Airport & Aircraft Safety R&D Notes

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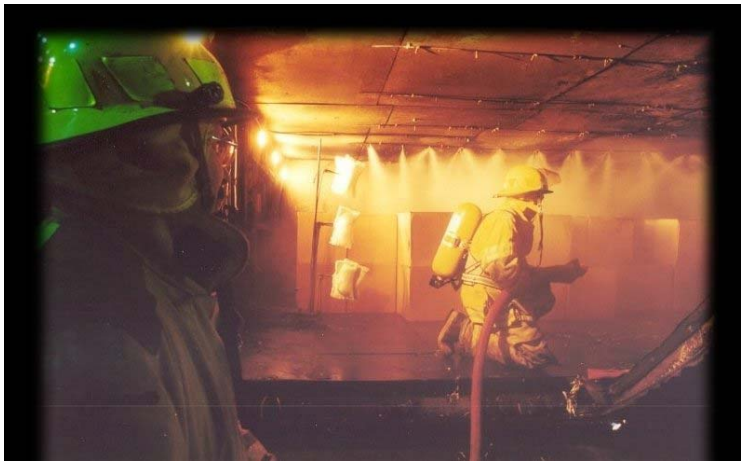
New Fire Suppression System Evaluated

The effectiveness of a new fire suppression system, employing water mist for initial fire knockdown and nitrogen for inerting against a deep-seated fire, was evaluated during full-scale cargo compartment tests using a series of standard cargo fires. Currently, commercial aircraft employ Halon 1301, an extremely effective extinguishing agent, to protect against cargo compartment fires. However, by international agreement, halon is no longer being produced because it is a chemical that depletes the stratospheric ozone layer. The availability of halon is diminishing, and there may be use restrictions. The test showed that the hybrid water mist and nitrogen system met the minimum performance standard for nongaseous halon replacement agents developed recently by the Fire Safety Branch, AAR-440. Moreover, cargo compartment temperatures were lower than with halon, and the weight of water consumed was less than the weight of halon that would have been needed to extinguish the test fires.



Testing of the water mist system

The test program was initiated by a recommendation from the International Aircraft System Fire Protection Working Group, chaired and administered by AAR-440. Comprised of government and industry fire safety specialists, the working group recommended two halon replacement systems for FAA tests: pentafluoroethane and water mist/nitrogen gas. Tests completed with pentafluoroethane were disappointing in that the agent did not consistently suppress cargo fires, there were anomalous test results, and use of the agent would require an unacceptable large weight penalty. Although not fully tested, a water mist/nitrogen system has a number of significant advantages: environmentally friendly, nontoxic and readily abundant agents.

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A water mist/nitrogen gas system would have two additional potentially major safety advantages. First, the nitrogen gas could be available from an onboard inert gas generation system (OBIGGS), used to inert fuel tanks to protect against an explosion. The dual application of nitrogen for fuel tank inerting and cargo compartment fire suppression would significantly offset the weight and cost of an OBIGGS. Second, water for cargo compartment fire protection could also be used for a cabin water spray system, which in past FAA

full-scale fire tests was shown to be capable of providing a significant increase in postcrash fire survivability.

The water mist/nitrogen gas system was evaluated in the 130-foot-long, "TC-10" fuselage test article located at the Full-Scale Fire Test Facility, Building 275. Its effectiveness was examined against four cargo fire scenarios: bulk-load fire, container fire, surface burning fire, and aerosol can explosion. Each fire test scenario was repeated five times for a total of 20 tests. The performance of the water mist/nitrogen system was impressive. Peak cargo temperatures were reduced by 35%-60% compared to the halon system. The quantity of water required ranged from 22-73 pounds, as compared to 80 pounds of halon that would be needed.

The test results are documented in final report DOT/FAA/AR-01/121, "The Evaluation of Water Mist With and Without Nitrogen, as an Aircraft Cargo Compartment Fire Suppression System," written by John Reinhardt, AAR-440. Support was provided by Leroy Dickerson, AAR-440, and Paul Scrofani, Matt Dutton, Rick Whedbee, Brian Meisenhelter, Joe DeFalco, and Frank Gibbons, all from Galaxy Scientific Corporation, during the extensive and successful fire test program.

