Transport Certification Update

Certification Information for the Aviation Industry & Designees

Edition 22
Spring 1997

Certification of Boeing's "Next-Generation" 737 Models

...see article on page 25

From the Directorate Manager...

Ronald Wojnar

Since the Fall 1996 edition of the *Update* was released, the FAA has seen several changes in personnel who have been occupying significant positions:

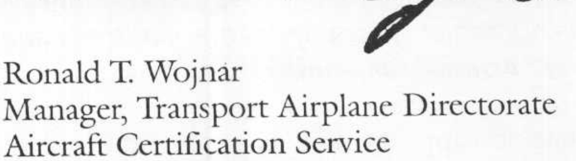
- Secretary of Transportation, **Federico Peña**, was recently selected to become the new Secretary of Energy. **Rodney M. Slater** has been tapped as Peña's replacement at the Department of Transportation.
- The FAA Administrator, **David R. Hinson**, stepped down shortly after the Presidential elections in November 1996. **Barry Valentine**, who has been serving for the past several years as the FAA's Associate Administrator for Policy, Planning, and International Aviation, is replacing Hinson on a temporary basis until a new Administrator is appointed.
- The FAA's Deputy Administrator, **Linda H. Daschle**, also stepped down shortly after Hinson.
- As reported in the last edition of the *Update*, the long-time Associate Administrator for Regulation and Certification, **Anthony J. Broderick**, retired. He is succeeded by **Guy S. Gardner,** who had been serving as the Director of the FAA's William J. Hughes Technical Center.
- **Frederick Isaac**, Regional Administrator for the Northwest Mountain Region for the past 10 years, retired earlier this year. He is succeeded by **Larry Andriesen,** who previously had been the Deputy Regional Administrator.

Within the Transport Airplane Directorate, there have been changes as well:

- **Dayton O. Curtis**, who was for many years the Directorate's Aging Aircraft Program Manager, retired at the end of 1996. He has been succeeded by **Dorenda Baker**, who comes to the position via the Brussels and Long Beach Aircraft Certification Offices.
- **Bill R. Boxwell**, Manager of the Directorate's Flight Test & System's Branch, retired in January 1997. **John J. Hickey** recently was chosen to fill the position. Until that time, John was the Directorate's International Program Manager.
- The *Update's* own Editor-in-Chief and Directorate Airworthiness Directive (AD) Coordinator for the past 14 years, **R. Jill DeMarco**, has accepted a position with The Boeing Company. **Rose R. Upton** will be acting supervisor.

Each of the individuals has left behind a legacy of quality work and professionalism that will continue to have a positive effect on the FAA — as well as the aviation community — for many years to come. During their tenures in the agency, they witnessed times of many diverse demands, ever-changing technology, and complicated international issues. They faced each of these challenges by creating and facilitating solutions, not problems.

We are all the richer for their contributions.



Ronald T. Wojnar
Manager, Transport Airplane Directorate
Aircraft Certification Service

Barry Valentine Named Acting FAA Administrator

Barry L. Valentine

On January 23, 1997, former Secretary of Transportation Federico Peña named Barry L. Valentine as Acting Administrator of the Federal Aviation Administration (FAA). A pilot with more than 30 years of experience in aviation and government, Valentine will temporarily leave his current post as Assistant Administrator for Policy, Planning, and International Aviation until a permanent administrator is appointed.

"*Barry Valentine's vast knowledge of aviation issues, as well as his proven public service experience in all levels of government will be a tremendous asset for the FAA*," said Peña. "*Barry has been extremely valuable in President Clinton's efforts to promote and advance aviation safety and security in the United States and throughout the world. His career reflects a strong understanding and recognition of the importance of a strong and vibrant aviation community*."

Valentine's appointment as acting Administrator took effect Saturday, February 1. In this position, Valentine will oversee an agency with over 48,000 employees. The administrator is in charge of oversight and regulation of the nation's airspace system, which last year safely transported over 500 million people over 500 billion miles.

Valentine, 53, was appointed to the FAA as assistant Administrator for Policy, Planning, and International Aviation in March 1994. In that position he reported to, and worked directly with, the Administrator. Valentine's work included long-range strategic planning and setting national and international aviation policies, goals, and priorities. His responsibilities also involved oversight of national environmental and energy aviation policies.

Valentine served on the U.S. Senate Select Committee on POW/MIA Affairs from 1992 to 1993. There, he worked as Senate majority leader's staff representative and investigator on the panel to resolve the issue of Americans unaccounted for in Southeast Asia.

From 1987 to 1991, Valentine was airport manager for the Portland International Jetport in Maine. As manager of the Northern New England airport, he oversaw the entire operation of the facility. His work involved interaction with city councils, neighborhood associations, private companies, and various federal agencies, including the FAA.

Valentine also worked as Director of Aeronautics for the Maine Department of Transportation from 1983 to 1987. As the chief advisor to the governor of Maine on aviation issues, he initiated a host of successful air transportation programs and worked with the FAA to expand and develop the state's Biennial Airport Capital Program.

Valentine's career has spanned a wide range of aviation, private sector, and government related areas including:

- vice president and treasurer of Gleichman and Co., of Portland, Maine, from 1981 to 1983;
- district manager of the U.S. Census Bureau in Portland from 1979 to 1980;
- state representative to the Maine House of Representatives and administrative assistant to the majority leader from 1974 to 1978; and
- chief pilot and aircraft sales manager of York Aviation, Inc., from 1972 to 1973.

A captain and pilot in the U.S. Air Force from 1967 to 1972, Valentine was awarded the Distinguished Flying Cross and four air medals. An avid aviator, he first soloed at age 16, and has logged over 3,000 hours, including 1,000 hours of combat time, in more than two dozen types of aircraft ranging from single-engine light planes to multi-engine jet transports.

With a Bachelor of Science degree in management engineering in 1966 from Rensselaer Polytechnic Institute in Troy, New York, Valentine worked as an industrial engineer at the Portsmouth Naval Shipyard in Kittery, Maine, from 1966 to 1967.

President Clinton Swears In Rodney E. Slater as the Thirteenth Secretary of Transportation

On Friday, February 14, 1997, former Federal Highway Administrator Rodney E. Slater was sworn in as the thirteenth U.S. Secretary of Transportation in a private ceremony with President Clinton in the Oval Office. The oath of office was administered by Tennessee Federal District Judge Curtis Collier, a friend of Mr. Slater' s from his hometown of Marianna, Arkansas.

The 41-year-old Slater is an Arkansas native who has been Federal Highway Administrator since 1993. He was confirmed by the U.S. Senate by a vote of 98-0 on February 6. His nomination received the unanimous support of the Senate Commerce Committee on February 5.

President Clinton nominated Slater to be Secretary of Transportation December 20, stating, *" He is the right person to help us meet the many transportation needs and challenges we face as we enter the 2lst century."*

Current DOT Secretary Federico Peña said, *"I leave my current position knowing that my successor, Rodney Slater, will build and expand on the progress that he helped to achieve."* Peña, President Clinton' s nominee to be Secretary of Energy, will continue temporarily at the Department of Transportation as a transition advisor.

Prior to his Federal service, Slater was appointed chairman of the Arkansas State Highway Commission in 1992 after serving as a commission member since 1987. Among his other positions, he previously has served as Director of Governmental Affairs at Arkansas State University, deputy campaign manager and senior traveling advisor to the 1992 Clinton presidential campaign, Assistant Attorney General - Litigation Division at the Arkansas State Attorney General's Office, and secretary-treasurer of the Arkansas Bar Association.

He received a B.S. from Eastern Michigan in 1977, and a J.D. from the University of Arkansas School of Law in 1980.

FAA Names New Chief Scientist for Human Factors

Dr. George Donohue, the FAA's associate administrator for research and acquisitions, has named Dr. Maureen A. Pettitt as the FAA's chief scientific and technical advisor for human factors.

In her new capacity, Pettitt serves as the principal advisor to the FAA administrator on the agency's human factors research. She also heads the FAA division that provides scientific and technical support for the civil aviation human factors research program and for human factors applications in acquisition, certification, regulation, and standards.

"Human factors is one of the most important issues we have to deal with as we modernize the National Airspace System and make the transition to the 'free flight' environment," Donohue said. *"Dr. Pettitt brings us the qualifications and leadership skills we need during this challenging period."*

Pettitt replaces Mark Hofmann, who left the FAA at the end of September 1996. Dr. Jan Brecht-Clark, deputy director of the agency's office of aviation research, had filled in on an acting basis since then.

From 1993 until joining the FAA, Pettitt was an associate professor of aviation science at Western Michigan University in Kalamazoo, Michigan. There she served as co-director of two multi-year grants totaling $3.2 million to develop innovative flight education curricula and a comprehensive program to increase participation of women and minorities in aviation career fields.

Pettitt also was instrumental in establishing an international center for the commercial pilot training program for the university's school of aviation sciences, which required building a consensus among private and government participants in the United States and in Europe. The program was designed to meet the requirements of the FAA and the United Kingdom's Civil Aviation Authority.

From 1985 to 1993, Pettitt was a tenured associate professor at California State University in Los Angeles, serving as coordinator and primary instructor for the school's aviation administration degree program. She taught courses on subjects including general aviation operations and administration, airport administration, safety factors in aviation, aviation sales, air transportation, airline economics and administration, and space exploration issues and trends. She also was area coordinator for the aviation administration degree program.

Previously, Pettitt owned and managed a flight school and air charter business. She has written extensively on human factors and training issues, including co-authoring three articles in 1996 alone. One of them, *"Cockpit Leadership and Followership Skills: Training and Evaluation Methodologies,"* was published in the proceedings of the ICAO Third Global Flight Safety and Human Factors Symposium.

Pettitt has served as a consultant to TWA, Continental Airlines, and USAir on training and human factors issues, and she is a member of the Council on Aviation Accreditation and the University Aviation Association.

Pettitt holds a doctorate in education from Claremont Graduate School, a master of arts in vocational education from California State University in Los Angeles, and a bachelor of science in aviation technology management from California State University.

FAA Appoints New Chair For Research, Engineering & Development Advisory Committee

George Donohue, the Federal Aviation Administration (FAA)'s Associate Administrator for Research and Acquisitions, has announced the selection of Ralph Eschenbach, Vice President and Chief Technology Officer at Trimble Navigation Limited, Sunnyvale, California, to serve as chairman of the FAA's Research, Engineering and Development (RE&D) Advisory Committee.

Ralph Eschenbach brings exceptional skills to the committee, said Donohue. "His extensive experience will serve the agency well as we continue to meet the challenge to revitalize and modernize the National Airspace System. I am confident he will build on the excellent work of the outgoing chair, John P. Stenbit."

Eschenbach has been a member of the Advisory Committee since 1995, serving as a member of the National Airspace System R&D subcommittee.

Prior to assuming his duties as Vice President of Business Development, Eschenbach served as Trimble's Vice President of Engineering and Vice President of the Navigation Group. Before joining Trimble, he worked for Hewlett Packard Labs where he helped to develop a low-cost Global Positioning Satellite (GPS) receiver.

Eschenbach is an expert in GPS and aircraft navigation systems, circuit design, feedback system, and spread spectrum communications. He has published 30 papers and holds several patents. He also is a private pilot with over 2,000 hours, and holds a Bachelor of Science degree in electrical engineering from the University of California at Berkeley, and a Master of Science degree from Stanford University.

The FAA's RE&D advisory committee was established in 1989, as mandated by the Aviation Safety Research Act of 1988. The committee meets approximately three times per year to advise the FAA administrator on research and development issues and to coordinate the agency's RE&D activities with industry and other government agencies.

The board currently is comprised of 30 unpaid members, representing corporations, universities, associations, consumers, and government agencies. Dr. Andres Zellweger, FAA's Director of Aviation Research, serves as executive director of the advisory committee.

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Vice President Gore Announces Initiatives Requiring Retrofit of 737 Rudder Components

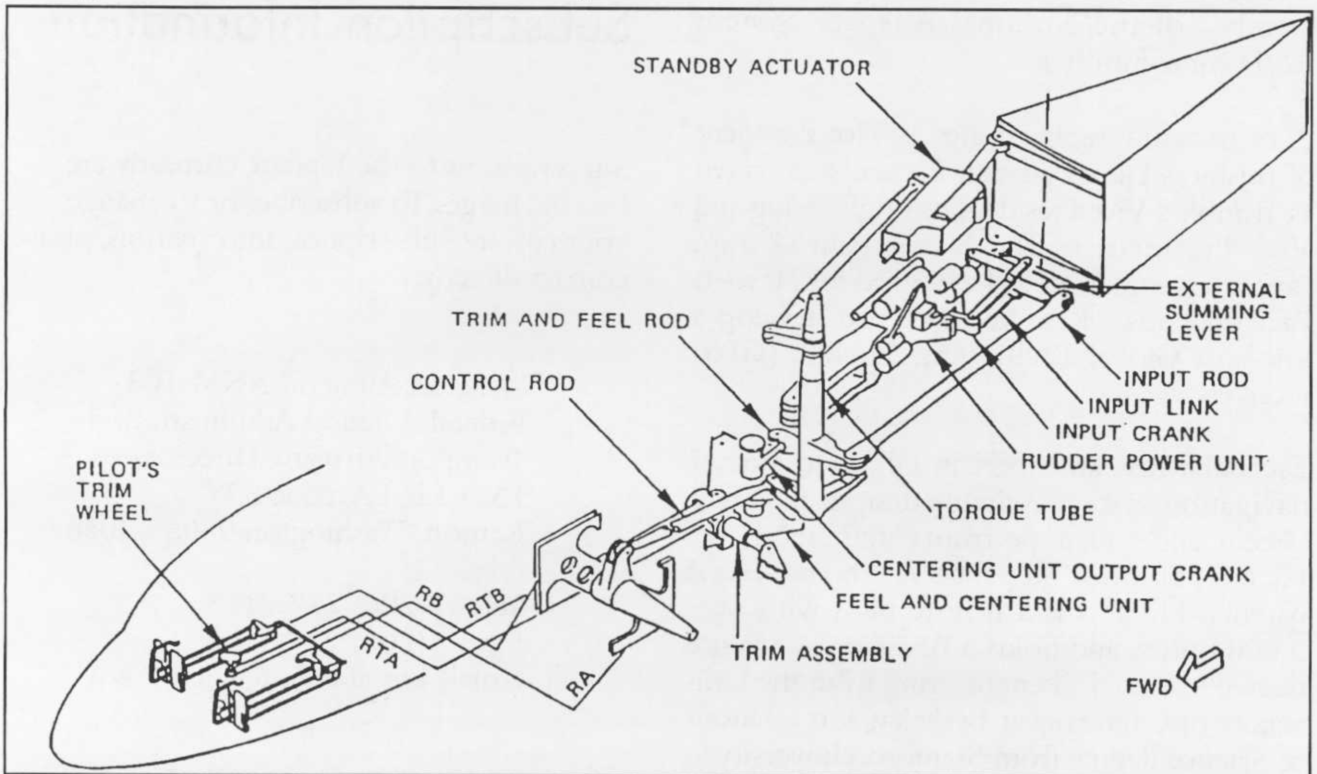
On January 15, 1997, Vice President Al Gore announced that the Federal Aviation Administration (FAA) — as part of its continuing aircraft operational safety program — intends to issue Airworthiness Directives (AD) requiring retrofit of four newly developed components into the rudder system of existing Boeing 737 aircraft. The AD's — a series of improvements to further minimize the already small risk of inadvertent 737 rudder movements — build on system advances developed by Boeing for inclusion in new Model 737's and other aircraft models.

Vice President Gore described the action as an important new step by government and industry to improve safety. Speaking at the conclusion of a major International Conference on Aviation Safety and Security, he said the FAA's initiatives "will enhance safety, in partnership with the aviation industry. And, [these initiatives] help set a tone for an expanded and more innovative approach to improving safety."

The New Proposed Rules

After Vice President Gore's announcement, the FAA issued two proposed AD's on March 7, 1997, which address four components of the Model 737 that would require retrofit with newly designed systems. In brief, those proposed rules concern the following:

Boeing Model 737-200 Rudder Control System



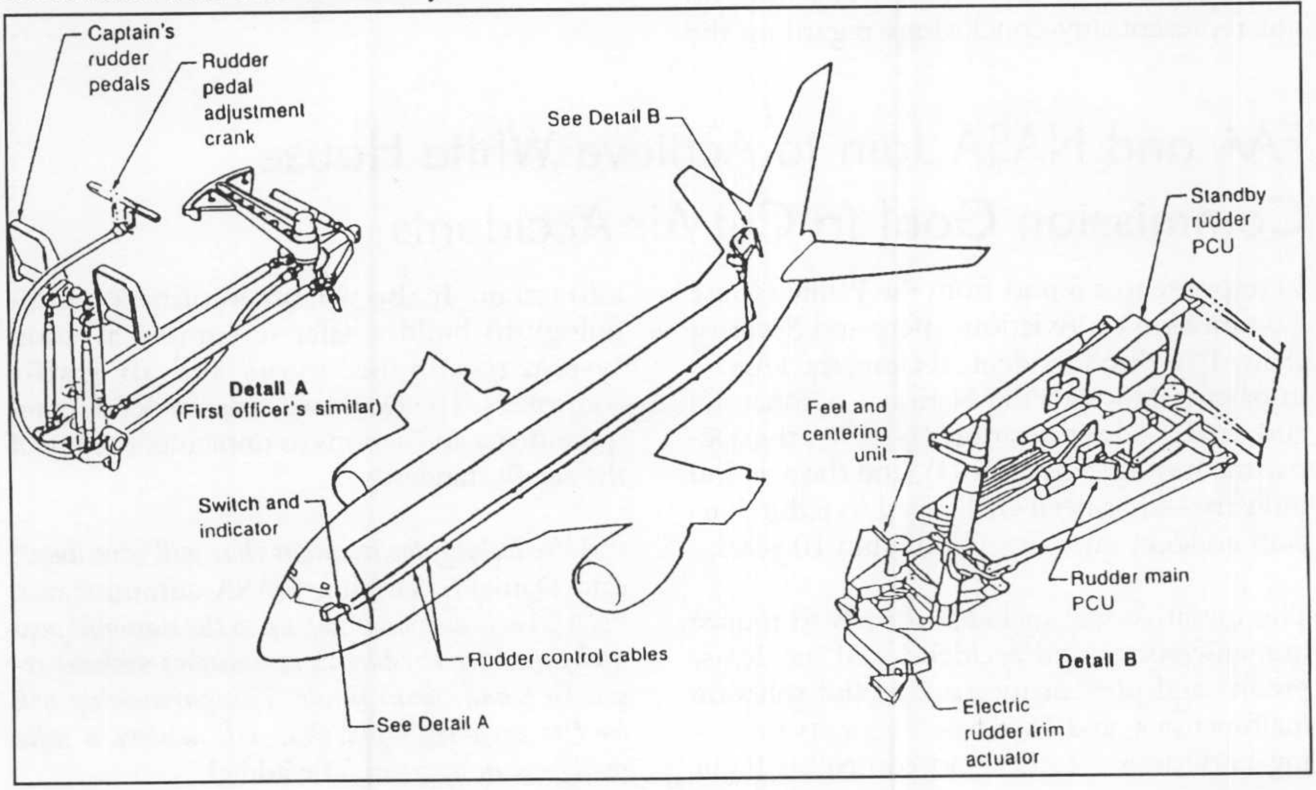
DOCKET 97-NM-28-AD:

- This proposed AD would require the installation of (1) a newly designed rudder-limiting device that reduces the rudder authority at altitudes above 1,500 feet above ground level (AGL); and (2) a newly designed yaw damper system that improves the reliability and fault monitoring capability.
- The installations are intended to prevent excessive rudder authority and consequent reduced controllability of the airplane; and malfunctions of the yaw damper system, which could result in sudden uncommanded yawing of the airplane and consequent injury to passengers and crewmembers.
- The proposed compliance time for accomplishing these installations is 3 years.

