 1: FIRST Program Concept

Great Things in Space

In 1999, the Office of Commercial Space Transportation (AST) established an FAA R&D liaison field office at NASA Kennedy Space Center (KSC). Modeled after other FAA field offices at NASA's Ames and Langley Research Centers, the role of the KSC office is to take advantage of R&D collaboration opportunities that could benefit both aviation and space transportation industries. The primary function of this office is to encourage, promote and facilitate the development of the nation's future commercial space transportation system.

The proprietor of the KSC office, Dr. Richard VanSuetendael, is from the FAA William J. Hughes Technical Center's Research and Technology Division. With over twenty five years of experience in aviation-related research, testing, and developing air traffic management (ATM) technologies, Dr. VanSuetendael's goal is to help evolve the currently separate space and air transportation systems into one integrated system.

The first order of business was to prepare a Memorandum of Agreement (MOA) between NASA and the FAA concerning Commercial Space Transportation Infrastructure Development (FNA/10-02-01). This broad agreement covers technical areas of collaboration needed to build a space transportation system. A particular area of interest to FAA is advanced range technologies. Like the National Airspace System (NAS), a primary mission of a range is safety. Weather, situational awareness, and collaborative decision-making are just a few of the functions that are common to both. NAS and range operations also share similar capacity, efficiency, and flexibility challenges, and similar solutions are being explored to address those challenges.

Over the past 6 years, AST's KSC field office has been supporting on-going activities, such as the Advanced Spaceport Technologies Working Group (ASTWG) and the Advanced Range Technologies Working Group (ARTWG). These working groups were chartered by NASA and the Air Force in response to several Presidential Directives to develop a national vision for U.S. spaceports and ranges, and to identify future technology needs and capabilities to meet a set of national goals. These two groups have a highly diversified membership of over 100 state and federal government, academia, and industry representatives. The vision and needed capabilities are documented in two reports that were published by ASTWG in 2003, (see http://astwg.ksc.nasa.gov/) and ARTWG in 2004 (see http://artwg.ksc.nasa.gov/).

As an extension of the ASTWG/ARTWG, the Future Interagency Range and Spaceport Technologies (FIRST) Program was created by three primary partners: NASA, DoD, and the FAA. For the past two years, the FIRST program formulation team has been developing planning documents that identify the needed spaceport and range technologies and business case data. Later in FY05, these documents will be published in a three-volume report: Volume 1 – *Baseline Spaceport and Range Configuration Report*; Volume 2 – ▶

Capability Gap Analysis and Technology Catalog; and Volume 3 – *Reference Configurations and Return on Investment (ROI)*. This report is expected to be used by the FAA, NASA and DoD to identify investment needs for developing the nation's future space transportation system. Figure 1 above illustrates the FIRST Program concept.

Aiming toward a national vision, the FIRST Program concept coordinates the development of needed technologies and capabilities established by the ARTWG/ASTWG coalition. Each partner funds their specific mission area, such as exploration (NASA), national defense (DoD), and commercial space transportation (FAA), and collaboration can occur when common needs are apparent (see http://firstprogram.ksc.nasa.gov/).

For the FAA, AST established a concept within the NAS, the Space and Air Traffic Management System (SATMS), which is expected to accommodate space operations with minimal impact to air traffic. Today's space operations typically affect only small regions of airspace for short periods of time. However, the potential for increased space operations over the next 20 years, coupled with an expected doubling of air traffic operations over the next 10 years, will require specialized traffic management decision support tools.

AST is currently planning a SATMS Decision Support Tool (DST) development effort to facilitate the emerging commercial space transportation markets and the introduction of new reusable, expendable, and hybrid space vehicles into the system. The potential effects of space vehicle malfunctions, debris and toxic plume dispersion, and blast overpressure shock waves are important safety considerations associated with space operations. The proposed tool will integrate existing range safety models with air traffic management technologies to create a new tool to help manage the risk to aircraft associated with space launch/return operations. The KSC field office is working with the FAA Space Systems Development Division to formulate a strategy to develop the proposed tool, and a project plan, schedule, and initial cost estimates are being prepared. Figure 2 above presents a possible architecture for the SATMS DST.
The SATMS DST would integrate ATM capabilities with debris dispersion and risk models currently used by Air Force safety analysts and range operators. The ATM algorithms would treat a potential debris hazard associated with a launch or return flight like an area of severe weather, and provide situational awareness information to help controllers efficiently route aircraft around the potential hazard. The DST would provide centralized command information to the Air Traffic Control System Command Center (ATCSCC), with localized control occurring at the appropriate Air Route Traffic Control Centers (ARTCCs) and/or Terminal Radar Approach Control (TRACON) facilities. Much like today's tools, the SATMS DST would provide valuable scheduling information for collaborative decision-making among spaceport, range operators, and airlines.