Gus Sarkos, AAR-440, (609) 485-5620.

FAA and Florida A&M University: A Strategic Partnership

In March 2001, the Airport and Aircraft Safety Research and Development Division established the new FAA General Aviation (GA) Center of Excellence (COE) with Embry-Riddle Aeronautical University (ERAU) as the lead institution. Florida Agricultural and Mechanical University (FAMU) was one of the other four universities selected to be members of this GA COE, called the Center for General Aviation Research (CGAR).

Florida Agricultural and Mechanical University (FAMU), a Historically Black College and University (HBCU) located in Tallahassee, Florida, proposed to establish a strategic partnership with the FAA. A major goal of such a partnership would be to develop an aviation safety curricula and an aviation R&D capability at FAMU that would be both supportive of, and responsive to, FAA needs. Other goals included establishing an aviation R&D Laboratory, providing the aviation industry with a pool of qualified minority graduates, and providing outreach scholarship opportunities to minority high school students interested in pursuing aviation careers. Chris Seher, Program Director of the Airport and Aircraft Safety R&D Division (AAR-400), seeing this as an opportunity to further the FAA's commitment to diversity, pursued the partnership.

Seher assigned Dr. Ron Lofaro of AAR-400 as the FAA on-site person at FAMU. Dr. Lofaro's responsibilities include providing an FAA interface with CGAR and providing guidance on the aviation course and curricula development. Dr. Lofaro, as a visiting professor, will also teach courses and workshops at FAMU.

At FAMU, Dr. Raju has developed an initial aviation option, to be offered at FAMU's College of Engineering Technology and Agriculture, Division of Engineering Sciences and Technology, beginning in the fall of 2002. This 27-credit-hour option is to be available to all students in FAMU's Bachelor of Science (B.S.) program in Manufacturing/Industrial Engineering Technology. The aviation option consists of foundation courses in aviation, air transport and flight/maintenance; manufacturing techniques and processes for aviation, such as composite materials; and in aviation management. The option will be

expanded to form the basis for a future set of BS degrees in varying areas of aviation. The first of the courses to be taught in the aviation option is "Fundamentals of Aviation."

FAMU worked closely with industry partners, such as Boeing, in developing the aviation option, and will continue to do so as the curricula and courses for degrees in aviation are developed. Industry will also provide faculty to teach some of the courses in the aviation option. There will be numerous internship and co-op opportunities for FAMU students in the program. In this way, FAMU is responding to the current and projected needs of the industry and preparing its students to immediately step into the workforce upon graduation.

Dr. Ronald Lofaro, AAR-400/FAMU, (850) 412-7092.

COE Student of the Year Visits

FAA Centers of Excellence (COE) 2001 Student of the Year, Dr. Tasha Inniss, visited the Technical Center on February 19, 2002. Patricia Watts, Nelson Miller, Satish Agarwal, Michel Hovan, and other members of AAR-400, as well as members of the Technical Center Federal Women's Program, met with Dr. Inniss throughout the day. During a driving tour, Dr. Inniss became familiar with Technical Center research facilities that included the wind tunnel, fire testing facility, the Pavement Test Machine. Dr. Inniss met with Dr. Michel Hovan and discussed the impact of flocks of birds on aviation safety. Nannette Kalani conducted a tour of the Aviation Weather Lab (ACT-320), an area of particular interest to Dr. Inniss, as "the impact of weather on aviation procedures was a major component of my dissertation and the work I am currently doing for the FAA." This segment of her agenda included demonstrations by Tom Weiss of the production version of the Integrated Terminal Weather System (ITWS).

Dr. Tasha Inniss observing research during a Technical Center visit.