DOCKET 97-NM-29-AD:

- This proposed AD would supersede two existing AD's that currently require tests of the main rudder power control unit (PCU) to detect excessive internal leakage of hydraulic fluid, stalling, or reversal; and to verify proper operation of the PCU. It requires replacement of the PCU with a new unit, if any of these discrepancies are identified. The new proposed AD would add requirements for replacement of the PCU and the vernier control rod bolt with newly-designed units. It also would require leak tests of the new PCU, and replacement of the PCU with a serviceable unit, if necessary.
- The actions are intended to prevent fracturing of the vernier control rod bolts, which could result in uncommanded movements of the rudder, and consequent reduced controllability of the airplane.
- The proposed compliance time for replacement of the components is 2 years, and for the leak tests is 6,000 flight hour intervals.

Directional Trim and Control System



The FAA will accept comments from the public on the two proposed AD's through April 23, 1997.

Worldwide, there are approximately 2,700 aircraft in the Model 737 fleet. Of this number; 1,115 are operated in the United States and would be affected by these two proposed AD's. Boeing estimates the cost of retrofitting the worldwide fleet at $126 million; of this amount, $50.4 million is estimated by Boeing to retrofit the U.S. fleet.

FAA's On-going Review of the 737

The proposed AD's issued by the FAA are part of its continuing review of the Model 737 flight control system, initiated following two accidents involving 737 aircraft near Colorado Springs, Colorado, and Pittsburgh, Pennsylvania. The Pittsburgh accident is still under investigation by the National Transportation Safety Board (NTSB) and the FAA is working closely with the Board as its investigation continues. The FAA's actions do not represent any conclusions regarding the cause of the two unresolved 737 accidents.

Shortly after the 1994 Pittsburgh accident, the FAA initiated a Critical Design Review (CDR) that generated changes or improvements of the 737 flight control system. The CDR found no design flaws that could have caused either accident that prompted the review, but identified some discrepancies in various components of the 737 flight control system that could possibly lead to reduced ability to control the aircraft. Last August, the FAA issued nine proposed AD's that addressed the discrepancies. None required immediate corrective action.

The FAA currently is developing final actions based on comments received on those nine proposed AD's.

In addition, as a precautionary measure, the FAA issued an AD on January 2, 1997, requiring 737 operators to adopt procedures to advise pilots how to deal with any uncommanded yaw or roll that might occur.

FAA and NASA Join to Achieve White House Commission Goal to Cut Air Accidents

In response to a report from the White House Commission on Aviation Safety and Security, chaired by Vice President Al Gore, the FAA — in partnership with the National Aeronautics and Space Administration (NASA), the Department of Defense (DoD), and the aviation industry — has been challenged to reduce aircraft accident rates five-fold within 10 years.

The initiative will include research to reduce human-error-caused accidents and incidents, predict and prevent mechanical and software malfunctions, and eliminate accidents involving hazardous weather and controlled flight into terrain. It also will use information technology to build a safer integrated aviation system to support pilots and air traffic controllers. The DoD will assist in defining requirements and actions to implement many of the safety standards.

"We're looking for solutions that will save lives," said Daniel S. Goldin, NASA administrator. *"NASA is prepared to step up to the national goal set by the Vice President's commission without requesting additional funds. This partnership will lead to breakthroughs that will achieve a safer tomorrow in aviation,"* he added.

To accomplish the goal, NASA is proposing to invest up to a half billion dollars over the next five years. Funding will originate from reprogramming existing aeronautic funds, in addition to reassigning people and NASA facilities' work.

"The FAA and NASA have a proud history of working together to make the U.S. aviation system the safest and most efficient in the world," said Acting FAA Administrator Barry Valentine. *"Our two agencies, along with our industry partners, are going to take this research investment and turn it into improvements that will benefit all aviation users."*

The FAA brings to the new initiative a diverse aviation safety research effort that ranges from basic studies on the airworthiness of materials to development of new products for safety inspectors, security inspectors, and air traffic controllers. The agency has vigorous programs in areas such as:

- aviation human factors,
- aircraft fire safety,
- advanced air traffic management technology, and
- safety information technology.

Last year, the FAA also unveiled an unprecedented concept to help reduce accident rates. The Global Analysis and Aviation Network (GAIN) would collect and analyze worldwide aviation safety data to spot safety-related trends, then share the analysis with the global aviation community. By learning more about potential problems, the participants in GAIN would be in a better position to take action to address the problems proactively. *[See article on page 61 in this edition of the **Update**.]*

NASA's aeronautics research is key to U.S. competitiveness and safety in the aviation industry. NASA's aeronautics research and development efforts span the aviation spectrum, from general aviation to jumbo jets.

"NASA has always worked to improve safety by developing the technology industry needs to improve the performance and reliability of aviation products. We have also worked closely with the FAA to conduct basic research in support of its mission. This initiative is the first time we have started with a clean slate to identify the most significant ways we can improve safety for today and the future," said Robert Whitehead, Associate Administrator for Aeronautics, Washington, DC.

Over the years, NASA, in partnerships with the FAA and private industry, has made significant accomplishments in aviation safety. Some examples include:

- providing technology for advanced warning of windshear;
- developing evaluation methods and analyses to help ensure older aircraft are as structurally sound as new ones;
- improving the control of aircraft stall and spin characteristics of general aviation aircraft;
- developing advanced ice-protection concepts to improve aircraft operations;
- improving engine reliability, systems, and displays; and
- designing advanced air traffic management equipment and procedures.

Great strides have been made over the last 40 years to make flying the safest of all the major modes of transportation. However, more technological advances are required today to prevent any rise in future aviation accidents if air traffic triples as predicted over the next 20 years.

Statement By Former Deputy Administrator Linda H. Daschle Regarding Aviation Safety Data

(This statement was presented by Mrs. Daschle on January 29, 1997.)

Last year, the U.S. aviation system carried more than 600 million passengers — every one of them a consumer who wanted to know if the plane was going to arrive on time, and if not, why not. Every passenger also wants to know if the carrier had a good safety record and whether it meets federal aviation safety regulations.

After examining the results of the GRA study, I believe that the FAA can find better and more timely ways of communicating with consumers about aviation safety. We want the public to know what's going on, not just in the skies but in the airports, airline maintenance hangars, and the legal arena as well.

As a result of our request and those of others to examine how the federal government can better inform the public about aviation safety, the FAA today is announcing the following steps:

- Beginning Feb. 1, [1997], the FAA will issue press releases on newly issued enforcement actions in the safety and security area that seek civil penalties of $50,000 or more, as well as releases on significant regulatory actions such as certificate revocations. Quarterly lists of all enforcement actions will be made available, beginning April 1.
- Effective Feb. 28, [1997], the FAA will have a dedicated internet page for safety information that consumers can access, including some data such as accident and incident data previously available only through Freedom of Information Act requests. (www.faa.gov)

  Additional safety data will be added during the year. And by this fall, the FAA will develop a new data base for the agency's internet safety page that compiles data from a variety of sources to provide basic information on carriers, such as the date of certification and the types of aircraft flown. The FAA will also explore other methods to make that information available to the public.
- The FAA also will add to the internet safety data page, by March 31, a public education area with narrative materials to help travelers better understand how impressive the U.S. safety record is. It will outline the roles and responsibilities of the FAA, carriers, manufacturers, repair stations, passengers, safety and security inspectors, flight crews, and others involved in the partnership to keep aviation in the United States the safest in the world.

In developing these actions the FAA has striven for the right balance between the public's right to know and the important need to protect information shared with the agency on a voluntarily basis that helps advance the cause of safety. One of the important findings of Secretary Peña's 1995 Safety Summit is that security and safety information given voluntarily to the FAA should be protected from disclosure so that we can encourage safety through voluntary disclosure and not endanger it by discouraging anyone from telling us something we ought to know. FAA intends to make as much information public as possible, while protecting key information it receivesvoluntarily so that continued reporting that will lead to even higher levels of safety can be encouraged.

I believe the program the FAA is implementing will make an important contribution in educating Americans about aviation safety by making the facts readily available.

The U.S. aviation system, overseen by the FAA, is the safest in the world. Well over 3,000 safety inspectors perform nearly 325,000 safety inspections a year to protect and enhance safety. More than 17,000 air traffic controllers work around the clock, every day of the year, to ensure the safe movement of air traffic. And, the agency issues hundreds and hundreds of directives to aviation industry each year aimed at making important safety upgrades to airplanes and security improvements.

FAA to Respond to NTSB Recommendations on 747 Fuel Tanks

On December 13, 1996, the National Transportation Safety Board (NTSB) issued four Safety Recommendations for action by the FAA. Each of the recommendations concern issues related to the center wing fuel tanks on Boeing Model 747 airplanes. These recommendations arise from the NTSB's on-going investigation of the accident involving a TWA-operated Boeing Model 747-131 that occurred last summer off the coast of New York.

NTSB's Safety Recommendations

In its recommendations, the NTSB urged the FAA to do the following:

- Require the development and implementation of design or operational changes that will preclude the operation of transport category airplanes with explosive fuel/air mixtures in the fuel tanks:
  - a) Significant consideration should be given to the development of airplane design modifications, such as nitrogent-inerting systems and the addition of insulation between heat-generating equipment and fuel tanks. Appropriate modifications should apply to newly certificated airplanes and, where feasible, to existing airplanes. *(Safety Recommendation A-96-174)*
  - b) Pending implementation of design modifications, require modifications in operational procedures to reduce the potential for explosive fuel/air mixtures in the fuel tanks of transport category aircraft. In the Model 747, consideration should be given to refueling the center wing fuel tank (CWT) before flight whenever possible for cooler ground fuel tanks, proper monitoring and management of the CWT fuel temperature, and maintaining an appropriate minimum fuel quantity in the CWT. *(Safety Recommendation A-96-175)*
- Require that the B747 Flight Handbooks of TWA and other operators of Model 747's and other aircraft in which fuel tank temperature cannot be determined by flight crews, be immediately revised to reflect the increases in CWT fuel temperatures found by flight tests, including operational procedures to reduce the potential for exceeding CWT temperature limitations. *(Safety Recommendation A-96-176)*

- Require modification of the CWT of Model 747 airplanes and the fuel tanks of other airplanes that are located near heat sources to incorporate temperature probes and cockpit fuel tank temperature displays to permit determination of the fuel tank temperatures. *(Safety Recommendation A-96-177)*

Evidence Prompting the Recommendations

Evidence found during the investigation of the TWA 800 accident revealed that, as the airplane was climbing near 13,800 feet mean sea level (msl) after takeoff from Kennedy Airport, an in-flight explosion occurred in the center wing fuel tank (CWT). The CWT was nearly empty at the time of the explosion.

Portions of the airplane wreckage have been reconstructed, including the CWT, passenger cabin above the CWT, and the air conditioning packs and associated ducting beneath the CWT. The reconstruction thus far shows outward deformation of the CWT walls and deformation of the internal components of the tank, which are consistent with an explosion originating within the tank. Airplane parts from in and around the CWT recovered and identified to date contain no evidence of bomb or missile damage. The investigation into what might have provided the source of the fuel/air mixture (including a bomb or missile) in the CWT is continuing.

General Findings

In its letter to the FAA, the NTSB pointed out some general findings concerning circumstances that can cause the fuel/air mixture in a CWT to ignite:

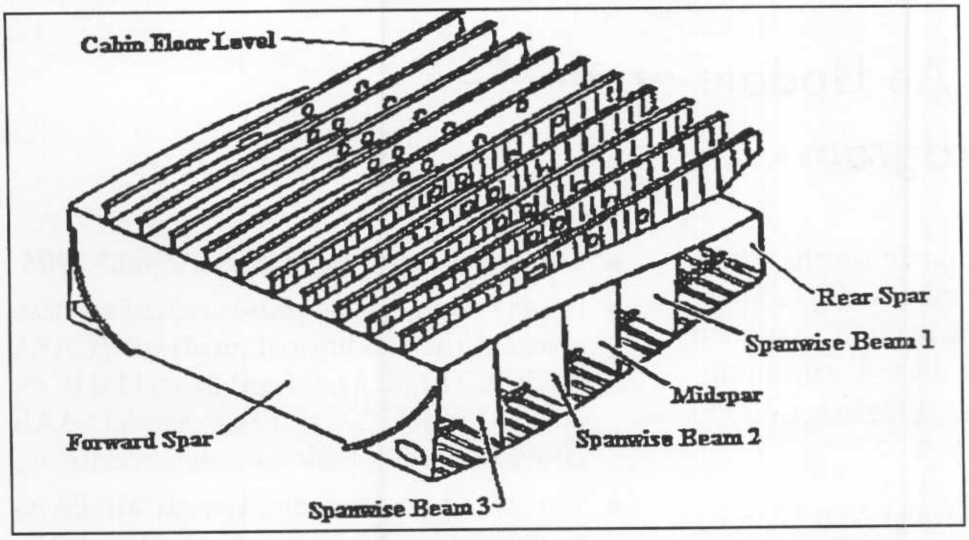
Fuel tank explosions require an energy source sufficient for ignition and temperatures between the lower explosive (flammability) limit (LEL) and upper explosive limit (UEL), which will result in a combustible mixture of fuel and air. Current FAA regulations require protection against the ignition of fuel vapor by lightning, components hot enough to create and autoignition, and parts of systems failures that could become sources of ignition. [Ref. FAR Sections 25.954 ("*Fuel system lightning protection*") and 25-981 ("*Fuel tank temperature*").]

Despite the regulations, at times airlines do operate transport airplanes under environmental conditions and operational circumstances that allow the temperature in a fuel tank ullage to exceed the LEL, thereby creating a potentially explosive fuel/air mixture. For example, fuel tank temperatures can become elevated when airplanes are sitting on the ground between flights during warm summer months. Additionally, it has been demonstrated that air conditioning packs operated on the ground can generate heat beneath the CWT.

Without oxygen in the fuel/air mixture, however, a fuel tank ullage could not ignite, regardless of temperature or ignition considerations. The military has prevented fuel tank ignition in some aircraft through the creation of a nitrogen-enriched atmosphere (nitrogen-inerting) in fuel tank ullage, thereby creating an oxygen-deficient fuel/air mixture.

Other Findings

During its investigation, the NTSB also found that the TWA B747 Flight Handbook, used by crewmembers, "understates the extent to which the air conditioning packs can elevate the temperature of the B747 CWT." Further, although the Flight Handbook instructs flightcrews not to exceed fuel temperatures of 54.5°C (130°F), the only fuel tank temperature indication displayed for flightcrews is that of the outboard main tank in the left wing. The design of the Model 747 (as well as various other airplanes) currently provides no means to measure the temperature of the fuel



Center Wing Fuel Tank

or ullage of fuel tanks that are located near heat sources.

Developing FAA's Response

Before initiating any action regarding the four NTSB Safety Recommendations, the FAA must determine both the feasibility and the effectiveness of the proposed methods of reducing the potential for an explosive fuel-air mixture within airplane fuel tanks. Implementation of the NTSB's recommendations would require a significant change in airplane design and/or operational practices currently in use. These changes could have major effects on passengers and the aviation community. The FAA will need accurate information regarding the impact and effect of the NTSB proposals in order to prepare formal response to these recommendations.

To obtain this information, the FAA published a *"Notice of Request for Comments on National Transportation Safety Board Recommendations"* in the **Federal Register** on April 3, 1997. The purpose of this notice is to solicit public participation in identifying and selecting a course of action by inviting interested persons to submit to the FAA specific comments concerning the NTSB recommendations. (The comment period closes on August 1, 1997.)

Comments in that regard will be requested from all of the public and aviation industry, including manufacturers and users (both domestic and foreign) of transport category airplanes and components, foreign airworthiness authorities, and any other interested persons. The type of information that will be sought is technical and economic data and information, arguments pro or con concerning the need for new standards, and specific details concerning:

- Controlling of fuel temperatures
  - Refueling fuel tanks from cooler ground sources
  - Limiting environmental control system (ECS) pack operation
  - Carrying additional fuel
  - Cost information for limiting fuel temperatures
- Nitrogen inerting

All comments received will be considered by the FAA before preparing a formal response to the NTSB recommendations.

In-Flight Icing: An Update on the FAA's Three-Phase Program

This article provides an update on the FAA's "Three-Phase Program" developed to address problems associated with in-flight icing on turboprop airplanes. (See related article published in the ***Transport Certification Update***, Edition 20, Spring 1996.)