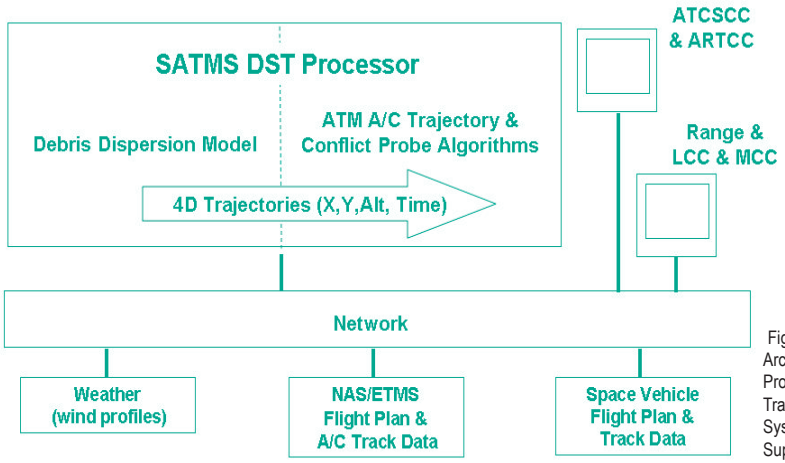


Figure 2: Possible Architecture for the Proposed Space & Air Traffic Management System (SATMS) Decision Support Tool (DST)

The KSC field office has a key role in another SATMS-related project. Supporting the AST Licensing & Safety Division, Dr. VanSuetendael serves as an on-site FAA technical advisor for a Columbia Debris Study. The study involves measuring and documenting aerodynamic characteristics of the debris recovered from the Columbia accident. During the recovery, Global Positioning System (GPS) position data was recorded for most of the debris that was found. The database can be used to evaluate analytical models that are used for public risk analyses, including the risk to aircraft, and the size and weight distributions can help researchers better understand vehicle break-up dynamics.▶

Great Things in Space

Another area being considered for possible studies by AST is how a common space-based communications, navigation, and surveillance (CNS) infrastructure could support both aviation and space operations. Some type of integrated CNS capabilities will be required for SATMS, and there has been some discussion within AST to look at current NASA, DoD and FAA space-based CNS programs to identify services and technologies that could support all three agencies' missions.

The KSC field office serves as an information conduit between NASA, DoD, contractors, and other space industry stakeholders, and the office supports other activities. For example, Dr. VanSuetendael provided assistance for installing an Airport Surveillance Radar (ASR-11) at KSC for additional security surveillance coverage north of the Shuttle launch pads (Complex 39). He supports a Common Standards Working Group (CSWG), which is establishing the criteria for determining the acceptable risk to aircraft in the vicinity of space launch and return operations. He has arranged for FAA panelists to speak at various technical conferences, and he has coordinated and participated in meetings among AST management and NASA Center Directors, the Joint Planning and Development Office, and the William J. Hughes Technical Center. R&D Review

Producing the Future - *from page 7*

Dense electronic packaging has been developed for portable consumer devices, such as cellular phones and pagers. The advanced packaging in these products has made its way into the aviation domain. These microprocessor devices have the general concept of reducing the size, weight, and power of a product and adding capability by using advanced design and component packaging techniques. However, the design and packaging techniques have led to the use of concepts such as caching and pipelining, which can affect system performance with regards to determinism and safety.

Most microprocessors are accepted on aircraft through a combination of service history, testing, and dissimilarity. However, as more complex microprocessors are used, more complex hardware is integrated, and fully partitioned systems are implemented, a defined process for microprocessor acceptance is needed. The project will provide practical techniques for use by aircraft manufacturers, avionics developers, certification authorities, and other stakeholders.