Dr. Inniss earned a Ph.D. in applied mathematics from the University of Maryland, a core member of the Center of Excellence for Aviation Operations Research (NEXTOR). Her doctoral dissertation was entitled "Stochastic Models for Estimating Airport Arrival Capacity Distriutions." Through this research, Dr. Inniss developed statistical models to estimate airport arrival capacity distributions (ACDs) during inclement weather conditions. Administrator Jane Garvey presented Tasha with the FAA Centers of Excellence Student of the Year Award at the NEXTOR Airport and Airspace Congestion Workshop held at the University of Maryland in March 2001.

In carrying out her doctoral research under the direction of Dr. Michael Ball, University of Maryland professor and Co-Director of NEXTOR, Dr. Inniss worked at length with both the FAA and the airlines on a regular basis. This experience prepared Dr. Inniss to serve in her current capacity as a Visiting Researcher in the Investment Analysis and Operations Research Division (ASD-430) under the direction of Norm Fujisaki, ASD-2, and Bob Bernard, ASD-400. Dr. Inniss also is a Clare Boothe Luce Professor of Mathematics at Trinity College.

Additionally, Dr. Inniss is currently assisting the FAA in student recruitment and outreach efforts. She joined Dr. Watts during a briefing to FAA Headquarters HR/Training representatives presenting COE accomplishments and opportunities. She is now working with Dr. Watts and FAA Headquarters

organizations to use the Air Transportation Centers of Excellence academic partners to help the agency in recruiting MBA and other students to meet various organizational staffing and research needs.

Patricia Watts, AAR-400, (609) 485-5043.

In Brief

Department of Defense Ice Detection and Removal Tests — During the week of April 22-26, 2002, Edward Pugacz, AAR-470, participated in Department of Defense (DoD) tests of the two currently available wide area ice detection systems. The ice detection systems were supplied by Cox and Company and Goodrich Sensor Systems. The tests were conducted in the McKinley Climatic Laboratory located at Eglin Air Force Base, Florida. The DoD is exploring a combination of infrared deicing, forced air deicing, and non glycol fluid deicing, coupled with ice detection, to lessen their dependence on glycol-based deicing fluids. They are also exploring nondeicing fluid methods of removing frozen contamination from helicopters. Helicopters cannot be deiced using currently available deicing fluids because these fluids are incompatible with helicopter rotor mechanisms.

Edward Pugacz, AAR-470, (609) 485-5707.

NRC Workshop on Fire Safety Needs — Dr Richard Lyon, AAR-440, at the request of the National Science Foundation, attended a workshop by the National Research Council to identify innovative research needs to improve fire safety in the U.S. The workshop reviewed the current state of knowledge of research, education and training, technology transfer, and development of practices and products in the fire safety field. The workshop covered the following areas: fire and explosion issues, materials and retardant issues, fire protection systems, fire protection engineering tools, structural performance issues, human behavior issues, and public policy issues. A major goal of the workshop was to determine what research would have the most immediate and greatest impact on fire safety.

Gus Sarkos, AAR-440, (609) 485-5620.

Safety and Security Task — On April 2, 2002 representatives from the Transportation Security Administration (TSA), Transport Airplane Directorate (TAD), Office of Policy and Plans (APO-320) and the former Airworthiness Assurance R&D Branch (AAR-430) met at the William J. Hughes Technical Center to discuss a proposed project entitled "Systems Approach to Overall Aircraft Safety and Security." During the meeting, existing efforts in TSA and AAR-400 were reviewed, and the group defined the following objective: "Develop a plan to support the TAD and TSA in performing systems analysis and cost benefit studies as needed to determine the best mix of methodologies and technologies for improving aircraft security without compromising aircraft safety, and recommend R&D when and where needed to accomplish these purposes."

Bill Emmerling, AAR-460, (609) 485-4009.

Continuing Analysis and Surveillance System (CASS) Research Project — Risk Analysis Branch personnel participated in a progress review meeting on April 15 with their sponsor (AFS-300) and contractors. The purpose of the CASS research project is to develop a generic model that will be used by FAA inspectors and industry maintenance personnel to effectively comply with the intended meaning for FAR Part 121.373. About two dozen FAR Parts 121 and 135 operators, several Flight Standards District Offices (FSDOs), and AFS and ASY organizations have been interviewed for inputs. The National Air Carrier Association, the Air Transport Association, and the Regional Airline Association have also been interviewed and briefed of the CASS research project. The input is being analyzed and a summary

technical report will be released. Based on the inputs and research results, a CASS model will be developed and is scheduled for delivery to the sponsor by September 2002.