In 1994, an Aerospatiale Model ATR72 series airplane was involved in an accident in which severe icing conditions outside of the icing certification envelope contributed to uncommanded roll. This accident prompted the FAA to initiate a three-phase safety review of aircraft operating characteristics during conditions of in-flight icing:

The *first phase* focused on the accident airplane. Results of this review resulted in modification of the airplane and crew training to minimize the possibility of similar incidents or accidents.

During the *second phase*, aircraft similar to the accident airplane were evaluated to determine if uncommanded aileron movement and unacceptable control wheel forces would occur if ice accreted aft of the protected area of the wing.

The *third phase* consists of an extensive review of in-flight aircraft icing safety and the determination of changes that can be made to increase the level of safety.

Since the issuance of the Spring 1996 ***Transport Certification Update***, the FAA has made progress in all three phases:

- The first phase was completed in mid-1995.
- Results of the second phase evaluations have revealed that additional airplanes (CASA model C212, de Havilland Model DHC-6, Fokker Model F27, and Saab Model SAAB 2000) have acceptable control wheel forces.
- The third phase began with an FAA-sponsored conference held in May 1996. This final phase is continuing with the development of an FAA icing plan to increase operational safety in icing conditions.

Phase I

On October 31, 1994, an Aerospatiale Model ATR-72-212 was involved in an accident involving *severe icing,* likely resulting from freezing drizzle size droplets that were reported in the area. [The Aeronautical Information Manual (AIM) defines "severe icing" as: *The rate of accumulation is such that deicing/anti-icing equipment fails to control the hazard. Immediate flight diversion is necessary.*] Freezing drizzle droplets are outside the icing envelope defined in Appendix C of part 25 of the Federal Aviation Regulations. Consequently, no airplanes have been certificated for operation in these severe icing conditions.

The accident profile was nearly replicated during flight tests when the aircraft was flown with ice shapes developed from testing in an artificial icing cloud having droplets in the size range of freezing drizzle at a temperature near freezing. This condition created a ridge of ice aft of the deicing boots and forward of the ailerons. Subsequent dry air testing with this ice shape resulted in uncommanded motion of the ailerons and rapid roll.

Aerospatiale developed a modification for the Model ATR-42 and -72 that increased the chord-wise coverage of the active portion of the upper surface of the outer wing deicing boots. In addition, Aerospatiale adopted certain flight manual procedures that allowed flightcrews to identify inadvertent flight into severe icing conditions, and provided restrictions and procedures to allow a safe exit from those severe conditions. The FAA issued an airworthiness directive (AD) to require installation of the extended coverage boots and adoption of the flight manual procedures and restrictions. The deicing system modification provides an increased margin of safety in the event of an encounter with freezing drizzle. However, even with the improved boots installed, the Aerospatiale airplanes (along with all other airplanes) are not certificated for flight in freezing drizzle conditions or any other conditions outside of the icing certification envelope. All Model ATR-42 and -72 airplanes have the extended coverage boots installed, and the FAA considers that all actions associated with Phase I have been accomplished.

Phase II

In March 1995, the FAA requested other airworthiness authorities and airplane manufacturers to review certain airplanes to determine if other type designs might experience control difficulties should a ridge of ice form aft of the deicing boots and forward of the ailerons. This investigation addressed part 23 and part 25 airplanes that are equipped with pneumatic deicing boots and non-powered roll control systems, and are used in regularly scheduled revenue passenger service in the United States.

Most manufacturers accomplished the review by performing high-speed taxi tests with one-inch quarter round shapes located aft of the deicing boots and forward of one aileron to simulate a worst-case freezing drizzle build-up. The control wheel forces obtained during these tests were then extrapolated to forces that would occur at holding speeds.

High-speed taxi tests were performed on the following airplanes. These airplanes were found to have acceptable roll control forces (less than the 60-pound limit specified in section 25.143, Amendment 25-42, and section 23.143, Amendment 23-45 of the Federal Aviation Regulations):

- Beech 99, 200, 1900-C/D
- British Aerospace ATP/HS 748
- de Havilland DHC-8-100, -200, 300, DHC-7, DHC-6
- CASA C212*
- Cessna 208*
- Dornier 328
- EMBRAER EMB-110
- Fairchild SA 226/227
- Fokker F27(all Marks)
- Jetstream 31/32, 4101
- SAAB 340
- Shorts SD3-30/-60

Initial testing of two aircraft with one-inch-quarter round shapes located forward of the entire span of the ailerons on one wing only resulted in roll control forces greater than 60 pounds. Additional tests were conducted on these aircraft (the EMB-120 Brasilia and the Saab 2000*) to determine more realistic ice shapes that could accrete in freezing drizzle conditions. The definition of these more realistic ice shapes was determined by flying the airplanes in simulated freezing drizzle conditions produced by a United States Air Force icing tanker. EMBRAER and Saab then performed airplane flight tests in dry air with artificial ice shapes based on the ice shapes formed during the tanker tests. The tests with these more realistic ice shapes resulted in acceptable roll control forces for both aircraft.

The CASA CN-235* test results currently are under review.

(**NOTE: These aircraft are not used in regularly scheduled revenue passenger service in the United States. The manufacturers voluntarily included these aircraft in the Phase II evaluation.*)

Phase III

The objective of this phase is to review current certification requirements, applicable operating regulations, ice detection/protection technologies, and forecast methodologies associated with aircraft icing under varying environmental conditions, and to determine changes that can be made to increase the level of safety when operating in icing conditions.

The FAA initiated Phase III with an FAA International Conference on Aircraft In-Flight Icing, which was held in May 1996. The conference included a review of all aspects of airworthiness when operating in icing conditions. The conference working groups made recommendations to the FAA regarding changes or modifications that can be made to provide an increased level of safety.

The conference proceedings were published in report number DOT/FAA/AR-96/81, Volumes I and II, dated August 1996. Volume I includes presentations of the speakers at the opening plenary session and the working group co-chair reports given at the closing plenary session. Volume II contains the technical papers presented in the working groups and the working group recommendations. The proceedings are available to the public from the National Technical Information Service (NTIS), Springfield, Virginia 22161.

The FAA is preparing an icing plan based, in greatest part, upon the recommendations made to the FAA during the conference. The plan will describe various activities, including rulemaking, development and revision of advisory material, research programs, and other initiatives that have already started or will be undertaken by the FAA to ensure safe operations in all icing conditions including freezing rain and freezing drizzle.

The icing plan is scheduled for release in Spring 1997.

For additional information on this subject, please contact:

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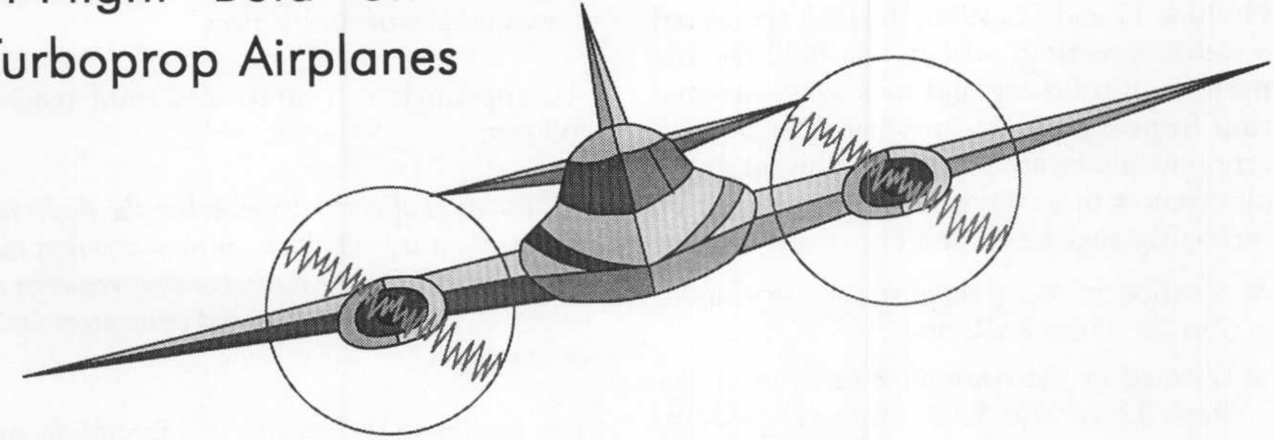
In-Flight "Beta" on Turboprop Airplanes



The term "beta" is normally defined as

"*the range of propeller operation intended for use during taxi, ground idle, and reverse operations, as controlled by the power lever settings aft of the flight idle stop.*"

Background

During the past several years, the FAA has received numerous reports indicating that propeller control was intentionally or inadvertently displaced from the flight regime into the beta range during flight on certain airplanes equipped with turboprop engines.

Of these in-flight beta events, 5 have been classified as accidents. In-flight beta operation that preceded these accidents resulted in two different kinds of consequences:

1. Permanent engine damage and loss of thrust on all engines when the propellers that were operating in the beta range drove the engines to overspeed; and
2. Loss of airplane control because at least one propeller operated in the beta range during flight.

In the most recent accident, both engines of a turboprop airplane lost power during descent after eight seconds of operation with the propellers in beta range. The propellers subsequently drove the engines into overspeed, which resulted in internal engine failure.

Relevant Rulemaking

Sections 23.1155 and 25.1155 ("*Reverse thrust and propeller pitch settings below the flight regime*") of the Federal Aviation Regulations (FAR) state:

"*...each control for...propeller pitch settings below the flight regime must have a means to prevent its inadvertent operation. The means must have a positive lock or stop at the flight idle position and must require aseparate and distinct operation by the crew to displace the control from the flight regime...*"

Generally, compliance with this requirement has been the installation of a power lever stop or detent that requires a separate distinct pilot action (such as lifting the power levers up and beyond the stop or detent) to displace the power levers from the flight regime.

Public Meeting

On June 11 and 12, 1996, the FAA sponsored a public meeting, which was held for the purpose of soliciting and reviewing information from the public on what type of FAA action would be appropriate to prevent future occurrences of in-flight beta operation on all turboprop airplanes that are:

- certified in the transport category under Part 25 of the FAR; and
- certified in the commuter category under Part 23 of the FAR, Special Federal Aviation Regulations (SFAR) 23, and SFAR 41.

Attendees were encouraged to provide information that would describe what they considered to be the best action (if any) to be taken to correct the problem.

At the meeting, one issue that was brought up was the apparent lack of consistency in the Limitations Section of the Airplane Flight Manuals (AFM) for turboprop powered airplanes not certificated for in-flight operation with the power levers below the flight idle stop.

Attendees discussed the merits of prohibiting the in-flight positioning of the power levers below the flight idle stop, and providing a warning or cautionary statement concerning the associated dangers including possible consequences of such action.

Current Actions

In light of the safety concerns involving in-flight beta range, the FAA has determined that, until further action is defined, it is necessary to ensure that a specific limitation is included in the AFM for those airplanes. The limitation should not only prohibit the in-flight positioning of the power levers below the flight idle stop, but also warn or caution about the associated dangers, including possible consequences of such action.

An appropriate limitation would read as follows:

"Positioning of power levers below the flight idle stop in-flight is prohibited. Such positioning may lead to loss of airplane control or may result in an engine overspeed condition and consequent loss of engine power."

The FAA is in the process of identifying specifically which turboprop airplanes that are not certificated for in-flight beta operation need to have their AFM limitations revised to include a statement such as the one specified above. All FAA Aircraft Certification Offices (ACO) have been requested to review the AFM's of turboprop airplanes to determine which ones have no limitation, or have a limitation that is not similar to the one suggested above.

As a result of this review, the FAA is planning to propose airworthiness directives (AD), applicable to each of the identified airplane models, that would require the addition of this specific limitation in the Limitations Section of the airplane's AFM.

Consideration of Future Rulemaking

A central issue at this meeting focused on consideration of requiring a "beta lockout system" retrofit for all turboprop airplanes. The FAA is currently considering those comments, and reviewing all turboprop commuter and transport category airplane designs and service histories to determine whether installation of a beta lockout system should be required.

Overview of the Aircraft Certification Service's Bilateral Technical Assessment Process

The FAA's Aircraft Certification Service (AIR) developed an "international vision" statement that serves as its guideline in all of its dealings with other countries in the issues of aviation and aviation safety:

A global network of airworthiness authorities working cooperatively to promote the highest level of public confidence in the safety of the international air transportation system with the lowest practicable regulatory burden to the system.

A technical assessment by the Aircraft Certification Service is a requirement prior to the Federal Aviation Administration implementing any Bilateral Safety Agreement (BASA) related to airworthiness certification.

The objectives of the Aircraft Certification Service in any country are to:

- assist the development and airworthiness competency of the Civil Aviation Authority (CAA).
- {*if a shadow certification is involved*}, assess compliance, through the Civil Aviation Authority, of the specific type design.
- learn more about the country's capability in the design and production of civil aeronautical products.

The BASA Assessment Process

This technical assessment process for a new or expanded BASA will normally progress in five phases:

- **Phase I** - Familiarization
- **Phase II** - Review
- **Phase III** - Shadow Type Design Approval to U.S. Aircraft Standards and Practices (This phase is optional for a BAA to BASA transformation):
- **Phase IV** - Negotiation
- **Phase V** - Award

The time required to complete the assessment varies depending on (1) whether Phase III is applicable, and (2) the type of product proposed by the CAA for shadow type design approval to U.S. aircraft standards and practices, *e.g., Transport category airplanes: 5 to 7 years.*

Phase I: Familiarization

During this phase, FAA personnel will become familiar with the CAA's processes and organization. It will do this by reviewing:

- Basic documentation on the CAA, such as legislation, regulations, organizational structure, and approval processes.
- Product design descriptions and certification plans.

FAA's written product/outcome from this phase is a "Master Plan" for the program.

Phase II: Review

During this phase, FAA personnel will conduct a detailed review of the:

- Type design for the proposed civil aeronautical product.

- CAA's aircraft certification system, including production and airworthiness certification and corrections for unsafe conditions that may develop in aeronautical product design.

This phase will result in two written products:

- The U.S. type certification basis for the civil aeronautical product.
- A preliminary assessment report on the CAA's aircraft certification system, including the identification of any areas of difference to be assessed in greater depth. These reports are updated at least annually as the project progresses.

Phase III: Shadow Type Design Approval to U.S. Aircraft Standards and Practices

During this phase, the FAA will observe and assist the CAA in their certification of a specific civil aircraft or aeronautical product to the U.S. aircraft standards and practices. The purpose of this phase is to assess:

- The CAA's ability to apply U.S. aircraft standards and practices; and
- How well the proposed type design complies with the U.S. certification basis through discussions with the CAA, monitoring CAA certification decisions, witnessing tests, etc.

A written code comparison between the CAA's aircraft standards and the FAR's and a final written report on the country's civil certification system will be completed during this phase.

Phase IV: Negotiation

During this phase, a final FAA recommendation is forwarded on the readiness of the CAA's aircraft certification system for a BASA. The work of the technical team is essentially over.

If the FAA's technical assessment establishes the competency of the CAA, and establishes the existence of an aircraft certification system that is able to produce results equivalent to the U.S. system, language for the BASA Executive Agreement and/or airworthiness implementation procedures are drafted.

U.S. Department of State personnel, with technical assistance from the FAA, will negotiate the final language of the BASA Executive Agreement with the Foreign Ministry. A special AIR team will negotiate language for implementation procedures with the CAA.

Phase V: Award

The BASA Executive Agreement is concluded through the exchange of diplomatic notes between the U.S. Department of State and its respective Ministry of Foreign Affairs of the exporting country.

The BASA is implemented through Implementation Procedures (IP) defining the scope of reciprocity, signed by the FAA and its counterpart aviation authority. Currently, there are two types of IP's:

- *Full scope IP's* allow for the import/export of a wide range of aeronautical products.
- *Limited scope IP's* are those which restrict import/export to only one or more product types, e.g., Part 23 aircraft.

The language of the BASA Executive Agreement is standard. The specific limitations are stated in the airworthiness implementation procedures.

Any FAA approval for the design of an aeronautical product (i.e., airplane, engine, etc.) assessed during the project may be issued once an IP has been concluded.

Why a "Shadow" Certification?

In *past* BAA efforts, the FAA:

- evaluated the country's system,
- evaluated their rules and regulations,
- discussed how FAA rules would be applied, and
- concluded a BAA on the basis of a paperwork review only.

This practice did not evaluate any actual product certifications and in some cases led to a BAA that later had difficulties.

The *current* procedure for any new countries requesting BASA's is to conduct "shadow" certifications of products to see how FAA rules are being applied by the CAA. The use of products during a "shadow" certification allows the FAA to better evaluate the authority and its understanding of the application of FAA rules and procedures.

The FAA is **not** directly certificating any products.

Summary of BASA Process

The following table delineates the BASA assessment process as it is currently carried out by the FAA.

Summary Table of BASA Assessment Process

PHASE	WHO	OUTCOME/PRODUCT
I: *Familiarization* (Aircraft certification system review)	FAA technical team	• Master Plan
II: *Review*	FAA technical team	• Certification basis for product (if applicable) • Assessment Report(s)
III: *Shadow Type Design Approval/Shadow Certification* (for all new or expanded BASA's or where a problem has been identified during earlier phases)	FAA technical team	• Final team recommendation/assessment report • Code Comparison (FAR's and ____)
IV: *Negotiation*	State Dept. BASA IP team	• BASA Executive Agreement (DOS) • Implementation Procedure (FAA/CAA)
V: *Award*	State Dept. and FAA Mgmt.	• Conclusion of BASA and IP • Type certificate, Letter of TSO Design Approval, etc.

U.S.-China Report Says Additional Resources Required to Ensure Future Safety of Chinese Civil Aviation

A joint U.S.-China review team announced on March 3, 1997, that the General Administration of Civil Aviation of China (CAAC) meets requirements for international safety oversight standards. However, to keep pace with the rapid growth in China's civil aviation, the team cautioned that additional resources will be required for the CAAC to provide effective oversight of its air carriers in the future.