In another AVSI project, "Advanced Guidance and Control - Operational and Safety Benefits," researchers will conduct the necessary work to clear away the obstacles to the introduction and certification of advanced flight guidance and control (FG&C) systems that are safer and operationally more effective than the current generation of FG&C systems onboard transport aircraft.

This project has been structured to overcome the impediments to the introduction of advanced FG&C systems that provide the required safety and operational improvements. Eight tasks have been identified for this project. The first two tasks, which will be completed under the AVSI umbrella of control are:

- assess merits, suitability, and operational effectiveness of advanced functionally integrated FG&C technology [i.e., Total Energy Control System (TECS)/Total Heading Control System (THCS)] and establish minimum performance standards; and
- document safety, operational, and certification requirements and objectives for future FG&C.

Six additional tasks will assess the operational suitability and safety improvements afforded by the previously developed advanced FG&C systems, as well as provide overall assessment of the technical and economic design readiness for introduction/certification on future transport aircraft. These efforts will be pursued under a joint research agreement between AVSI and NASA. The payoff for the Government will be to bring the relatively large research investment already performed for FG&C safety improvements to fruition. For industry, the payoff will be a reduction in FG&C system development, and design assurance/certification effort.

Through the project, "Methods to Account for Accelerated Semiconductor Device Wear Out," AVSI suggests a possible way to assess semiconductor lifespan is to develop mathematical models of the major wear out mechanisms for semiconductor devices. With these models in place, it then becomes possible to calculate the implication of device de-rating (running them at lower temperatures, clock speeds, or voltages) as a means of extending their lifetimes and reducing failure rates.

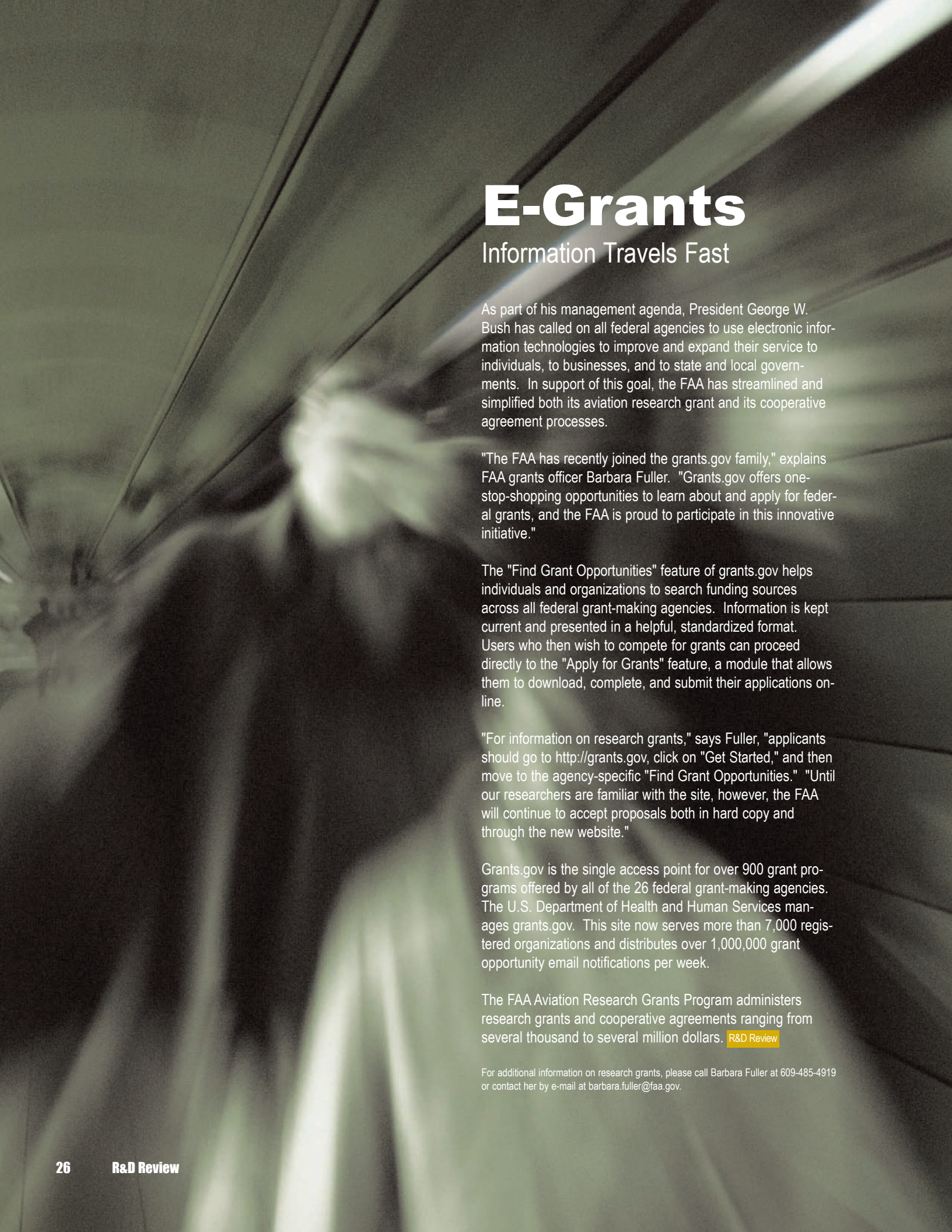
The aerospace industry has been and continues to be faced with unprecedented technical challenges. "Understanding the lifecycles of the semiconductors used in aircraft avionics, for example, is of particular concern," explains Chuck Kilgore. "As the commercial airline fleet ages, it is important that we understand the life expectancy of the computer chips used in avionics. This is why we are developing methods to evaluate mechanisms and accommodate the effects of accelerated semiconductor device wear out on avionics systems design, production, and support."