Michael Vu, AAR-490, (609) 485-8143.

Airport Technology Transfer Conference — The FAA held its fourth Airport Technology Transfer Conference May 5-8 at the Tropicana Hotel in Atlantic City, New Jersey. The theme of this year's conference was Trends in Airport Technology for the New Millennium. Spencer Dickerson of the American Association of Airport Executives opened the conference and introduced U.S. Congressman Frank A. LoBiondo as the keynote speaker. Marion Blakey, Chairman of the National Transportation Safety Board; Arlene B. Feldman, Regional Administrator for the FAA Eastern Region; and Dr. Anne Harlan, Director of the William J. Hughes Technical Center Director were the guest speakers at the conference. Approximately 165 experts in airport safety and pavements representing the United States and 12 foreign nations, Australia, Brazil, Canada, France, Hong Kong, Japan, the Netherlands, Norway, Papua New Guinea, Russia, Taiwan, and the United Kingdom, attended the conference. Over 60 technical papers were presented including several from the researchers at the Technical Center's Airport Technology Branch. The attendees also toured two of the FAA's unique research facilities, The National Airport Pavement Test Facility and the Fire Test Facility.

Dr. Satish K. Agrawal, AAR-410, (609) 485-6686

Aircraft – Ground Deicing — On April 10-13, 2002, the AAR-470 manager participated in activities of the aircraft deicing fluid aerodynamic working group at the University of Quebec at Chicoutimi (UCAC), Canada. In attendance were representatives from fluid testing laboratories, Transport Canada, major aircraft manufactures, and the airlines. The thrust of the meeting addressed issues associated with the review and assessment of the adequacy of the current SAE Standard (AMS-1428) for specifying the aerodynamic flow-off performance of Type II & Type IV anti-icing fluids. Recently there have been concerns raised by several European airlines relative to the residue left by spent Type IV fluid in certain aerodynamically quiet areas of their aircraft. The FAA has served as the lead in providing for the review of fluid certification results by UCAC to ascertain and compare aerodynamic performance data of current production Type II and Type IV fluids. Results from the ongoing investigation could possibly lead to additional research to establish separate aerodynamic standards for Type II and Type IV fluids. Currently, both fuel types have the same performance standards.

Charlie Masters, AAR-470, (609) 485-4135.

Reports Corner

Temporary Installation Methods for PAPI/A-PAPI Systems, AR-01/111— Airports have a need to temporarily install a precision approach path indicator (PAPI) or an abbreviated PAPI (A-PAPI) to provide accurate approach slope guidance when a runway threshold is temporarily displaced due to construction or maintenance projects. This report describes three temporary installation methods that were effective in maintaining proper aiming angles within the FAA Advisory Circular 150/5345-28 limitations.

Software Service History Handbook, AR-01/116— The handbook is intended to aid industry and the FAA in the formulation and evaluation of product service history data for certification credit.

Software Service History Report, AR-01/125— This report represents the results of research in this area, for use by the FAA in formulating new guidance and prioritizing future research work in the area of product service history.

Study of the Factors Affecting the Sensitivity of Liquid Penetrant Inspections: Review of Literature Published From 1970 to 1998, AR-01/95— This report summarizes the factors that can have an effect on the sensitivity of a liquid penetrant inspection (LPI). The intent of this task was to identify and organize the body of work that has led to current LPI practices as well as help the FAA guide future research efforts regarding LPI procedures.

Probabilistic Design of Damage Tolerant Composite Aircraft Structure, AR-01/55— Under this effort, a methodology for calculating reliability of composite aircraft structures was developed and is contained in the software Probabilistic Design of Damage Tolerant Composite Structures (ProDeCompoS).