Of this effort, Federal Aviation Administration (FAA) Acting Administrator Barry L. Valentine said; *"I am pleased with the excellent working relationship developed between the United States and Chinese civil aviation authorities. This report recognizes the important strides the CAAC has made to meet the growing demands on its aviation system. However, both nations agree more needs to be done, and the FAA is committed to helping China improve its safety oversight capabilities."*

The report points out that CAAC is already undertaking many initiatives to improve its air carrier operations and maintenance oversight, but still has some areas which will require additional resources to ensure future safety. The team's findings were compiled and organized into 10 categories outlining recommendations in the areas of:

1. resources,
2. aviation laws and regulations,
3. certification,
4. inspector qualifications and training,
5. enforcement,
6. structure,
7. surveillance,
8. guidance materials,
9. records and document management, and
10. technical documentation.

Since 1980, civil air transportation in China has grown annually by an average of 20 percent, a rate 4.3 times greater than the world average. The strain on China's aviation system became evident as its accident rate rose in the early 1990's. Prompted by the safety decline, the CAAC initiated a comprehensive program in 1993 to slow the growth, review its system, and implement corrective measures. This joint U.S.-China review and report is part of China's ongoing effort to improve its safety oversight.

Prior to the release of the report, the CAAC and FAA worked together on several cooperative efforts. In the mid 1980's, FAA worked with the CAAC to establish an aircraft certification program for China. In 1993, the two civil aviation authorities initiated cooperative efforts aimed at improving China's aviation regulations. Building on these accomplishments, the CAAC and FAA began formal arrangements in November 1994 to develop a joint program that would assist China in identifying improvements needed in its flight standards operations and maintenance oversight system. To guide this effort, the CAAC and FAA developed a three-phase cooperative program, which included this review.

The joint review team was made up of members from both the FAA and the CAAC. Its findings and recommendations resulted from a cooperative safety review conducted in China between October 23 and November 3, 1995. This joint review was more extensive in scope and depth than the usual FAA assessments of foreign civil aviation authorities whose carriers operate or propose to operate in the United States.

The FAA intends to work with the CAAC to implement recommended changes.

Certification of Boeing's "Next-Generation" 737 Models

[Some of the material for this article came from Boeing's Internet Home Page at www.boeing.com.]

The first Boeing Model 737-700 series airplane made its first flight on February 9, 1997, from Renton Municipal Airport in Renton, Washington, with Boeing Capts. Mike Hewett and Ken Higgins at the airplane's controls. During the 3 hour and 35 minute flight, Hewett and copilot Higgins conducted a series of tests on the airplane's systems and structures. Using flight-test equipment on board the aircraft, information from the tests was recorded and the pilots transmitted verbal data back to Flight Test personnel working at the control room at Boeing Field. The same team of specialists later will analyze the data.

Type certification of the Model 737-700 is proceeding on schedule:

- Ground testing of the first airplane, Boeing model identification YA001, in support of the type certification program, was conducted the week of February 24, 1997.
- The first flight of a second 737-700 airplane, Boeing model identification YA002, was conducted on February 27.
- A third airplane, Boeing model identification YA003, had its first flight on March 11.

The Next Generation Product Line

The 737 was thought to have a limited market when it was first introduced in the late 1960's. Supersonic planes and big jets were expected to be the future. But the plane, with its low operating costs, became a mainstay of the short- to medium-length routes.

The jet went through one reincarnation in the 1960's, when the Model 737-300, -400, and -500 were introduced. Those planes featured updated cockpits, new fuel-efficient engines and other improvements.

The "Next-Generation 737" product line was launched in 1993. Its flight-test program consists of 10 airplanes, including four 737-700's, three 737-800's, and three 737-600's. Each model's flight-test program is planned to last approximately seven months and will consist of more than 2,300 in-flight test hours.

On a historic note, the first 737-100 made its first flight nearly 30 years ago. Since then, almost 3,600 of the popular twinjets have been ordered, making it the best-selling jetliner ever. In addition to commercial airplanes, Boeing also offers a business jet derived from the 737-700. With auxiliary fuel tanks, the business jet can fly more than 6,000 nautical miles. The business jet is sold and marketed through Boeing Business Jets, a joint venture formed last summer between The Boeing Company and the General Electric Co.

Designing the Airplane

The Next-Generation 737's started out as a computer image. Integrated Product Teams—customers, engineers, buyers, production people, cost accountants, and support representatives, all working together—used the image to communicate their changes to each other as the design evolved. Instead of creating the design one step at a time, the computer model let them do it all together, all at once—what is called "concurrent design."

Propulsion

The Model 737-600/-700/-800 airplanes are powered by new CFM56-7 engines produced by CFMI, a joint venture of General Electric of the United States and Snecma of France. These engins have a 10-percent higher thrust capability than the CFM56-3C engines that power today's 737's. They also meet all Federal noise and emission standards, making them quieter and cleaner-operating. Additionally, the CFM56-7 has been designed for low maintenance; for example, changing this engine takes half the time that it took to change its predecessor.

Fuselage

In the fuselage, the cabin and the lower hold carry the passengers and freight.

Fuselages used to be shipped in pieces. Now a new assembly process, a product of the Wichita Integrated Product Teams, produces a one-piece fuselage. The new process reduces the time it takes to make the fuselage and the time it takes to put it together with the rest of the airplane.

Flightdeck

A basic requirement for the Model 737-600/-700/-800 models is maintaining crew commonality with the flight deck of over 1,800 current generation 737's that have already been ordered. For example, installing the new Flight Deck Common Display System increases crew commonality by incorporating programmable liquid-crystal displays.

The heart of the Next-Generation flight deck is this Common Display System (CDS). Its six brightly colored, flat-panel, liquid-crystal displays have replaced all of the individual gauges of former flightdeck designs. The six displays are designed to be user-friendly, reliable, and easy to maintain. They also generate less heat. And a pilot who prefers the old individual-gauge format can program the CDS to mimic it.

These three newest 737 models will fly higher, faster, farther and with lower operating and maintenance costs.

Wing

Modifications to the new Model 737-600/-700/-800 airplane's wing increases the chord (width) and span (length), which increases fuel capacity and improves fuel efficiency, both of which increase range. On each wing, the chord increases by about 20 inches (50 cm) and the total span by almost 18 feet (5 m). The total wing area is increased by 25% to 1,340 square feet (125 square meters), providing 30% more fuel capacity, for a total of 6,878 U.S. gallons (26,136 L).

With this increase in wing area, the range of these airplanes is approximately 3,000 nautical miles (3,454 statute miles or 4,847 km), an increase of up to 900 nautical miles over current-production 737's.

Modifications to the wing airfoil will provide a cruise speed of 0.79 Mach (530 mph), compared to 0.745 Mach for today's 737, with sprint capability of 0.82 Mach. Additionally, the aircraft will be able to cruise up to a maximum altitude of 41,000 feet, compared to 37,000 feet for the current-production 737.

Next Generation Models Comparison

From the C-17 to the MD-17

[Much of the material for this article came from McDonnell Douglas' Internet Home Page at www.mdc.com.]

The Transport Airplane Directorate currently is working with McDonnell Douglas to certify a commercial configuration of the C-17 (Globemaster), a state-of-the-art, wide-body military cargo airplane. The commercial version will be called the *MD-17*. It will carry large items that do not fit in any current civilian commercial freighters, and will also be capable of landing and operating at short, austere airports.

Many of the MD-17 features are not covered by existing regulations; therefore, extensive work will be necessary to develop a certification basis that will contain safety standards appropriate for this (commercial) design. These requirements currently are under development by FAA technical specialists with the support of McDonnell Douglas.

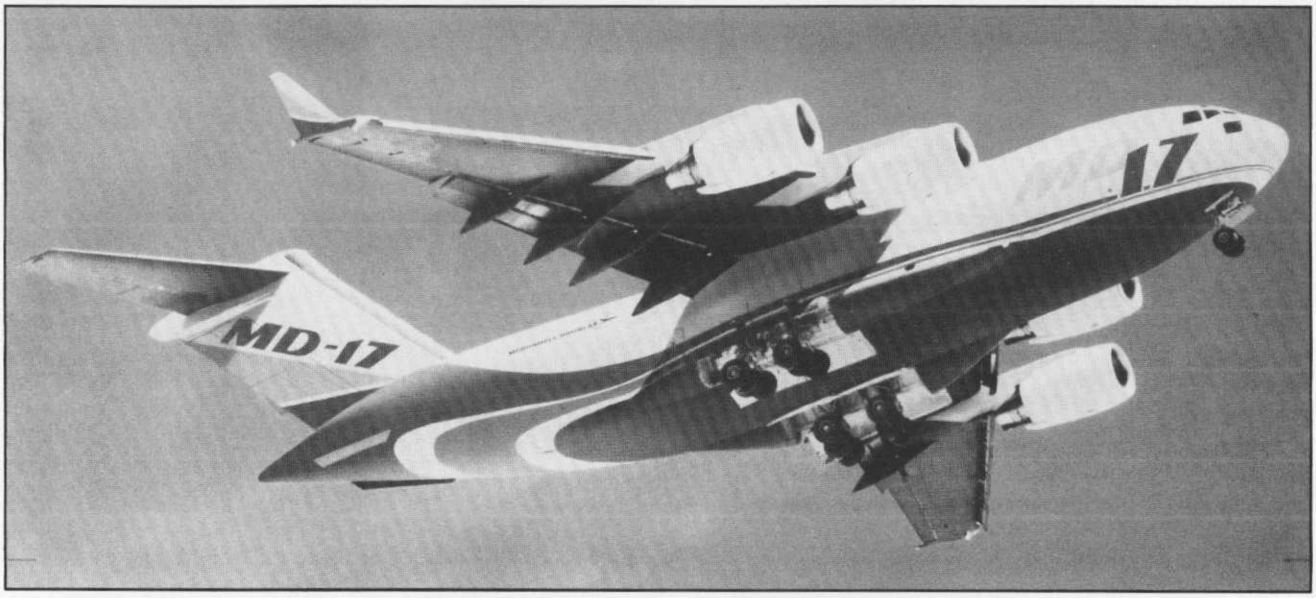
Background: Development of the C-17

The concept of the C-17 was initially developed under the Defense Department's "Cargo-Experimental (C-X) Program" in 1979, and the Air Force selected McDonnell Douglas as the manufacturer of the envisioned airplane in 1981. The C-17 made its maiden flight on September 15, 1991.

The C-17 was designed to replace the C-141 and supplement the C-5 and C-130 aircraft. It has performance characteristics that distinguish it from its predecessors, however, including:

- long-range capability,
- outstanding aerodynamic efficiency,
- ease of ground operations,
- heavy cargo payload capability; and
- ability to perform extensive airdrops over hostile territory and make precision landings and takeoffs from short or makeshift runways.

McDonnell Douglas MD-17: Commercial Heavylifter



The newest version of the airplane, the *C-17 Globemaster III*, has been recognized as key to fulfilling the U.S. Air Force's post-Cold War mission of "global reach—global power."

C-17 Details

Propulsion: The aircraft is powered by four fully reversible Pratt & Whitney F117-PW-100 turbofan engines (the commercial version is currently used on the Boeing 757). Each engine is rated at 40,900 pounds of thrust. The thrust reversers direct the flow of air upward and forward to avoid ingestion of dust and debris.

Flightcrew: The aircraft is operated by a crew of three (pilot, copilot, and loadmaster). Cargo is loaded onto the C-17 through a large aft door that accommodates military vehicles and palletized cargo. The C-17 can carry virtually all of the Army's air-transportable, outsized combat equipment. It is also able to airdrop paratroopers and cargo.

Measurements: The C-17 measures approximately 55 feet 1 inch in height, and 174 feet in length, with a wingspan of 170 feet 9 inches (to winglet tips). Its cargo compartment measures 85 feet 2 inches long and 18 feet high; 12 feet 4 inches is forward of the wing and 13 feet 6 inches is aft of the wing.

Capacity and Range: The C-17's maximum payload capacity is 170,900 pounds, and its maximum gross takeoff weight is 585,000 pounds. With a payload of 130,000 pounds and an initial cruise altitude of 28,000 feet, the C-17 has an unrefueled range of approximately 5,200 nautical miles. Its cruise speed is approximately 450 knots (.77 Mach).

Operation: The design of this aircraft lets it operate on small, austere airfields. The C-17 can take off and land on runways as short as 3,000 feet and as narrow as 90 feet wide. Even on such narrow runways, the C-17 can turn around by using its backing capability while performing a three-point star turn.

Powered Lift: A key element of the aircraft is a flap system developed by a team of researchers at NASA Langley Research Center in the mid-1950's. The "externally blown flap" or "powered-lift system" enables the airplane to make slow, steep approaches with heavy cargo loads. The steep approach helps pilots make precision landings with the aircraft, touching

McDonnell Douglas C-17

down precisely in the spot desired on limited runway surfaces. This was accomplished by diverting engine exhaust downward, giving the wing more lift.

In the flap system, the engine exhaust from pod-mounted engines impinges directly on conventional slotted flaps and is deflected downward to augment the wing lift. This allows aircraft with blown flaps to operate at roughly twice the lift coefficient of that of conventional jet transport aircraft.

Supercritical Wing: Like other military transports, the C-17 uses a "supercritical" wing. These are advanced airfoil designs that enhance the range, cruising speed, and fuel efficiency of jet aircraft by producing weaker shock waves that create less drag and permit high efficiency. This major innovative technology was conceived through NASA Langley wind tunnel research in the 1960's.

Fly-by-Wire: Another NASA contribution to the C-17 was fly-by-wire flight-control technology, a lower volume, lightweight replacement for hydraulic control systems. This developed from the F-8 digital fly-by-wire program that began at Dryden in the 1960's. In a flight research program that began in 1972, Dryden demonstrated the feasibility of the concept, and digital fly-by-wire technology was first used on a production aircraft — the F-18 — in 1978. Since then it has been incorporated into many other aircraft, including the C-17.

Composite Materials: Composites technology has been incorporated extensively on components of the C-17 design. Sixteen-thousand pounds of composite materials have been applied to the aircraft. Several of the major control surface and secondary structural components of the C-17 are made of composites. The most direct contribution to C-17 applications was the development of the DC-10 graphite-epoxy upper aft rudders. These rudders have accumulated more than 500,000 flight hours since they were introduced into regular airline service in 1976. (The high-time rudder alone has flown for 75,000 hours.) The control surfaces of the C-17 follow the same multi-rib configuration as the DC-10 rudders.

National Recognition

McDonnell Douglas was recognized for the innovative nature and soundness of the C-17 design when it received the Collier Trophy for 1994, U.S. aviation's greatest annual achievement award.

Future Commercial Applications

On July 7, 1996, McDonnell Douglas Military Transport Aircraft (MTA), a component of the McDonnell Douglas Corporation, submitted an application for Type Certification of a commercial version of the C-17, designated as the "Model MD-17." The MD-17 is planned as a civilian version of the C-17, in a cargo configuration only, designated for carriage of oversized cargo and landing on short and unimproved airfields. McDonnell Douglas also sees the MD-17 as a potential competitor for the AN-124.

In its preliminary form, the MD-17 would cost approximately $170 million, and would be able to carry 80 tons about 3,000 nautical miles. Some applications envisioned are the portage of large airplane engines (i.e., like the Boeing 777's large Pratt & Whitney 4000 engines), oil rig drilling equipment, and other outsize goods that are currently transported only by ship.

Certification on Schedule for the MD-95

This year will be an important one in the development of the new McDonnell Douglas Model MD-95 twin-jet airplane. With certification milestones in place, its transition from paper to hardware will take place in 1997. The FAA, working with the European Joint Airworthiness Authority (JAA), has established a certification basis for the airplane, and is reviewing design data and test proposals in preparation for the eventual type certification.

The MD-95 is the newest McDonnell Douglas twin-jet, designed specifically for the growing 100-seat market. The airplane is powered by the latest technology BR715 engines, one of the quietest engines currently manufactured. The flight deck has a 6-across liquid crystal display (LCD) system integrated with an advanced flight management system (FMS) and a CAT IIIb-capable autoland system. Two configurations of the airplane will be produced initially: the standard MD-95-30, and the longer range MD-95-30ER version.

Milestones in the MD-95 certification project that are scheduled to be accomplished by the end of 1997 are:

- By the end of this year, 95 percent of the first test airplane (T-1) will have been assembled.
- All MD-95 design reviews and prototype development are scheduled to be completed in 1997.
- Numerous aircraft parts and components will be delivered by Douglas Aircraft and its 14 supplier-partners worldwide.
- Assembly of all three flight test aircraft will begin.

During the first half of this year, McDonnell Douglas-Canada (MDCAN) in Toronto will ship T-1's wing halves to Tracor Flight Systems in Palmdale, California, where workers will join them to form the first wing. MDCAN is building the initial wing sets; later ones will be delivered by Hyundai Space and Aircraft Co. in the Republic of Korea.

In addition, aircraft prototype development is scheduled to be finished and the first fuselage barrels from Alenia in Italy (including engine pylons from ShinMaywa in Japan) will be joined together and mated with the first wing

from MDCAN and Tracor — formally marking the beginning of MD-95 assembly.

Joint agreement on the master certification plan by the FAA and by Europe's Joint Airworthiness Authority (JAA) is expected in the second half of this year. Assembly will also begin on T-1's first BMW/Rolls-Royce 715 production model engine for the MD-95.

By late in the year, all T-1 aircraft parts are scheduled to have arrived at Douglas Aircraft in Long Beach (California), and the jet's roll out is scheduled for early 1998.

Concurrently, work will be proceeding on the second and third MD-95 test aircraft, and on the first production model.

Last year, the program completed 100 percent of all preliminary system design reviews and all wind-tunnel testing except thrust-reverser tests, which will be finished early this year. The T-1 empennage has been delivered to Douglas Aircraft from McDonnell Douglas' Salt Lake City (Utah) facility, as has the nose from the company's Huntington Beach (California) plant. The first pylon has been shipped by ShinMaywa to Alenia.

The first deliveries of the MD-95 are expected to start in 1999.