Until recently, the lifetime of a semiconductor device could be measured in decades, which was essentially infinite with respect to its required service life. It was therefore not critical to quantify the device lifetimes exactly, or even to understand them completely. Technological pressure on the electronics industry runs counter to the needs of aerospace applications where long life and high reliability are critical. As the design rules shrink, power consumption increases and voltage margins become almost non-existent for the designed performance level, the lifetime of most commercial parts is the ultimate casualty.

With the first 3 phases of the project completed, this project has led to the development of an aerospace industry Standard for the Aerospace Qualified Electronic Component, which will be adopted by the electronics industry for qualifying electronics used in aerospace applications. In Phase 4, the project team proposes to make the results of this project more useful to avionics system designers by providing design handbook and guideline information. They will also verify this work through accelerated testing of static random access memory devices and by providing models and simulations of specific component types. Challenges like semiconductor life are making it necessary for all members of the aviation industry, from private sector to Government agencies, to work together to develop and implement industry-wide solutions.

In addition, Tony Wilson, FAA manager of the Electromagnetic Hazards to Aircraft Systems project, is using the AVSI in two of his project areas. The first task involves the investigation of the effects of cosmic radiation on avionics. The AVSI is actively working to define any potential problems for aircraft systems caused by cosmic radiation and the thermal neutrons associated with it. Researchers are defining an initiative to quantify the effects of cosmic radiation and to evaluate the effectiveness of present day facilities for carrying out single event effects testing for avionics applications. The second task involves protecting the aircraft avionics against the effects of electromagnetic interference from wireless devices and other sources of spurious emissions that could cause potential upset to the avionics of the aircraft.

Through consortia, such as AVSI, the aviation community is achieving cost reduction in design, development, manufacturing, and operations, rapid introduction of new technologies to the market, and increased safety and reliability of the end products. R&D Review



E-Grants

Information Travels Fast

As part of his management agenda, President George W. Bush has called on all federal agencies to use electronic information technologies to improve and expand their service to individuals, to businesses, and to state and local governments. In support of this goal, the FAA has streamlined and simplified both its aviation research grant and its cooperative agreement processes.

"The FAA has recently joined the grants.gov family," explains FAA grants officer Barbara Fuller. "Grants.gov offers one-stop-shopping opportunities to learn about and apply for federal grants, and the FAA is proud to participate in this innovative initiative."

The "Find Grant Opportunities" feature of grants.gov helps individuals and organizations to search funding sources across all federal grant-making agencies. Information is kept current and presented in a helpful, standardized format. Users who then wish to compete for grants can proceed directly to the "Apply for Grants" feature, a module that allows them to download, complete, and submit their applications online.

"For information on research grants," says Fuller, "applicants should go to http://grants.gov, click on "Get Started," and then move to the agency-specific "Find Grant Opportunities." "Until our researchers are familiar with the site, however, the FAA will continue to accept proposals both in hard copy and through the new website."