A Study of Helicopter Crash-Resistant Fuel systems, AR-01/76— This report presents the historical efforts that led to the current state of the art in military helicopter fuel systems and describes the basic research, testing, field investigations, and production efforts that have led to the crash-resistant fuel system.

The Evaluation of Water Mist With and Without Nitrogen as an Aircraft Cargo Compartment Fire Suppression System, AR-01/121— This report documents the full-scale evaluation tests of a water mist system, with and without nitrogen that would be available from an onboard inert gas generation system on a series of standardized aircraft cargo fires.

Microscale Combustion Calorimeter AR-01/117— This report describes a method for measuring the heat release rate of milligram-sized samples.

Options to the Use of Halons for Aircraft Fire Suppression Systems—2002 Update, AR-99/63— This report documents the full-scale evaluation tests of a water mist system, with and without nitrogen, that would be available from an onboard inert gas generation system against a series of standardized aircraft cargo fires.

A Study of Transport Airplane Crash-Resistant Fuel Systems, AR-01/82— This report covers the historical studies related to aircraft crash fires and fuel containment concepts undertaken by the FAA, NASA, and the U.S. Army, which ultimately led to the current state of the art in crash-resistant fuel system technology.

Damage Resistance Characterization of Sandwich Composites Using Response Surfaces, AR-01/71— The influence of material configuration and impact parameters on the damage resistance characteristics of sandwich composites made of carbon-epoxy woven fabric facesheets and Nomex honeycomb cores were investigated using empirically-based response surfaces. A series of carefully selected tests were used to isolate the coupled influence of number of facesheet plies, core density, core thickness, impact energy, impactor diameter, and impact velocity on the damage formation due to impact normal to the surface.

For copies of these or any other reports produced by the Airport and Aircraft Safety R&D Division, contact Jim Lignugaris, at (609) 485-4431.

Personnel Notes

Thomas J. (T.J.) O'Brien retired after 31 years in Federal service, most recently as Deputy Program Director of the Airport and Aircraft Safety Research & Development Division. T.J. spearheaded efforts for the Division in interaction and coordination with the Department of Defense (DoD), leveraging FAA resources with those of DoD in a number of areas critical to aviation safety. Additionally, he instituted the use of the Joint Aeronautical Commanders Group (JACG) computerized system for managing all projects

in the Division and worked closely with research sponsors to finalize process documentation for the development and prioritization of sponsor research requirements.

Paul Boris retired after almost 42 years in Government service, split between the FAA and the U.S. Air Force. Most recently, Paul worked on research and test developments to enhance aircraft safety during hazardous winter operations. Working for the Air Force during the period of 1968-1975, he participated in the development of the Minuteman Intercontinental Ballistic Missile (ICBM). Returning to the FAA in 1976, Paul worked on a variety of aircraft safety programs and participated in the design of the Fire Test Laboratory for evaluating aircraft components. Paul received the Administrator's Award in 1999 for Environmental Excellence in Mitigation of Environmental Impact.

Dr. Catherine A. Bigelow has been selected to fill the position of Deputy Program Director of the Airport & Aircraft Safety Research & Development Division. Since coming to the Technical Center from NASA Langley in 1994, Cathy has served ably in numerous positions of increasing responsibility including Aging Aircraft Research Program Manager and, most recently, Branch Manager of the Airworthiness Assurance R&D Branch. Cathy received her MS in Civil Engineering in 1977 and her Ph.D. in Civil Engineering in 1984, both from Georgia Institute of Technology.

Nelson Miller will be taking on the duties of FAA/NASA Aviation Safety and Security Program Director. NASA is currently formulating plans for another five-year commitment to Aviation Safety R&D and Nelson will be responsible for coordinating not just aircraft safety R&D but all areas including communication, navigation, and surveillance, air traffic management, environment and energy, human factors and security. Nelson was most recently the manager of the Aircraft Safety Research and Development Branch.

Paul Swindell joins the Airworthiness Assurance Branch on a one-year detail from the Naval Air Systems Command at Lakehurst, NJ. He will be working on nondestructive inspection equipment.

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