Certification of "Class A" All-Cargo Interiors

The Transport Airplane Directorate has become aware of a number of instances where transport category airplanes, mostly Learjet and Cessna Citation models, have been reconfigured as all-cargo airplanes. These airplanes have cargo compartments classified as Class A, or the cargo compartment classification is not addressed at all. This article serves to clarify the Directorate's position regarding certification of passenger airplanes converted to all-cargo Class A or unclassified cargo compartment configurations.

A 1988 FAA (Flight Standards) policy letter stated:

"...the agency policy has always been, and still is, that cargo compartments larger than that stated in Order 8110.27A(5)(b) are to be classified as Class B through E, whichever is applicable, and that operators comply with all requirements relative to each class."

FAA Order 8110.27, referenced in that policy statement, describes the Class A compartment as:

"...small open compartments used for storage of crew luggage and located in the cockpit area where a fire can be easily discovered by a crewmember."

That Order goes on to state:

"During the 74/75 Airworthiness Review, it was mentioned that full cabins or other large cargo compartments were presented for approval under Class A category, and that these compartments were consistently rejected on the basis that their volume was outside the intent of the Class A category where a fire must be rapidly detected and extinguished. Since the Class A compartment has no liner, large cargo areas have been considered to be outside the intent of the Class A category. It was recommended to limit the volume to 200 cubic feet."

Advisory Circular (AC) 25-18, "Transport Category Airplanes Modified for Cargo Service," issued January 6, 1994, also addresses this subject. In that AC, Class A compartments are defined as follows:

"A Class A compartment is one that is located so close to the station of a crewmember that the crewmember would discover the presence of a fire immediately. In addition, each part of the compartment is easily accessible so that the crewmember could quickly extinguish a fire with a portable fire extinguisher. A Class A compartment is not required to have a liner.

(1) Typically, a Class A compartment is a small open compartment in the cockpit area used for storage of crew luggage. A Class A compartment is not, however, limited to such use; it may be located in the passenger cabin and used for other purposes provided it is close to a crewmember's station. Typically, the crewmember would be a member of the flightcrew; however, the compartment could be located adjacent to the station of any other crewmember.

(2) Because a Class A compartment does not have a liner, it is absolutely essential that the compartment be small and located close enough to a crewmember that any fire that might occur could be discovered and extinguished immediately. Without a liner to contain it, an undetected or uncontrolled fire could quickly become catastrophic by burning out of the compartment and spreading throughout the airplane. There is no specific limit on the volume; however, all portions of the compartment must be virtually within arms length of the crewmember in order for any fire to be detected immediately and extinguished in a timely manner. Although there may be some exceptions, such as a 'U-Shaped' compartment for example, a Class A compartment greater than 50 cubic feet in volume would not typically have the accessibility required by § 25.857(a)(2) for fighting a fire."

Advisory Circular 25-17, "Transport Airplane Cabin Interiors Crashworthiness Handbook," issued July 15, 1991, notes that a Class A compartment was envisioned as a small, open compartment located in the cockpit area.

It is clear from reviewing the above policy, and noting the chronology, that the intent of Class A compartments is not consistent with the conversion of an entire passenger cabin to a cargo compartment and identifying it as Class A.

A number of issues support this view: In order to exit the airplane in the event of an uncontrollable fire, the only path may be through the fire zone. Access to the right-hand emergency exit often does not exist with the compartment fully loaded. In come instances, access to the left-hand exit (i.e., the main cabin entrance) is also blocked. Further, there are no means to protect the flightcrew from the effects of toxic gasses that can be generated in a smoldering fire. (In cargo compartments classified Class B through Class E, the cargo and crew areas are separated and certification tests are conducted to ensure that no hazardous quantities of smoke or fumes will penetrate occupied areas, including the cockpit.)

In addition, other factors that are frequently not addressed in these (Class A) modifications are:

- lack of a cargo restraint system,
- compartment liners, and
- a second emergency exit.

The Transport Airplane Directorate has determined, for the reasons discussed above, that it is inappropriate to classify full cabin or other large areas as Class A compartments. For future certification projects — whether new, amended, or supplemental type certification — the guidance discussed above will be considered.

Slide Cold Soak Test Protocols Simplified

The purpose of this article is to provide a simplified, standardized evacuation slide or slide/raft "cold soak" test protocol applicable to new Technical Standard Order (TSO) C69b applications and for use on new slide or slide/raft programs. This protocol addresses the issues of ambiguity in the TSO and the deployment of the slides or slide/rafts in ambient temperature conditions (65 to 85 degrees F) rather than in a cold soak chamber at -40 or -65 degrees F.

The pertinent issues were discussed among members of the various FAA offices responsible for oversight of the two U.S. companies producing evacuation slides and two U.S. manufacturers of large transport airplanes. These discussions highlighted the practicality of adopting a single cold soak test protocol which would adequately address the requirements of paragraph 4.2 in Appendix 1 of TSO C69b and Section 25.1309(a) of the Federal Aviation Regulations (FAR).

Section 25.1309(a) states:

"The equipment, systems, and installations whose functioning is required by this subchapter, must be designed to ensure that they perform their intended functions under any foreseeable operating condition."

The development of a single protocol will ensure standardization of the cold soak test for all manufacturers of escape slides and large transport category airplanes, including companies not currently manufacturing either product.

The protocol is as follows:

1. Stabilize the stored gas bottle to a temperature of 70 degrees F, plus or minus 5 degrees F, then reduce the stored gas bottle pressure to the minimum dispatch pressure.
2. For components of the slide or slide/raft system installed within the pressurized cabin of the airplane, cold soak the components for at least 16 hours at a maximum temperature of -40 degrees F. For components of the slide or slide/raft system installed outside of the pressurized cabin of the airplane, cold soak the components for at least 16 hours at a maximum temperature of -65 degree F.
3. Deploy the slide or slide/raft into ambient temperature conditions (typically 65 to 85 degrees F) from the appropriate airplane door or a suitable airplane door mock-up or module as soon as possible after removal from the cold soak chamber, with a target of 5 minutes, but not to exceed 10 minutes.
4. To be considered acceptable, the unit should achieve "minimum operating pressure" in all inflation chambers. Minimum operating pressure is the minimum pressure necessary to achieve the evacuation rate specified in paragraph 4.11 of Appendix 1 of TSO C69b. The pressure reading should be taken as soon as possible after deployment, with a target of one minute maximum. A time greater than one minute would be acceptable if the applicant can demonstrate that it is not feasible to get the pressure reading within the target time. In this case, the change in pressure due to the longer time to take the reading should be taken into account.

Steps 1, 2, and 4 of this protocol are virtually identical to comparable steps in protocols in use for current and previous slide development programs in which the slides are/were deployed inside a large cold soak chamber rather than into ambient conditions. It is important to note that the conditions contained in steps 1 (minimum dispatch pressure) and 4 (minimum operating pressure) are considered necessary for compliance with the requirements in section 25.1309(a).

In summary, this protocol is intended for use on new TSO C69b applications and for all new slide or slide/raft programs. It is not intended to be implemented for minor changes to existing slide or slide/raft designs. The protocol specified above will be included in the next revision to TSO C69.

Alternative protocols (which may require more than one test) may be used, provided the requirements of both the TSO and part 25 are met for the specific installation. If an applicant desires to use an alternative protocol, the applicant should discuss the differences from the above protocol and the rationale for using an alternative protocol with the appropriate Aircraft Certification Office (ACO) and the Aircraft Engineering Division of the Aircraft Certification Service (AIR-100) prior to conducting the test. If the ACO and AIR-100 agree to the use of the alternative, the differences and the rationale should be provided and highlighted in the substantiating data package.

Address any questions on this subject to Frank Tiangsing, Transport Standards Staff, at telephone (206) 227-2121; or John Petrakis, Aircraft Engineering Division, at telephone (202) 267-9274.

Guidance on Certification of On-Board Oxygen Generation Systems: Quantity of Oxygen Available

This is article is in response to an inquiry received in the Transport Airplane Directorate, regarding the means to determine the quantity of oxygen available when an on-board oxygen generating system is installed.

The installation of an on-board oxygen generating system (OBOGS) in a transport category or small airplane was not envisioned when the Civil Air Regulations and the Federal Aviation Regulations were formulated. The requirements for a means to determine, during flight, the quantity of oxygen available from each source, appears in both Section 23.1441(c) and Section 25.1441(c) ("*Oxygen equipment and supply*") of the Federal Aviation Regulations (FAR), which pertain to Part 23 and Part 25 certificated airplanes.

A draft Society of Automotive Engineers (SAE) report, prepared by SAE Committee A-10 (Aircraft Oxygen Equipment) in November 1985, discusses the design and installation of OBOGS. It appears that the report was intended to address United States Air Force systems for 1 and 2 crewmember airplanes. There was a note indicating that a report covering transport aircraft would be provided later; however, we do not have the additional report.

Conditions Determining Need for Backup Oxygen System

The author of the SAE report stated that there are two conditions which determine whether a backup oxygen system would be required.

The first consideration addresses the need for 100 percent oxygen. A molecular sieve system will provide 95 percent oxygen, with the remaining gas being primarily nitrogen. It could not, at the time the report was written, provide 100 percent oxygen.

The second consideration addressed the need for a backup oxygen system. This depends on whether oxygen would be required following a failure of the OBOGS. Since OBOGS operates on engine bleed air, loss of engine(s) would result in loss of pressurization and loss of the OBOGS.

It was noted in the SAE report that the difference between 95 percent and 100 percent oxygen in the gas supplied by the OBOGS would have little effect on the time of useful consciousness following a high altitude decompression. For this reason, the oxygen supply was deemed acceptable for crewmembers during emergency descents.

Another consideration is the purity of the oxygen supplied by OBOGS. There are no specific requirements in FAR 23 or FAR 25 regarding contamination of crewmembers (aviator's) breathing oxygen other than Sections 23.1441(b) and 25.1441(b), which note that the oxygen system itself must be free from hazards. SAE Aerospace Standard 8010A, "Aviator's Breathing Oxygen Purity Standard," addresses oxygen purity, but requires 99.5 percent oxygen by volume. This standard cannot be met by an OBOGS. Therefore, special conditions should contain requirements stating that the oxygen supplied by the system must be safe for crew member use. Aerospace Standard 8010A does, however, provide limits on constituents present in breathing oxygen that can be used as a guide.

Need for Special Conditions

The Transport Airplane Directorate considers that Special Conditions may be necessary to provide standards for installation of "new and novel" systems because OBOGS was not envisioned when Parts 23 and 25 were codified. Special Conditions can then be used to document the means by which the system is certificated, thus providing guidance for future applications of this technology.

Generic Issue Papers

The Transport Airplane Directorate has been developing certification handbooks — "Mega Advisory Circulars (AC)" — for each of the certification disciplines. These will be similar to those currently available for engine (AC 33-2B) and rotorcraft (AC 27-1) certification. During development of these Mega AC's, however, it became apparent that much of the guidance and policy has been developed within "issue papers" generated by Aircraft Certification Offices (ACO) during certification projects.

The Directorate's Transport Standards Staff has reviewed issue papers from many recent projects and has developed sets of "*generic issue papers*" relating to the disciplines of Propulsion, Structures, Electrical Systems, Mechanical Systems, and Flight Test. These issue papers have been "genericized" by replacing the applicant's name with a generic name. The resulting "generic issue papers" have been issued to each ACO, and are being provided to the General Aviation Manufacturers Association (GAMA) and Aerospace Industries Association of America (AIA) to facilitate better working relationships with airplane manufacturers.

Purpose of Generic Issue Papers

Generic issue papers serve two purposes:

1. **First**, they provide each ACO a catalogue of issues on recent service-wide transport category projects. Not all of these issue papers were used on each project, and many will not apply to future projects. However, this catalogue can serve as a very useful tool in:
   - identifying potential issues to an applicant,
   - helping to plan initial type boards, and
   - identifying areas where the ACO or applicant may have questions about national or Directorate policy that should be raised to the Transport Airplane Directorate for clarification.
2. **Second**, they provide a useful starting point for the creation of issue papers on new projects.

Although most of the generic issue papers may not be applicable to any single future project, they serve as a useful catalogue of issues and solutions on past certification programs.

It is anticipated that the cognizant ACO will work with an applicant to determine the applicability of any generic issue paper to a new project. In many cases, it may be that the applicant, upon reviewing an issue paper, elects to certificate in the manner described and provides certification plans to achieve this. Under these circumstances, it may only be necessary to document agreements via letter.

In other cases, it may become evident that the product design is different enough so that the generic issue paper does not apply, and that the applicant is using standard compliance means which need no additional documentation via issue paper.

Finally, it may be that the design requires a completely new issue paper.

These decisions must be made by the ACO, applicant, and Transport Standards Staff in accordance with normal certification procedures. Through all of this, the existing generic issue papers should provide a useful library of information for background and decision-making.

Approval Process

The Transport Standards Staff also has implemented a streamlined process for the approval of generic issue papers. Generic issue papers only require coordination within the Directorate by a technical specialist and the project officer — without any additional requirement for upper management approval. The concept behind this approach is that generic issue papers have been "previously-approved," and therefore management approval should only be needed if the issue paper is changed substantially. This streamlined approval process will benefit both the FAA and the applicant/industry.

Benefits

In summary, generic issue papers should offer many benefits to applicants, such as:

- early identification and resolution of issues,
- standardized application of guidance to all applicants,
- in some cases, identification of previously accepted methods of demonstrating equivalency to a specific requirement, and
- an opportunity for open dialogue regarding acceptable methods of compliance.

Color of Emergency Controls: FAR 25.1555(d)(1)

The Transport Airplane Directorate has recently been asked to provide additional guidance concerning the color of various emergency controls installed in transport category airplanes.

Section 25.1555(d)(1) (*"Control markings"*) of the Federal Aviation Regulations (FAR) states: *"Each emergency control (including each fuel jettisoning and fluid shutoff) must be colored red..."*

A question has been raised as to what is included in the category of "emergency controls." For example, does it include the emergency locator transmitter (ELT) switch, the emergency lighting switch, etc.? If the emergency lighting comes on automatically, and it has to be turned off to reserve power for landing, does the switch annunciation need to be red?

The following have been suggested as qualifiers to determine if an item is an emergency control and should be painted red:

- The use of an emergency control is referenced in an emergency procedure.
- The emergency procedure requires immediate use of the control for the emergency condition being addressed.
- The use or misuse of the emergency control for conditions other than that addressed in the emergency procedure may create a hazard or unsafe condition (examples: fuel jettisoning and fluid shutoff).

Based on these qualifiers, the ELT switch does not need to be red if the unit does not have a cockpit switch. For a cockpit-mounted manual ELT switch (on, armed, and off) where the pilot may wish to activate the ELT before crashing, locating a switch painted red may save a few seconds from hunting, and thus allow for the Search and Rescue Satellite System (SARSAT) to receive a signal or two while the airplane is going down. This is a benefit if the ELT or ELT antenna does not survive the emergency landing.

Additionally, based on these qualifiers, the emergency lighting switch should be red if associated with an emergency procedure and/or if the switch should not be touched until necessary because switch activation may drain the batteries. Certain emergency procedures call for turning off the emergency lights to save the emergency lighting batteries, and then turning them on just before the emergency landing. Either the cockpit or flight attendant emergency lighting switch should be red, depending on who has responsibility for its use during the emergency procedure. An alternative to a red switch is a switch located on a panel that has been painted red.

Concerning the question if the switch annunciation needs to be red for emergency lighting that comes on automatically, this Directorate suggests that FAR section 25.1322(b) (*"Warning, caution, and advisory lights"*) would require the color to be amber, indicating the possible need for future corrective action if the pilot must turn off the emergency lights to conserve power. If the pilot does not need to take any action when the emergency lights come on, then white or some other color may be appropriate, as indicated in section 25.1322(d).

There is no evidence to confirm that the installation of red ELT and emergency light switches is a standard practice throughout the industry. Therefore, this policy may be new to some manufacturers. It should be considered as a recommendation and advisory only, and implemented at a convenient change to the type design.

The Installation of TCAS II on Cargo Carrier Aircraft

The following article is the text of the statement made by Guy S. Gardner, FAA's Associate Administrator for Regulation and Certification, on February 26, 1997, before the House Committee on Transportation and Infrastructure, Subcommittee on Aviation, concerning the installation of TCAS II on cargo carrier aircraft.

Mr. Chairman and Members of the Subcommittee —

Mr. Chairman, if I may, I would like to take a moment before beginning my testimony to introduce myself. I am Guy Gardner, and I am pleased to be serving as FAA's Associate Administrator for Regulation and Certification. I look forward to working with you and the other distinguished Members of this Subcommittee on the many important and challenging aviation issues that will be facing this Congress.

I welcome the opportunity to appear before you today to discuss the petition concerning installation of the Traffic Alert and Collision Avoidance System, or TCAS II, on cargo carrier aircraft. You have also asked me to discuss new technology currently under development known as Automatic Dependent Surveillance-Broadcast, or ADS-B. Joining me today are David Harrington, FAA's Acting Deputy Director for Flight Standards, and Ronald E. Morgan, FAA's Director of Air Traffic.

As you know, the FAA is reviewing a petition for rulemaking filed by the Independent Pilots Association (IPA) that asks the FAA to mandate installation of TCAS II on transport category aircraft flown in all-cargo operations. I appreciate the Subcommittee's decision to hold a hearing on this issue. The testimony presented today will be included in the rulemaking docket; therefore, the agency will have the benefit of today's discussions before making its decision on the petition. Although I cannot discuss our ongoing deliberations concerning the petition, this hearing is an opportunity for us to hear your concerns and the concerns of others who will be testifying today. Mr. Harrington and I will be happy to address technical questions you may have concerning operation of these systems.

You have asked me to comment on two particular systems: TCAS and ADS-B. I will briefly discuss TCAS, how it works, and the success we have had with the system. I will also explain how ADS-B is intended to work and the additional benefits ADS-B could provide. Unlike TCAS, ADS-B is not a collision avoidance system, and it does not have a proven track record.