Grants.gov is the single access point for over 900 grant programs offered by all of the 26 federal grant-making agencies. The U.S. Department of Health and Human Services manages grants.gov. This site now serves more than 7,000 registered organizations and distributes over 1,000,000 grant opportunity email notifications per week.

The FAA Aviation Research Grants Program administers research grants and cooperative agreements ranging from several thousand to several million dollars. R&D Review

For additional information on research grants, please call Barbara Fuller at 609-485-4919 or contact her by e-mail at barbara.fuller@faa.gov.

Creating Partnerships

Next Generation Air Transportation System Institute

Since the release of the Next Generation Air Transportation System Integrated Plan, in December 2004, the inter-Agency Joint Planning and Development Office (JPDO) has established eight integrated product teams to oversee the creation of plans detailing the activities needed to meet the strategic vision outlined in the Integrated Plan. The product teams focus on the need to:

Develop Airport infrastructure to meet future demand, led by the FAA

Establish an effective security system without limiting mobility or civil liberties, led by the Department of Homeland Security

Establish an agile air traffic system, led by NASA

Establish User-specific situational awareness, led by DoD

Establish a comprehensive proactive safety management approach, led by the FAA

Environmental protection that allows sustained aviation growth, led by the FAA

Develop a system-wide capability to reduce weather impacts, led by the Department of Commerce

Harmonize Equipage and operations globally, led by the FAA

The creation of the teams, however, is just a first step in achieving the JPDO's mandate. As pointed out in the plan, the full benefits from complex investments and assuring protection of public safety can only be realized through a genuine public and private industry partnership. The JPDO is currently formalizing a public-private partnership.

In a speech to the Aerospace Industries Association, FAA Administrator Marion Blakey characterized the need for industry involvement in the JPDO: "We want to make sure that the preliminary technical plans we propose have the benefit of private sector expertise before they are delivered to these august bodies. And of course, we need the finest and most creative minds working on the task of creating the Next Generation System."

The Administrator also remarked that "Given the JPDO's unique structure and mission and the Administration's commitment to develop innovative public-private partnerships, we are employing a blend of traditional and non-traditional mechanisms to help foster and expand our 'engage and then decide' outreach process."

To encourage private industry participation, the Administrator announced the creation of the NGATS Institute, chaired by the presidents of the Air Traffic Control Association and the Air Transport Association, and managed by the National Center for Advanced Technologies. The new institute is an alliance among organizations representing major aviation stakeholder communities, who are recruiting, selecting, and assigning private sector experts and technical resources to participate on the JPDO integrated product teams and perform additional technical work.

Testifying to the U.S. House of Representatives Transportation & Infrastructure Aviation Subcommittee in April, John Douglas, president and chief executive officer of the Aerospace Industries Association of America explained the role of the Institute "Joint operations by the JPDO and the Institute will unite researchers, regulators, producers, organized labor, and operators in the construction of a safe and flexible Next Generation Air Transportation System."

Mr. Douglas further pointed out "Stakeholder involvement will bring capabilities and insights to the JPDO that would not otherwise be available. Broad user involvement representing all segments of the aviation community is key to defining the architectural and operational needs for the NGATS. Involving the users, operators and providers will ensure that the new aviation system can be practically deployed, and safely and efficiently operated. The JPDO will benefit from the extensive experience industry stakeholders have gained through the transformational initiatives with other agencies. Manufacturers of aircraft, aircraft systems and air traffic systems will, for example, provide broad systems engineering skills, technology readiness awareness, and business case understanding to support the definition of an optimized architecture and timeline for deployment."▶

Creating Partnerships

United Airlines pilot and Air Force reserve colonel Dale Goodrich is the NGATS first executive director. The executive director, selected by an Executive Committee of the Council, manages the day-to-day operations of the institute. A sixteen member Institute Management Council that is broadly representative of the aviation stakeholder community will manage the organization.

Chaired by James C. May, president and CEO of the Air Transport Association (ATA), and Paul P. Bollinger, Jr., president of the Air Traffic Control Association (ATCA), the Council has one seat each for regional airlines, business aircraft operators, helicopter operators, small aircraft general aviation, commercial pilots, air traffic controllers and airport operators. Two seats are allocated for aircraft manufacturers (including piloted and unpiloted vehicles) and manufacturers of air, space, and ground-based equipment. Two additional seats are also intended for federal advisory committees, universities, and nonprofit research organizations - and two seats are for participants at large.

The NGATS Council includes:

John S. Carr of the National Air Traffic Controllers Association, representing air traffic controllers;

Greg Principato of the Airports Council International - North America, representing airport operators;

Duane E. Woerth of the Air Line Pilots Association, representing commercial pilots;

David S. Watrous of RTCA and Steve Hampton of Embry-Riddle Aeronautical University, representing federal advisory committees, universities, and non-profit research organizations;

Roy Resavage of the Helicopter Association International, representing helicopter operations,

John W. Douglass of the Aerospace Industries Association and Peter J. Bunce of the General Aviation Manufacturers Association, representing manufacturers;

Deborah C. McElroy of the Regional Airline Association, representing regional commercial airline operations;

Phil Boyer of the Aircraft Owners and Pilots Association, representing small-aircraft general aviation operations; and

Henry Ogrodzinski of the National Association of State Aviation Officials, Ed Bolen of the National Business Aviation Association, and Bill Connors of the National Business Travel Association, serving as at-large representatives.

May and Bollinger, along with John W. Douglass, Aerospace Industries Association president and CEO, Phil Boyer, president of the Aircraft Owners and Pilots Association, and Duane E. Woerth, president of the Air Line Pilots Association, make up the Executive Committee. The JPDO Director, the FAA's Charlie Keegan, serves in a non-voting capacity.

Participation is free of charge, and open to everyone. The Institute will hold at least one public meeting pR&D Reviewnd comments will be invited in an annual report.

For additional information on the NGATS Institute, email ncat@ncat.com. For information on the JPDO please email 9-awa-jpdo@faa.gov.04.

And the Winner is?

Aviation Weather Research Program Lead Finalist for Service to America Medal

The Partnership for Public Service and Atlantic Media recently recognized Gloria Kulesa, the FAA's Aviation Weather Research Program Lead, lead Gloria Kulesa as one of this year's finalists for the Service to America Science and Environment Medal. Ms. Kulesa was selected as a finalist from this year's 500 nominees; 9 finalists be chosen as medal recipients. The Service to America Medals recognize the accomplishments of America's outstanding public servants. The winners will be publicly announced and honored at a gala reception on September 28, in Washington, DC's Andre Melon Auditorium.

Gloria Kulesa named as finalist for the 2005 Service to America Science and Environment Medal.

Kulesa's nomination points out that she "is doing what many have thought impossible - understanding weather science and using that knowledge to develop new aviation weather forecasting tools that are improving aviation safety and capacity." Under her leadership, new research has produced many significant accomplishments.

In the past year alone, the weather research program has developed:

- Current Icing Potential And Forecast Icing Potential Products: In-flight icing presents a major concern for general aviation, regional carriers, and air taxis. Even a thin coat of ice on an aircraft surface can seriously affect flight safety by decreasing lift, increasing aircraft weight, and increasing drag. To remedy this problem, the aviation weather research program developed a diagnostic product and a 12-hour forecast product. These tools enable users to better anticipate where icing hazards are going to occur so air traffic controllers can make more informed decisions when assigning altitudes to aircraft.

- Aviation Digital Data Service: The Aviation Digital Data Service is a tool that is available 24/7 on the Internet, providing pilots, airline dispatchers, and other users easy access to up-to-date weather data.

- Terminal Ceiling And Visibility Product: A new capacity-enhancing tool that forecasts marine stratus (fog that forms over coastal areas) is now operational at San Francisco International Airport. When this condition is present, the airport cannot use the independent parallel approaches to its closely spaced parallel runways. Air traffic controllers must impose delay programs to regulate the flow of traffic until the fog dissipates, and the air traffic arrival rate is cut in half. The new system, developed by the FAA and operated by the National Weather Service, accurately forecasts when the marine stratus will clear. Prior to the use of this tool, the airport could not have resumed use of its parallel runways until the fog actually dissipated.

Applied weather research led by Ms. Kulesa is enhancing the safety of the flying public as well as helping to reduce delays in the national airspace system. Based upon independent benefit analyses, aviation weather research program products provide capacity and efficiency benefits that exceed more than $150 million/year, nationwide. The benefits provided by her research results are significant, users have only praise for the products and she has broad support for her work from within the FAA, in the United States Congress and throughout the aviation community.▶

And the Winner is?