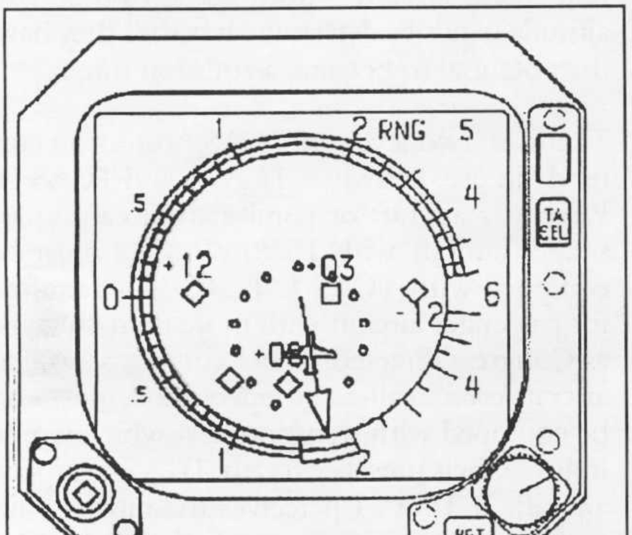
TCAS was developed to reduce the potential for mid-air collisions. The system was designed to operate independently from the air traffic control (ATC) system and to serve as a backup to the ATC system. TCAS operates by transmitting interrogations that elicit replies from transponders in nearby aircraft. The system tracks aircraft within certain range and altitude bands to determine whether they have the potential to become a collision threat.

There are two levels of TCAS protection currently in use, known as TCAS I and TCAS II. Passenger aircraft or combination cargo/passenger aircraft with 10 to 30 seats must be equipped with TCAS I. TCAS II is required for passenger aircraft with more than 30 seats, as Congress directed. These aircraft, as well as aircraft used in all-cargo operations, must also be equipped with transponders, which would indicate their presence to any TCAS-equipped aircraft. If TCAS I perceives the intruder aircraft as a threat, it will provide the pilot with a visual and audible traffic advisory (TA), which gives the intruder aircraft's range, relative altitude, and bearing. TCAS II, in addition to traffic advisories, provides the pilot with a resolution advisory (RA), which suggests a vertical maneuver to avoid the intruder aircraft.

By every indicator, TCAS has been a success. TCAS II is the most common collision avoidance system in use throughout the world today. It has been in operation on various types of aircraft since 1990 worldwide. Today, over 10,000 airline, corporate, and military aircraft are equipped with TCAS II and over 80 million hours of operation have been logged. The number of reported near mid-air collisions in the U.S. has decreased significantly since 1989, during a period when both passenger and cargo air traffic increased substantially. Many foreign countries are mandating the installation of collision avoidance systems and TCAS II is becoming the standard.

By the year 2000, the European Community plans to require TCAS II technology on all civil turbine aircraft weighing more than 15,000 kilograms (approximately 33,000 pounds). Australia, Japan, and India have announced similar plans.

TCAS II Processor



In addressing ADS-B, I would like to clear up a misconception that may have arisen. ADS-B, standing alone, is not a collision avoidance system, and is not an alternative to TCAS. ADS-B is a technology that is intended to support surveillance of aircraft while airborne and on the airport surface. This technology uses the global positioning system (or GPS) and a radio frequency link to broadcast information between aircraft as well as between aircraft and ground-based ADS-B receivers. An aircraft equipped with ADS-B would broadcast its aircraft identification, along with position, velocity, and other time-sensitive surveillance information, to other aircraft and it would receive the same information from other aircraft. But ADS-B is not a collision avoidance system, and would need to be supplemented to provide such protection.

Although ADS-B does not have the operational history enjoyed by TCAS, it does have a potential for improving the range, accuracy and reliability of the air-to-air surveillance information that TCAS uses for collision avoidance. These potential benefits derive principally from the fact that TCAS units must actively interrogate transponders in nearby aircraft, while the ADS-B technique obtains surveillance data simply by listening for ADS broadcasts from other aircraft.

Although ADS-B technology may be promising, there are several significant issues that need to be addressed. Many of the technical standards for ADS-B have not been agreed upon, either in the United States or internationally, and several key technical issues regarding applications of ADS-B message sets need to be developed. In addition, ADS-B must be operationally tested. There are no aircraft equipped with ADS-B in service today, and much work needs to be done before ADS-B can be used to support a collision avoidance system.

Air cargo operators have proposed a phase-in plan that would have the ADS-B system fully operational by the year 2001. Projections that propose full operational capability of ADS-B by the year 2001 would be challenging, given the number of technical hurdles that lie ahead. However, the agency is interested in working with industry to develop and implement this technology. As announced by Vice President Gore in January, and noted in the White House Commission's recommendations for accelerating modernization of the national airspace, we are developing a plan to demonstrate this system.

As I stated earlier, Mr. Chairman, I want to thank you for holding this timely hearing. The IPA petition and the cargo industry's proposal concerning ADS-B raise complex safety and policy issues. We have not yet reached a final determination whether to require cargo carriers to equip with TCAS II, or whether to pursue other alternatives. Many factors need to be balanced, and we will consider these issues very carefully in making our decision on IPA's petition for rulemaking. Today's discussions will help the agency develop a thoughtful and responsible resolution.

Recent Efforts in TCAS Technology: TCAS II Version 7

TCAS II Version 7 is planned to be the final TCAS logic update sponsored by FAA. Accordingly, it will contain solutions to all currently known problems, and will incorporate new requirements deemed necessary by FAA and Radio Technical Commission for Aeronautics (RTCA) participants from industry.

Many of the change items concern performance features. Some circumstances have been identified for which TCAS would not properly resolve a conflict. Solutions for these must not disturb the overall performance of the system. Some of these areas include better use of rate increase advisories and sense reversals.

Reversals would also be made available against a TCAS-equipped threat. The multi-aircraft logic, which resolves multiple simultaneous threats, has been made more robust.

In other areas, experience has provided more insight into the nature of aircraft encounters, both in the U.S. and worldwide. Some changes improve the system's compatibility with air traffic operations, such as the reduction in alerts enabled by a horizontal miss distance filter. This feature, that once was thought to be infeasible using range-only measurements, has proved very effective in simulations using airborne data.

Another change of this kind results from the new advisory aurals and displays, which should mitigate the large vertical displacements sometimes caused by overreaction to a TCAS advisory. Still another such area is the modification to assure compatibility in oceanic airspace where reduced vertical separation minima (RVSM) will soon be implemented. Without this change, frequent nuisance alerts would be issued for aircraft properly separated.

The FAA is pursuing the capability to downlink TCAS Resolution Advisories in real time and display them to controllers. This change will bring signal formats into compliance with new International Standards and will enable the end of an advisory to be rapidly detected, thus avoiding extended display on the controller's screen.

Some other changes that might not be evident to the pilot will still reduce the potential for disruption. Vertical tracking of threats will use altitude data quantized to 25 ft when available, as is the case for most Mode S aircraft. Resolution advisories issued for vertically converging aircraft will usually call for a level-off (as is likely intended by the crews) rather than for a reversal of rate.

FAA Selects Raytheon for New Weather Hazards Prediction System

The FAA has selected Raytheon Company, Equipment Division (Marlborough, Massachusetts) to build a 21st century weather-prediction system that will give air traffic personnel and pilots much better information on weather hazards in the airspace within about 60 miles of an airport.

The *Integrated Terminal Weather System (ITWS)* will generate predictions of weather phenomena such as microbursts, gust fronts, storm cell movements and runway winds up to 10 minutes in advance. The system also will display data on the presence of lightning, hail and tornadoes. This information is especially critical during takeoffs and landings, when weather hazards pose the greatest danger to aircraft.

"We believe this system will be a significant step toward avoiding delays caused by threatening weather and increasing the margin of safety," said Acting FAA Administrator Linda Hall Daschle. *"It is another sign of the FAA's commitment to making improvements in our weather forecasting capabilities."*

Under the contract, which ultimately could be worth $44.5 million with options, Raytheon will develop, test, install and maintain ITWS at 34 operational sites covering 45 airports with significant weather hazards. The company also will install and maintain ITWS at the FAA's William J. Hughes Technical Center, the FAA Academy, and the ITWS Program Support Facility.

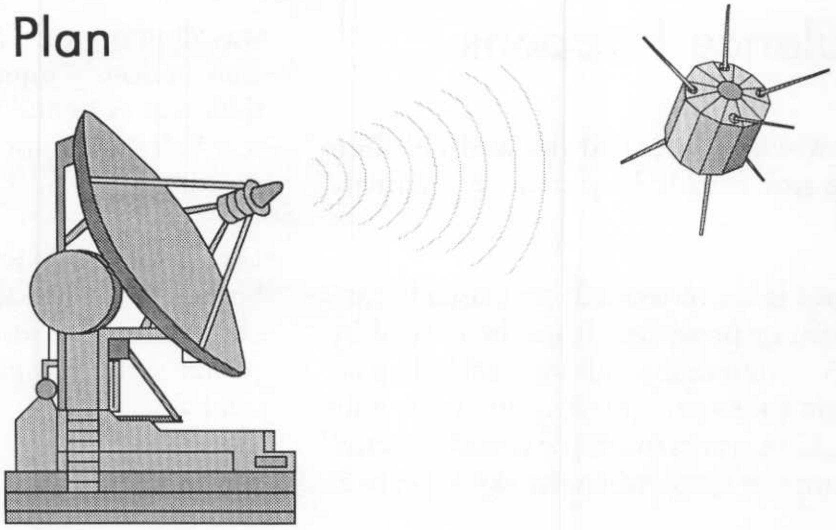
The first production ITWS is scheduled to be operational at Memphis, Tennessee, in November 2001, with the last installation at Dayton, Ohio, becoming operational in February 2003.

ITWS will automatically combine data from FAA and National Weather Service sensors and radars and present the information to air traffic personnel via easily understood graphics and text. This will let controllers focus on normal air traffic functions and will free them from the sometimes confusing, labor-intensive task of manually interpreting the data.

ITWS also will be used by aircraft equipped with "data link" — equipment that permits error-free communications between computers on the ground and in the cockpit. They will access the ITWS updates via a ground-based terminal weather information system designed especially for pilots.

The information generated by ITWS will help produce a common situational awareness between air traffic controllers and pilots. It also will let controllers better manage aircraft during periods of threatening weather, which will cut down on delays and increase the capacity of the terminal area airspace.

GPS Transition Plan



By the year 2010, most of the current ground-based navigation systems could be a part of aviation history. Some systems, such as LORAN-C and Omega, will be "retired" even sooner under the FAA's recently approved Global Positioning System (GPS) Transition Plan.

Former FAA Administrator David R. Hinson said,

"If everything goes as outlined in the plan, an augmented GPS will replace today's ground-based systems that uses technologies dating back to the 1950's." Satellite-based navigation, he continued, "will have a profound effect on aviation. For the first time, pilots using GPS will be able to determine their crafts' precise positions anywhere in the world, whether they are in the air or on the ground."

Under the transition plan, the FAA will phase out ground equipment and avionics that support VOR, DME, ILS, NDB, Omega, LORAN-C, and marker beacons. The U.S. will discontinue Omega by the end of 1997, and Australia plans to discontinue Omega by September 30, 1997. GPS does now and will replace the RNAV function of Omega. LORAN-C service will be ended in 2000.

Hinson said the GPS transition plan represents *"a compromise between aircraft operators' desire to get maximum return on their investments in current systems and the FAA's goal of decommissioning"* ground-based systems and moving to GPS.

"Moving from the navigation and landing guidance system already in place to a GPS-based system will require air carriers, general aviation, and the military to make significant equipment changes," said Hinson. Accordingly, the transition plan outlines a transition period of about 10 years. During that time, augmentations to enhance GPS accuracy will be put in place, and pilots are expected to increase their experience with GPS, resulting in increased confidence in the satellite-based navigation system.

During the first half of the transition, all ground-based systems will be maintained at full function. In the second part of the transition, ground-based systems will be decommissioned in proportion to the reduction of users but at a level that will support those who have not yet transitioned to GPS. Hinson assured pilots that current ground systems would be totally decommissioned *"only after the aviation community is convinced of the integrity and availability of the GPS system."*

Turbulence Happens

... And when it does, adults and children who are not buckled up can be seriously injured.

Turbulence is air movement that usually cannot be seen or predicted. It can be created by a number of different conditions, including atmospheric pressures, jet streams, mountain waves, cold or warm fronts, or thunderstorms. Turbulence can occur when the sky appears to be clear.

To help people prepare for unexpected turbulence, the Federal Aviation Administration is launching ***Turbulence Happens***, a multimedia campaign to raise public awareness about airline passenger restraint and how to avoid injury caused by turbulence. It is designed to educate Americans about airline passenger restraint and how to avoid injury caused by turbulence. ***Turbulence Happens'*** multimedia campaign materials include a series of television, print, and radio public service announcements that FAA produced to publicize its safety message.

History

In non-fatal accidents, in-flight turbulence is the leading cause of injuries to airline passengers and flight attendants. Each year, approximately 58 airline passengers in the United States are injured by turbulence while not wearing their seat belts. Two-thirds of turbulence-related accidents occur at or above 30,000 feet.

From 1981 to November 1996, there were 252 reports of turbulence affecting major air carriers. As a result, two passengers died, 63 suffered serious injuries, and 863 received minor injuries. Both of the fatalities in these incidents involved passengers who were not wearing their seat belts while the seat belt sign was illuminated. Of the 63 passengers who were seriously injured, 61 were not wearing their seat belts and 59 were not wearing their seat belts while the seat belt sign was illuminated.

One of the latest incidents occurred on December 5, 1996, when an American Airlines jetliner ran into clear-air turbulence over Colorado; 16 people suffered injuries, including a 7-month-old baby.

What about the Regulations?

Current FAA regulations require passengers to be seated with their seat belts properly fastened at the following times:

- when the aircraft leaves the gate and until it climbs after takeoff;
- during landing until the aircraft reaches the gate and comes to a complete stop; and
- whenever the seat belt sign is illuminated during flight.

In the aftermath of two serious turbulence events in June 1995, the FAA issued a public advisory to airlines urging the use of seat belts at all times when passengers are seated. The FAA concluded that the rules concerning seat belts did not require strengthening, but that a public education initiative was necessary to encourage the use of seat belts.

FAA's Turbulence Happens Campaign

Turbulence Happens is supported by several major aviation and child safety organizations, including the Association of Flight Attendants, Air Transport Association, National SAFE KIDS Campaign, and the National Safety Belt Coalition.

During 1997, the FAA will work with travel, health, and consumer safety partners, to enhance its efforts to reach and educate all Americans about the importance of passenger restraint.

The FAA strongly urges all passengers to follow important safety advice so that injuries can be avoided. Children weighing less than 40 pounds should be securely placed in an approved child restraint system. Children weighing over 40 pounds are urged to follow the same recommendation as all other passengers — keep their airplane seat belt fastened at all times.

New Weight Categories for Wake Vortex Separation

Following two high visibility accidents involving wake turbulence, the FAA conducted a full review of the aircraft weight classification system used with wake vortex separation standards for approach and arrival. This review was conducted by a working group composed of government and industry representatives, including manufacturers, airlines, and pilots. As a result of the working group's recommendations, the weight categories, for the purposes of wake vortex separation standards, have been changed.

The new weight (maximum certificated takeoff gross weight) classification definitions of *Heavy*, *Large*, and *Small* are:

- ***Heavy***: Aircraft capable of takeoff weights of more than 255,000 pounds, regardless of weight during any particular phase of flight.
- ***Large***: Aircraft capable of takeoff weights of more than 41,000 pounds but less than 255,000 pounds.
- ***Small***: Aircraft of 41,000 pounds or less.

This means that 55 aircraft previously in the *large* category have been moved to the *small* category.

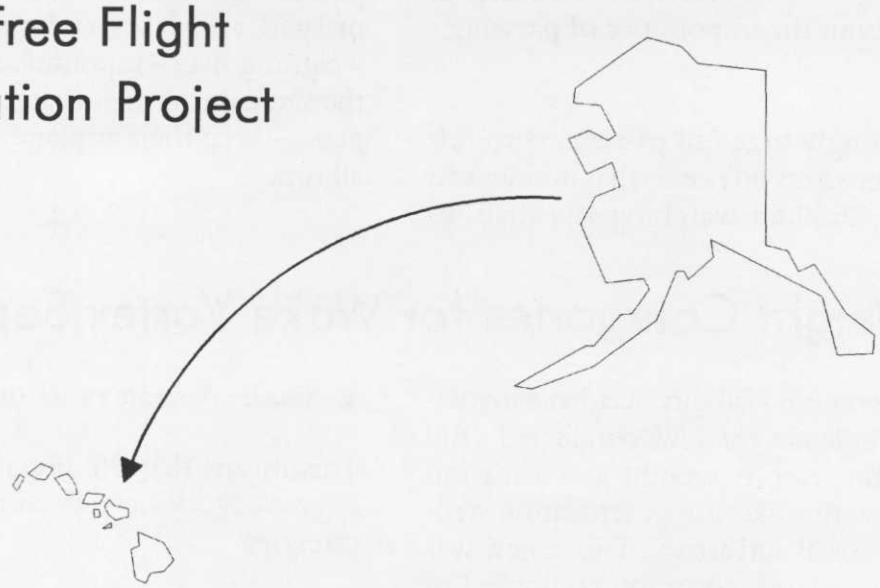
There are a few exceptions, however. For example, the Saab Model SF-340 and Aerospatiale Model ATR-42 are less than 41,000 lbs., but are classified as *large* aircraft for the purposes of wake vortex separation. Other aircraft may also be moved from the *small* to the *large* class as FAA continues an on-going study of wake vortex separation standards.

For the separation standards themselves, consult a current edition of the FAA's "*Aeronautical Information Manual,*" available at most Government Printing Office bookstores.

Summary of Weight Categories for Wake Vortex Separation

Category	Previous	New
Heavy	More than 300,000 lbs.	More than 255,000 lbs.
Large	More than 12,500 lbs., less than 300,000 lbs.	More than 41,000 lbs., less than 255,000 lbs.
Small	Less than 12,500 lbs.	Less than 41,000 lbs.