Through Kulesa's leadership, the research program is developing new safety, efficiency, and capacity enhancing products based on emerging technology and is making these products accessible to aviation users. Weather research efforts have gained an operational focus on outcomes and are now extensively coordinated with the research of government agencies, industry, and other institutions.

In addition to her scientific research activities, this program manager actively encourages today's students to think about careers in science. She participates in an annual forum for high school students held at Howard University's summer weather camp. She also find means to work with non-engineers and non-scientists, explaining the science of weather forecasting and challenging them to catch the "weather bug." Her community interest does more than inform others about her program - it also builds program advocacy.

While Ms. Kulesa is the only federal employee in the FAA's Aviation Weather Research program, she has created a consortium of federal laboratories to explore weather-related aviation science. She provides research grants to: the National Oceanic and Atmospheric Administration (NOAA) Environmental Technology Laboratory; NOAA's Forecast Systems Laboratory; FAA's own William J. Hughes Technical Center; the Naval Research Laboratory; MIT's Lincoln Labs; and the National Center for Atmospheric Research. And within her own program, she encourages and mentors her colleagues to share their efforts with the full scientific community.

The Weather Program's research has resulted in 18 scientific patents. Its researchers have also published 500 papers in proceedings of professional conferences - including those sponsored by the American Meteorological Society, the Society of Automotive Engineering International Ground Deicing Conferences, and the American Institute of Aeronautics and Astronautics. Program participants have also published more than 200 technical papers and articles through other professional channels. Research products developed under the Kulesa's leadership have received accolades from users, and her program has received many formal awards and considerable recognition. Examples include the 2002 FAA "Excellence in Aviation Award" and the United States National Weather Association's "Aviation Meteorology Award." R&D Review

Hot off the Press!

FAA's Latest Technical Reports

Steven J. Lundin, Charles E. Frankenberger, and Richard B. Mueller UNCONTAINED ENGINE DEBRIS FIRE MITIGATION TEST-FUSELAGE-MOUNTED ENGINES (DOT/FAA/AR-05/3). Uncontained engine failures can liberate fragments that can penetrate the fuselage. In a few cases, fragments severed pressurized fuel lines in aft engine airplane configurations. The FAA sponsored this effort, to test commercially available technologies that could improve aircraft safety.

These tests investigated the viability of suppressing aircraft fires induced by uncontained engine failures, specifically in fuselage-mounted engine configurations. Six contractors participated in the tests, providing detectors and suppressors for evaluation. A total of 55 tests were conducted with 7 suppression and 5 detection technologies. Some tests were conducted in airflow and some with actual blade fragment impacts. This report documents the results of tests conducted during July and August 2002 at the Naval Air Warfare Center, China Lake, Ca.

S.J. Hooper and M.J. Henderson DEVELOPMENT AND VALIDATION OF AN AIRCRAFT SEAT CUSHION COMPONENT TEST-VOLUME I (DOT/FAA/AR-05/5,I). This report describes the methodology that was employed to develop and verify the pass-fail criteria associated with the aircraft Seat Cushion Component Test. This component test provides a pass-fail criterion based on an "equivalent or improved level of safety" and will be used in comparative tests of the certified bottom seat cushion and a candidate replacement cushion. The successful component test of a candidate replacement bottom seat cushion shows that its design satisfies the applicable lumbar load injury criterion specified in Title 14 Code of Federal Regulations 25.562 or Technical Standard Order C127a.

Todd Jones, John W. Rustenburg, Donald A. Skinn, and Daniel O. Tipps STUDY OF SIDE LOAD FACTOR DURING AIRCRAFT GROUND OPERATIONS (DOT/FAA/AR-05/7). The primary objective of this study was to support the FAA Operational Loads Monitoring Research Program by developing new and improved methods and criteria for processing and presenting commercial transport airplane ground loads usage data. The scope of activities performed involved: (1) defining the service-related factors that affect the operational life of commercial aircraft; (2) designing an efficient software system to reduce, store, and process large quantities of optical quick access recorder data; and (3) reducing, analyzing, and providing processed data in statistical formats that will enable the FAA to reassess existing certification criteria. Equally important, these new data will also enable the FAA, the aircraft manufacturers, and the airlines to better understand and control those factors that influence the structural integrity of commercial transport aircraft.