Ha-laska Free Flight Demonstration Project



Beginning in 1999, the Federal Aviation Administration will conduct a two-year evaluation of new air traffic management concepts and technologies in Alaska and Hawaii to help accelerate the pace of safety and efficiency improvements throughout the U.S. aviation system.

Goal of the Project

The goal of the "Ha-laska" (Hawaii-Alaska) project is to demonstrate that existing technologies can support the concept of "free flight" — a revolutionary air traffic management concept that greatly increases users' flexibility to plan flight routes and operate aircraft. These technologies include the Global Positioning System (GPS) navigation satellites; digital data link for communications, navigation, and surveillance; and conflict probe and safety alert systems on the ground and aboard aircraft.

What is Free Flight?

Free Flight is an idea whose roots lie in economic necessity. In the United States, airspace users feel that the current air traffic management (ATM) system significantly limits the capacity, efficiency, and flexibility of their operations, thereby imposing higher costs on the industry. The cause of this problem rests in the inability of the present system to keep pace with growing demand. Existing equipment and procedures rely on outdated systems and cause continuous intervention.

Free Flight is a pre-flight through arrival gate (or block) concept that provides maximum flexibility to the users without compromising safety. Each aircraft will fly a dynamic, optimum flight path, making full use of on-board performance management systems and enhanced cockpit situation awareness. Position and short-term intent information will be provided to the air traffic management system, which will perform separation monitoring and prediction functions.

Intervention will occur on a "by exception" basis to resolve any detected conflicts. Short-term restrictions will be used only when two or more aircraft are in contention for the same airspace or airport runway in the same time period. In normal situations, aircraft maneuvering will be unrestricted. Separation assurance, currently provided by ground-based automation, will be enhanced by appropriate on-board systems, and collision avoidance systems will continue to guard against failure.

Central to the idea of Free Flight are new operational concepts for reallocating the roles of air and ground in providing separation and for relaxing system flow constraints. New cockpit capabilities are being envisaged and prototyped to provide the pilot with enhanced situation awareness, enabling decision-making in the cockpit.

The Ha-laska Free Flight Concept

The free flight concept to be tested in the Ha-laska program, in its ultimate form, could let pilots fly whatever route and altitude is best for the existing conditions. The advantages include fuel and time savings from flying more direct routes and a more efficient use of airspace to accommodate aviation growth.

The FAA and its industry partners already have conducted simulation tests and laboratory demonstrations of all the free flight technologies separately. But to make a rapid transition to a modernized system across the United States that takes advantage of these technologies, a complete operational system evaluation must be done under real operational conditions prior to system-wide deployment.

This will significantly reduce the learning curve and pave the way for a faster and smoother transition to the new modernized system. It also will help ensure that the money spent to modernize the U.S. air traffic system will achieve the intended benefits.

Another objective of the Ha-laska evaluation will be to help find ways to reduce the cost of avionics as well as the cost of certifying this on-board equipment. The FAA believes true system-wide safety and capacity benefits will be realized only if there is virtually universal equipage of aircraft.

Selection of Evaluation Sites

Alaska and Hawaii were selected as evaluation sites because of their unique features:

- **Hawaii** offers a controlled environment with an affordable fleet size to do full-scale evaluation safely and quickly.
- **Alaska** offers similar advantages, plus a wide range of weather conditions and rugged terrain to help evaluate the safety benefits of providing weather displays, collision avoidance alerts and other safety information directly to the cockpit.

Approximately 2,000 aircraft in both states will be equipped with compatible on-board avionics. These include all commercial and general aviation (non-commercial) aircraft in Hawaii (about 600) and 1,400 commercial aircraft in Alaska. Approximately 100 military aircraft also will be similarly equipped.

Funding issues are currently under consideration.

Commercial Aviation Forecast Reports Three Straight Years of Strong Growth and Counting

Citing President Clinton's policies and the third longest economic expansion since World War II, Secretary of Transportation Rodney E. Slater announced on March 5, 1997, that U.S. airlines have recorded a third straight year of strong growth — an encouraging sign that a continued upward trend is expected into the 21st Century.

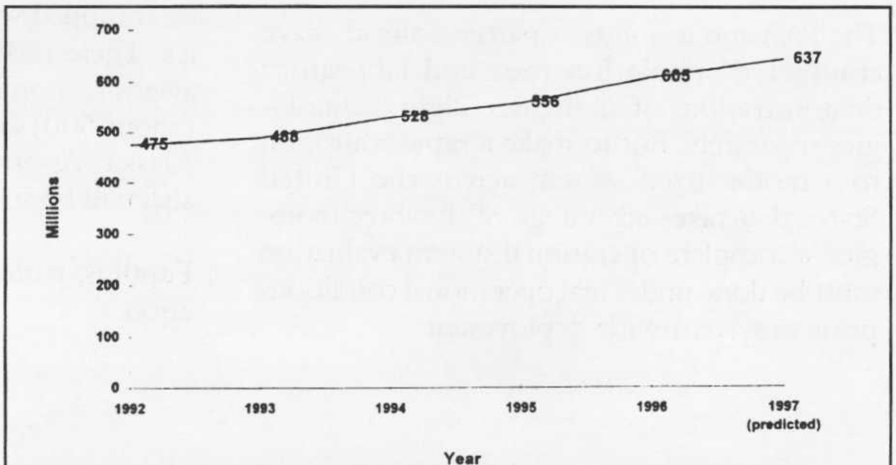
This announcement came on the heels of the release of the FAA's annual commercial aviation forecast, which revealed that an unprecedented 605 million people flew on the nation's air carriers in 1996 with enplanements expected to grow to nearly one billion by 2008.

Slater said: *"Together with the aviation community, this administration has diligently worked to maintain a safe, vibrant, and competitive air transportation system. "The 'one level of safety' rules, advanced air-traffic technologies, better safety reporting, enhanced oversight and maintenance methods, and improved satellite navigation, are just a few of the challenges successfully moving forward to advance aviation safety and efficiency. These successes and others, give me confidence that together we can meet future needs of a growing and dynamic aviation system of the 21st Century."*

Slater's announcement came on the first day of FAA's two-day 22nd Annual Commercial Aviation Forecast Conference with airlines, airports, labor, and other travel-related sectors in Washington, D.C. The event focused on "Growth Strategies for the 21st Century." The conference coincided with release of FAA Aviation Forecasts — Fiscal Years 1997-2008.

Speaking at the event was Acting FAA Administrator Barry L. Valentine, who said, *"Working with the business, labor, and entire aviation communities, over the last four years the Clinton administration has boldly moved forward with a number of comprehensive measures to improve aviation safety. Today's report demonstrates that we can — and will — make aviation even more safe while still maintaining a vibrant and competitive air-transportation industry."*

Air Carrier Traffic Statistics: Total Passenger Enplanements (domestic): 1992-1997



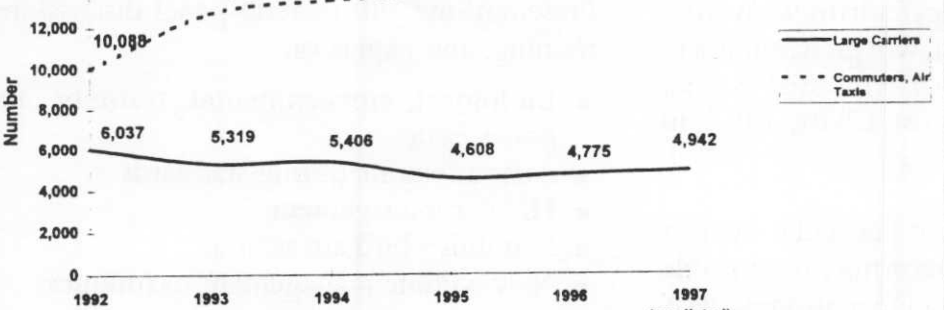
According to the forecast report, domestic and international air traffic was stimulated by world-wide economic expansion as well as falling air fares. Domestic enplanements increased from 527.8 million in 1995 to 555.6 million in 1996, an increase of 5.3 percent. United States air carrier international enplanements also increased by 3.5 percent from 48.6 million to 50.3 million.

The figures in this FAA forecast cover a wide range of areas, including large U.S. commercial air carriers (greater than 60 seats) and U.S. regional/commuter airlines (60 seats or less). For the first time ever, the forecast looks at total air traffic (including foreign flag carriers) between the United States and rest of the world. According to the figures, total traffic to and from the United States is expected to increase from 94.8 million in 1996 to 183.6 million in 2008, an annual increase of 5.7 percent.

FAA forecasts find that large domestic air carrier enplanements are expected to increase by 4.3 percent to 546.2 million next year. With an average 3.9 percent increase each year, enplanements on large aircraft are expected to grow to 827.1 million in 2008. United States international enplanements are forecast to increase to 53.1 million in 1997, and grow 5.8 percent a year over the 12-year forecast period to 98.5 million in 2008. Pacific routes are expected to have the greatest increase in enplanements, growing from 15.3 million in 1996 to 32.6 million in 2008 — an average 6.5 percent increase per year.

In 1995, the Department of Transportation and FAA embarked on an aggressive *"One Level of Safety"* regulatory package to make small aircraft of 10 to 30 seats follow the same certification and regulation practices as large planes. Many critics felt the changes called for in the rules could be too costly. However, according to the forecast report, the smaller regional/commuter carrier enplanements are expected to increase to 62.5 million in 1997, and average a 5.3 percent increase per year reaching 106.9 million in 2008.

Aircraft manufacturers are also expected to continue to experience increases. In 1996, the U.S. large air carrier jet fleet was 4,775 aircraft. In 2008, it is expected to grow annually by 3.5 percent to 7,226 aircraft. The commuter passenger fleet is also expected to increase from 2,090 in 1996 to 2,909 in 2008, an average yearly increase of 2.8 percent.



Total Number of Domestic Aircraft 1992-1997

Agencies Work Together to End Wildlife Threat to Flying Aircraft

The FAA and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, and Animal Damage Control (USDA-APHIS-ADC) are working to resolve animal hazards to aviation.

Wildlife hazard to aviation has become a national problem. The populations of geese, gulls, deer, coyotes, and other wildlife that have been hazards to aviation, have been steadily increasing over recent years. The size and the number of aircraft are also increasing. The resultant combination is an increased likelihood of aircraft experiencing a multiple bird strike or engine ingestion, or a damaging collision with wildlife other than birds.

Most bird strikes occur in the fall, and 80% happen below 1,000 feet AGL. Landing aircraft account for 50% of the reported bird strikes.

Regardless of these statistics, the reported number of bird strikes is probably much lower than it should be for several reasons:

- Airports traditionally have not been keeping good records of bird strikes. Some are not keeping any records at all.
- Many people are afraid to report a bird strike, because the bird might be on the endangered species list.
- Some pilots feel that reporting a bird strike will bring additional unwanted scrutiny from the FAA.

Because ADC has the expertise to provide the technical and operational assistance needed to reduce wildlife hazards to aviation on and near airports, the ADC and FAA will begin working more closely in the early stages of an airport project.

Seventh Annual Bird Strike Committee USA

Each year, up to $200 million is lost and lives are endangered worldwide when birds and other wildlife damage aircraft. To meet this ongoing challenge, the FAA, the U.S. Air Force's Bird Aircraft Strike Hazard Team, and U.S. Department of Agriculture's Animal Damage Control Program, will present the seventh annual meeting of the Bird Strike Committee USA on August 12-14, 1997, in Boston, Massachusetts.

This annual gathering is of particular interest to military and civilian personnel responsible for airfield operations, wildlife managers, FAA airport inspectors, university researchers, engineers, pilots, air transport industry representatives, and anyone interested in reducing bird-strike hazards to aircraft.

The meeting will feature a field trip to Logan International Airport and surrounding areas. A bird-strike-reduction training session will round out the program.

Presentations will include panel discussions, training, and papers on:

- Biological, environmental, training, and policy issues
- Aircraft engine testing standards
- Habitat management
- Landfills - bird attractants
- New wildlife management techniques.

The meeting will be held at the Ramada Inn near Logan Airport. For more information, please contact Jim Forbes at (518) 477-4837.

Allowable Carbon Dioxide Concentration in Transport Category Airplane Cabins

On November 21, 1996, the acting FAA Administrator issued Amendment 25-89 to the Part 25 of the Federal Aviation Regulations (FAR). The amendment revises the standards for maximum allowable carbon dioxide (CO_2) concentration in occupied areas of transport category airplanes by reducing the maximum allowable concentration from 3% to 0.5%. That action was initiated in response to a recommendation from the National Academy of Sciences to review the CO_2 limit in airplane cabins, and provide a cabin CO_2 concentration level representative of that recommended by some authorities for buildings.

Background

In October 1984, the Department of Transportation was directed by Congress (Public Law 98-466) to commission the National Academy of Sciences (NAS) to conduct an independent study on the cabin air quality in transport category airplanes. The NAS formed the Committee on Airliner Cabin Air Quality to study all safety aspects of airliner cabin air quality, and submitted its report, "*The Airliner Cabin Environment—Air Quality And Safety*," to the FAA on August 12, 1986. One of the recommendations in the report relates to the allowable carbon dioxide (CO_2) concentration in the airplane cabin.

Carbon Dioxide in Aircraft Cabins

(NOTE: For the purposes of this article, the term "cabin" is meant to include the passenger cabin, the flight deck, lower lobe galleys, crew rest areas, and any other areas occupied by passengers or crew members in a transport category airplane.)

Carbon dioxide is the product of normal human metabolism, which is the predominant source in airplane cabins. The CO_2 concentration in the cabin depends on the ventilation rate, the number of people present, and their individual rates of CO_2 production, which varies with activity and (to a smaller degree) with diet and health. Carbon dioxide is also generated by sublimation of dry ice used to cool food in the galleys, and to preserve certain cargo carried in the cargo compartments. The carbon dioxide concentration level is frequently used as an indication of general air quality. At concentrations above a given level, complaints of poor air quality or "stuffiness" begin to appear.

The maximum CO_2 limit delineated by Section 25.831(b)(2) of the FAR is 3% by volume, sea level equivalent. This 3% limit was incorporated into Section 4b.371 of the Civil Air Regulations (CAR) by Amendment 4b-6 on March 5, 1952. This limit was carried over into 14 CFR Part 25 when that part was codified in 1965. This high limit was established to allow for increases in the carbon dioxide levels in the crew compartment to ensure that, in airplanes with built-in carbon dioxide fire extinguishing systems, safe carbon dioxide concentration levels would not be exceeded in the occupied areas when combating fires in cargo compartments.

CO_2 Limits Recommended by Other Organizations

The **American Conference of Governmental Industrial Hygienists (ACGIH)** has adopted a short-term exposure limit (STEL) for CO_2 of 30,000 parts per million (3%). The 3% limit specified in Part 25 may therefore be satisfactory as a short-term limit, but is inappropriate for a steady-state condition.

However, the NAS Committee noted in their report that this 3% limit is much higher than the limits adopted by the air conditioning industry for buildings and other types of interior environments, and recommends that the limit specified in part 25 be revised to more closely match the currently acceptable limits.

In contrast to the 3% limit specified in Part 25, the **American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE),** in their Standard 62-1989, recommends an outside air ventilation rate of 15 cubic feet per minute for vehicles. Based on the ASHRAE calculations, this equates to a CO_2 limit of 1,000 parts per million (PPM), or 0.1%, if the occupants have a low physical activity level. As most of the airplane occupants are passengers who are not active, this is a reasonable parallel. ASHRAE standards such as the 0.1% CO_2 limit are frequently quoted in magazine and newspaper articles when reporting on airliner cabin air quality.

As CO_2 concentration in the air increases, there is an increase in both the rate and the depth of breathing, reaching twice the normal rate at 3% concentration. At 3% concentration, there is some discomfort; at higher concentrations, headache, malaise, and, occasionally, fatigue occur, and the air is reported by those affected as being stale. People can function for long periods of time at levels of CO_2 as high as 1% (as in nuclear submarines), but it is generally considered by ASHRAE that 0.1% is a better limit. This value, however, is based on the dissipation of smoke and odors and not on health considerations.

As noted above, according to ASHRAE Standard 62-1989, a steady-state CO_2 concentration of 0.1% would require a fresh-air ventilation rate of 15 cubic feet per minute (cfm) per person. In the previous edition of the Standard (62-1981), ASHRAE recommended a limit of 0.5% for office buildings and other occupied spaces, but suggested that 0.25% would provide an additional safety factor. The ASHRAE standard is intended to be used as a comfort standard rather than a health and safety standard.

ASHRAE has recognized that the 0.1% CO_2 concentration limit may not be appropriate for airliner cabins, and has formed an aviation subcommittee, the charter of which is to develop a transport airplane cabin air quality standard. While this subcommittee is not an FAA advisory committee, industry often uses ASHRAE standards in designing systems. The subcommittee will sponsor research studies to determine the quality of the ambient air and quantify the correlation between measurable contaminants and passenger perception of air quality. As noted above, ASHRAE standards were intended to be used for buildings rather than vehicles such as airplanes, and they consider it appropriate to establish a new standard for airplanes at this time.

The **Occupational Safety and Health Administration (OSHA),** in Section 1910.1000 of Part 1910 (CFR 29), sets an interim (transitional) limit for CO_2 at 5,000 ppm or 0.5%, with a final rule limit of 10,000 ppm or 1%, effective December 31, 1993. The increase to 1% is apparently in deference to operators of commercial bakeries and breweries, both of which generate a significant amount of CO_2 in their processes. The FAA does not consider that it is appropriate to base the allowable CO_2 concentration in transport category airplanes on the needs of specific manufacturing processes. Other commercial enterprises have no difficulty in meeting the existing OSHA limit of 0.5%.

The **American Conference of Governmental Industrial Hygienists**, in its "*Documentation of the Threshold Limit Values and Biological Exposure Indices - Sixth Edition*," also recommends 0.5% as a limit, but ACGIH recommends this value as a time-weighted average limit for repeated daily exposure by workers. In Amendment 25-89, the FAA has adopted this value as a limit. A concentration limit of 0.5% is considered to be appropriate because there are no documented safety or health benefits associated with the establishment of a lower value.