The data presented in this report will provide the user with information comparing the side load factors encountered during ground maneuvers for airplane models B-747-400, B-767-200, B-737-400, CRJ100, and A320 in actual operational usage. The University of Dayton Research Institute database used for this report consisted of 95,862 flight hours for the B-747-400; 44,990 flight hours for the B 767-200; 89,269 flight hours for the B-737-400; 463 flight hours for the CRJ100; and 30,817 flight hours for the A320. ▶

Hot off the Press!

Richard E. Lyon Ph.D. and David Blake **HEAT RELEASE RATE OF OBJECTS BURNING IN CARGO COMPARTMENTS** (DOT/FAA/AR-TN05/9). The heat release rate of objects burning in a relatively large, simply-ventilated cargo compartment is reconstructed from the oxygen consumption history of the exiting gas stream, assuming perfect mixing of the combustion gases in the compartment. The model was calibrated using a premixed propane gas burner to generate a variety of well-defined heating histories. Qualitative agreement between actual and computed heat release rate histories is obtained when the duration of the burning is on the order of 1/2 of the mixing time of the compartment. This research supports efforts by the FAA to develop new certification requirements for aircraft cargo compartment fire detectors.

Holly M. Cyrus **LIGHT EMITTING DIODE TAXIWAY EDGE LIGHTS EMISSIONS EVALUATION** (DOT/FAA/AR-TN05/10). This study was conducted to evaluate taxiway edge fixtures using light emitting diode (LED) technology to determine (1) if electrical emission levels from these fixtures are sufficient to cause interference to airfield circuits and warrant further investigation and (2) if there is a need to change the certification requirements for these electrical emissions. Five LED fixtures from different manufacturers were tested. The airfield lighting test bed located at the William J. Hughes Technical Center was used to measure the emissions of the fixtures.

Electrical emissions occur in two forms, harmonic and nonharmonic. Harmonics are a distortion of the normal electrical frequencies emitted by the LED fixtures, which can cause problems with other equipment. Multiple electronic devices on a circuit, all emitting similar harmonics, can be additive and disruptive to the power distribution network. Harmonic emissions can cause voltage variations and overheating of the airfield circuit wiring. Nonharmonic emissions are a result of the circuitry in the power supply, which causes frequencies that are multiples of the power supply switching frequency. This can cause interference on the electrical circuit. The current certification requirements contain procedures to test for emissions, with the lowest frequency being 150 Hz. The data from this study showed that four out of five fixtures had significant emissions that could possibly cause interference. These emissions were at a frequency as low as 12 kHz, which is much lower than the current certification requirements of 150 Hz, and warrants a change in the certification requirements.

Yuqiao Zhu and Keith Kedward **METHODS OF ANALYSIS AND FAILURE PREDICTIONS FOR ADHESIVELY BONDED JOINTS OF UNIFORM AND VARIABLE BONDLINE THICKNESS** (DOT/FAA/AR-05/12). Researchers analyzed adhesively bonded joints under tensile lap shear loading using the finite element method and closed-form solutions. They compared predictions of the stress distribution and failure prediction with experimental failure load data. They performed case studies that addressed the finite element meshing strategies of adhesively bonded joints such as h- and p- methods, mesh density around the overlap regions, element types. They also made comparisons with available closed-form solutions.

Titanium single lap joints were analyzed using a linear analysis and the effects of bondline thickness and fillet were investigated. Parametric studies showed that the maximum strength of the adhesively bonded single lap joint increased with decreasing adhesive thickness. The researchers investigated the proposed use of varying adhesive layer thickness to reduce the stress singularity by profiling the adherends' thickness quadratically or linearly to reduce or eliminate the shear stress concentration at the ends. Preliminary analysis on the effect of variable thickness along the overlap direction showed that maximum stress occurred at the end of least thickness. Further analysis on profiling the adherend thickness to reduce the stresses at the ends is recommended. To support and validate the analysis, researchers tested single lap joints with uniform and variable bondline thickness. The specimen used titanium adherends and 3M's DP460 adhesive. Finally, they performed nonlinear analyses of titanium single lap joints, taking into consideration the ductility of the adhesive; the predicted failure load was shown to be 10% less than the test failure load. The cause of this lower prediction is discussed, and future work is suggested. R&D Review

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