Cabin Ventilation Rates

Cabin ventilation provides air for dilution of airborne contaminants, and supplies oxygen for passengers and crew. Oxygen requirements for sedentary adults can be met with a fresh-air ventilation rate of only 0.24 cubic feet per minute (cfm) per person. Ventilation rates for current transport category airplanes vary from a low of approximately 7 cfm per person (with one or more air conditioning packs turned off for economy), to over 20 cfm per person (which includes up to 50% filtered, recirculated air).

Thus, even at the lowest ventilation rates available on current airplanes, there is no significant reduction in the percentage of oxygen, or increase in the amount of water vapor in the cabin due to respiration. However, the design parameters for the ventilation systems are driven by operation on the ground during hot days. Contamination of air with CO_2 varies inversely with the ventilation rate, because CO_2 production by sedentary people is nearly constant.

In order to bring the maximum allowable carbon dioxide concentration into concert with accepted modern limits, Amendment 25-89 adopts a new maximum allowable carbon dioxide concentration of 0.5%. According to ASHRAE, for sedentary people this concentration can be maintained by a fresh air flow rate of 2.25 cfm per person, which is lower than that currently measured in transport category airplanes.

Specific Changes to the Rule

Section 25.831(b)(2) currently reads, "*Carbon dioxide in excess of three percent . . . is considered hazardous in the case of crewmembers*." The health and comfort considerations discussed earlier are equally valid for passengers. Therefore, the FAA has removed the reference to only crewmembers.

In addition, Section 25.831(b)(2) also specifies that, "*Higher concentrations of carbon dioxide may be allowed in crew compartments if appropriate protective breathing equipment is available*." This sentence was incorporated when the 3% limit was established in CAR 4b.371 in 1952. As noted above, the origins of the 3% limit are unclear, but it is likely that the limit was set at this high level to account for the discharge of CO_2 fire extinguishers in the flight deck, cabin, or cargo compartment. This thesis is supported by the mention of protective breathing in the existing rule. However, most CO_2 extinguishers have been replaced by Halon or other types of fire extinguishers. Further, the rule is not intended to cover the short-duration rise in CO_2 concentration that would accompany discharge of a fire extinguisher. Therefore, that sentence in Section 25.831(b)(2) is removed because it is no longer considered necessary or appropriate.

Section 25.831(b)(1) specifies a limit for carbon monoxide (CO) concentration of 1 part in 20,000 parts air (0.005 %). This limit is the same as currently recommended by ASHRAE and the Occupational Safety and Health Administration (OSHA), and therefore the new Amendment does not change this limit.

Amendment 25-89 became effective on January 2, 1997.

For any additional information on this subject, contact: Kristin L. Larson, Flight Test and Systems Branch, ANM-111, Transport Airplane Directorate, at tel. (206) 227-1760, facsimile (206) 227-1100, e-mail kristin.larson@faa.dot.gov.

Current Advisory Circular Projects

Underway currently in the Transport Airplane Directorate are the following projects related to Advisory Circulars (AC):

Airplane Flight Manual

Description: This document defines the information required to be included in an airplane flight manual (AFM) by the applicable airworthiness regulations, and provides current guidance as to both the form and content of the approved and unapproved portions of an AFM.

Status: The proposed AC was published in the **Federal Register** for public comment on April 15, 1992. The project has been subsequently revised to harmonize more fully with work by the Joint Airworthiness Authorities (JAA). The work on the technical aspects of the AC have been completed. The FAA plans to re-publish the AC in May 1997 for public comment.

Related Rule: Section 25.1581 of the Federal Aviation Regulations (FAR).

Revision of AC 25-7, Flight Test Guide for Certification of Transport Category Airplanes

Description: The objective of this project is to update the guidance in FAA Order 8110.8, "Engineering Flight Test Guide," and incorporate that guidance into an AC. The first portion of this project was completed when Subpart B (Flight) was updated and issued as AC 25-7 on April 9, 1986. The current portion of this project includes a review of AC 25-7 to address harmonization of the FAR/Joint Aviation Regulations (JAR). Ultimately, all remaining Part 25 guidance from Order 8110.8 will be updated and incorporated into AC 25-7, at which time Order 8110.8 will be canceled.

Status: The FAA is currently reviewing comments received during the public comment process. The AC is being revised based on those comments.

Related Rules: Various sections of Part 25 of the FAR.

Operations Without Normal Electrical Power

Description: This AC sets forth three specific methods of compliance with the requirements pertaining to electrical power sources and distribution systems required to power instrument displays, systems, equipment, or parts of the airplane which are required for safety of flight during instrument meteorological conditions (IMC) operations.

Status: The draft AC is being reworked as a result of comments received from coordination within the FAA. A redraft is expected to be ready for recoordination within the FAA by Summer 1997.

Related Rules: Sections 25.1309, 25.1333, and 25.1351 of the FAR.

Revision of AC 25.571-1A, Damage-Tolerance and Fatigue Evaluation of Structure.

Description: This revised AC provides clarification of the damage tolerance assessment for the operational life of an airplane type that exceeds the original design life.

Status: The AC was published in the **Federal Register** for public comment October 19, 1993; the comment period closed on January 14, 1994. The revised AC has been finalized and is currently on hold awaiting FAA issuance of the associated final rule (see Current Rulemaking Projects; Fatigue Evaluation of Structure).

Related Rule: Section 25.571 of the FAR.

High Altitude Takeoff Approval for Turbojet Powered Transport Airplanes

Description: This AC provides guidance for the certification of takeoff power at high altitudes for turbojet and turbofan powered airplanes. It consolidates FAA guidance concerning this subject and serves as a ready reference for those involved with transport category airplane type certification and operation. Guidance is included concerning the evaluation of power management techniques, thrust lapse rates, engine limits compliance, and altitude extrapolation limits.

Status: The draft AC is in early stages of coordination within the FAA.

Related Rules: Sections 21.101 and 25.105, 25.111, 25.939, 25.1521 of the FAR.

Flammable Fluid Drainage

Description: This AC provides guidance for demonstrating compliance with Section 25.1187 of the FAR, "Flammable Fluid Drainage."

Status: A notice requesting public comments on the draft AC was published in the **Federal Register** on July 25, 1995. The period for public comment closed on November 22, 1995. The team developing this project is reviewing comments received.

Related Rule: Section 25.1187 of the FAR.

Transport Category Airplane Electronic Display Systems

Description: A project has been initiated to revise AC 25-11, "Transport Category Airplane Electronic Display Systems," to address known deficiencies and correct errors.

Status: A proposed AC is in its initial drafting stage.

Related Rules: Pertinent sections of Part 25 of the FAR.

Airworthiness Criteria for the Approval of Airborne Windshear Detection and Avoidance Systems in Transport Category Airplanes

Description: A project is underway to develop an AC that provides guidance for the airworthiness approval of airborne windshear short and long-range detection and avoidance systems in transport category airplanes.

Status: A draft AC is in its initial drafting stage.

Related Rules: Pertinent sections of Part 25 of the FAR.

Airframe Handbook

Description: A project is underway to develop a consolidated source of advisory/policy material pertaining to the structural and flight control requirements of Subpart C, and portions of Subparts D and E of the FAR.

Status: The handbook has been drafted and is currently in the early coordination process within the FAA. The FAA plans to issue this AC by the end of 1997.

Related Rules: Part 25 of the FAR, Subparts C, D, and E.

Mechanical Systems

Description: A project is underway to provide a consolidated source of advisory material associated with Subpart D, "Design & Construction," and Subpart F, "Equipment," of part 25 of the FAR, for those areas related to mechanical systems.

Status: The handbook has been drafted and is in the early stages of coordination within the FAA. The FAA plans to issue this AC by the end of 1997.

Electrical Systems

Description: A project is underway to provide a consolidated source of advisory material associated with Subpart F, "Equipment," of part 25 of the FAR, for the area related to electrical systems.

Status: The handbook has been drafted and is in the early stages of coordination within the FAA.

Certification of Transport Category Airplane Propulsion Systems.

Description: A project is underway to provide a consolidated source of advisory material associated with Part 25 of the FAR, Subpart E, "Propulsion." Some of the topics included are:

- Engine Nacelle Anti-icing Provisions
- Certification Methods for Full Authority Digital Electronic Engine Control Systems (FADEC)
- Automated Fuel Management Systems
- Engine Fire Extinguishing Concentration Testing

Status: The AC is currently being drafted.

Related Rules: Part 25 of the FAR, Subpart E, "Propulsion."

The FAA also is considering various other AC projects to initiate. Some of these are:

Revision of AC 20-57A, Automatic Landing Systems

Description: This project updates existing AC 20-57A, "Automatic Landing Systems." The existing AC was written for and based on airplanes utilizing ILS guidance for final approach and landing and is no longer appropriate for new systems. This revision to AC 20-57A will include additional guidance concerning localizer/glideslope characteristics, windshear modeling, irregular terrain, and threshold crossing height.

Related Rules: Various sections of the FAR.

Contaminated Runway Accountability

Description: This AC updates AC 91-6B, "Water, Slush, Snow and Ice on the Runway," dated May 24, 1978, to include guidance on takeoff, landing, and reduced braking friction, as well as water/slush drag forces.

Related Rules: Sections 25.107, 25.109, 25.125, 25.1581, 91.37, 121.189, 121.195, 121.197, 135.379, 135.385, and 135.387 of the FAR.

Engine Restart Demonstration

Description: This AC will provide guidance for demonstrating compliance with a proposed rule to require improved engine in-flight restarting capability within the airplane operating envelope.

Related Rule: Section 25.903 of the FAR.

Design Guidance for Turbojet and Turbine Engine Rotor Unbalance

Description: This project would develop an AC that provides guidance on installation and operation of turbojet and turbofan airborne vibration monitors (AVM) for transport category airplanes.

Related Rules: Sections 25.901, 25.903, 25.1301, 25.1305, 25.1309, and 33.29 of the FAR.

Revision of AC 25.1329-1A, Automatic Pilot Systems Approval

Description: This revised AC would include guidance pertaining to autopilot features that can result in attitude changes at rates imperceptible to the flightcrew and thus remain undetected until the airplane reaches significant attitude deviations.

Aircraft Materials Fire Test Handbook

Description: This project would prepare an AC that explains the purpose of the handbook and gives the handbook guidance status by incorporating it by reference.

Revision to AC 25-17, Transport Airplane Cabin Interiors Crashworthiness Handbook

Description: This project would revise AC 25-17, "Transport Airplane Cabin Interiors Crashworthiness Handbook," to bring it up-to-date with the current regulatory amendments. This AC provides an acceptable certification method for demonstrating compliance with the crashworthiness requirements of Part 25 of the FAR.

Photoluminescent Floor Proximity Emergency Escape Path Marking Systems

Description: This AC provides guidance material for use in demonstrating compliance with the provisions of Part 25 of the FAR regarding floor proximity emergency escape path marking (FPEEPM) systems while using photoluminescent elements.

Status: The FAA is reviewing the public comments received.

Emergency Evacuation Demonstrations

Description: This AC provides guidance material for use in demonstrating compliance with the provision of Part 25 of the FAR regarding emergency evacuation demonstrations. The proposed revision to AC 25.803-1 would expand the sections covering conduct of the demonstration and when and how to use analysis in lieu of the demonstration.

Status: The draft AC is in its early drafting stage.

Current Rulemaking Projects

During Fiscal Year 1997, the FAA issued the following new rules:

Amendment 25-89, "Allowable Carbon Dioxide Concentration in Transport Category Airplane Cabins"

Issued on November 21, 1996; published in the **Federal Register** on December 2, 1996. This amendment to Section 25.831 ("Ventilation") of the FAR (14 CFR 25.831) revises the standards for maximum allowable carbon dioxide (CO_2) concentration by reducing the allowable maximum concentration from 3 percent to 0.5 percent. This action is in response to a recommendation from the National Academy of Sciences to review the CO_2 limit in airplane cabins, and provides a cabin CO_2 concentration level representative of that recommended by some authorities for buildings.

Amendment 25-88, "Type and Number of Passenger Emergency Exits Required in Transport Category Airplanes"

Issued on November 1, 1996; published in the **Federal Register** on November 8, 1996 (a correction was published on January 13, 1997). This amendment to the FAR defines two new types of passenger emergency exits in transport category airplanes. This amendment also provides more consistent standards with respect to the passenger seating allowed for each exit type and combination of exit types, and requires escape slides to be erected in less time. These changes allow more flexibility in the design of emergency exits and reflect recent improvements in escape slide technology. The changes also enable more cost effective emergency exit arrangements and, in the case of escape slides, enable more rapid egress of passengers under emergency conditions.

The FAA also has several rulemaking projects currently underway:

1-G Stall Speed as a Basis for Compliance with Part 25 of the FAR

Purpose: This notice proposes to amend the FAR to redefine the airplane referenced stalling speed as the 1-g stalling speed in lieu of the minimum stalling speed. The proposed changes would: (1) provide for a consistent, repeatable reference stalling speed; (2) ensure consistency and dependable maneuvering margins; (3) clarify the requirement for the use of 1-g stalling speeds in determining structural design speeds; (4) increase the head-on gust structural design requirement; and (5) provide for adjusted multiplying factors to maintain essentially equivalent requirements in areas where the use of minimum stalling speed has proven adequate. These changes are needed since the stalling characteristics of modern jet transports as determined by current methods can result in inconsistent reference stalling speeds. These changes would result in a higher level of safety where current methods have resulted in artificially low operating speeds.

Status: Issued as Notice 95-17, on November 29, 1995; published in the **Federal Register** on January 18, 1996. The period for public comments closed on May 17, 1996.

FAR Sections Affected: 1.1, 1.2, 25.103, 25.107, 25.111, 25.119, 25.121, 25.125, 25.143, 25.145, 25.147, 25.149, 25.161, 25.175, 25.181, 25.201, 25.231, 25.233, 25.237, 25.331, 25.333, 25.335, 25.345, 25.349, 25.479, 25.481, 25.527, 25.531, 25.533, 25.535, 25.729, 25.735, 25.773, 25.1001, 25.1323, 25.1325, 25.1507, 25.1583, 25.1587, and App. C, Sec. 36.9, of Part 36

Fatigue Evaluation of Structure

Purpose: This rule would amend the fatigue requirements for damage-tolerant structure on transport category airplanes to require: (1) full-scale fatigue testing, and (2) inspection thresholds based on crack growth from likely initial manufacturing defects in the structure. These changes are needed to ensure continued airworthiness of structures designed to the current damage tolerance requirements. They are intended to ensure that should serious fatigue damage occur within the operational life of the airplane, the remaining structure can withstand loads that are likely to occur, without failure, until the damage is detected.

Status: This project was previously issued as a notice, and public comments have been received. The final rule is in its final stages of coordination within the FAA. The final rule is expected to be published in the **Federal Register** by June 1997.

FAR Section Affected: 25.571

Improved Standards for Determining Rejected Takeoff and Landing Performance

Purpose: This project involves developing amendments to the FAR, applicable to transport category airplanes, that provides revised standards for determining the runway length that must be available for takeoff and landing. The current standards have been revised to: (1) revise the method of accounting for pilot reaction time in determining the runway length that must be available for the pilot to reject a takeoff; (2) account for the effect of wet runways on takeoff performance; and (3) account for the reduced capability of worn brakes on takeoff and landing performance.

Status: A final rule is currently under review in the Office of the Secretary of Transportation.

FAR Sections Affected: 1.1, 1.2, 25.101, 25.105, 25.109, 25.113, 25.115, 25.735, 25.1587, 121.189, 135.379

Revised Access to Type III Exits

Purpose: This project involves developing amendments to the FAR that adjust the requirements for access to Type III emergency exits (typically smaller over-wing exits) in transport category airplanes with 60 or more passenger seats. These adjustments reflect additional data derived from a series of tests conducted at the FAA's Civil Aeromedical Institute (CAMI) subsequent to the adoption of these requirements and are intended to relieve an unnecessary economic burden. The amendments would affect air carriers and commercial operators of transport category airplanes, as well as the manufacturers of such airplanes.

Status: This project was previously issued as a notice, and public comments have been received. The final rule currently is under review within the FAA. It is expected to be published in **Federal Register** by June 1997.

FAR Sections Affected: 25.813(c)(2)(i), 121.310(f)(3)(iii)

Miscellaneous Cabin Safety Changes

Purpose: This project involves developing an amendment to the FAR to: (1) require an assist handle at all designated flight attendant assist spaces to enable attendants to steady themselves while helping passengers out the exit; (2) require a means to hold door-type emergency exits open when opening in an emergency; to require a viewing window or equivalent; (3) enable outside conditions to be viewed prior to opening an emergency exit, at each emergency exit; to specify that 12" X 20" area on the floor for flight attendant assist space; and (4) prohibit the installation of an interior door between a passenger and an emergency exit.

Status: This project was previously issued as a notice and published in the **Federal Register.** The FAA currently is reviewing the public comments submitted.

FAR Sections Affected: 25.809, 25.813, 25.1447, 121.310, 121.333

Fuel System Vent Fire Protection

Purpose: This project involves developing an amendment to the airworthiness standards for transport category airplanes to require fuel vent system protection during post-crash ground fires. This action is the result of information obtained from public hearings on aircraft fire safety and recommendations by the Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee, and is intended to provide protection against a fuel tank explosion following a post-crash ground fire. This amendment would apply to air carriers, air taxi operators, and commercial operators of transport category airplanes, as well as the manufacturers of such airplanes.

Status: This project was previously issued as a notice, and public comments have been received. The final rule for this project is currently being drafted.

FAR Sections Affected: 25.975, 121.316, 125.214, 135.187

Fuel System Crash Resistance

Purpose: This project involves developing a notice that proposes requirements for improved fuel system crash resistance. The current standards would be amended to require: (1) a means to isolate fuel tanks within the fuselage; (2) a means to shut off the fuel supply to the engine during normal and emergency shutdown procedures; (3) improved fuel line impact resistance; and (4) location of fuselage mounted fuel tanks in protected locations.

Status: Initial draft of the notice is in the early stages of coordination within the FAA.

FAR Sections Affected: 25.963, 25.993, 25.1189

Loss of Engine Cowling

Purpose: This project involves developing an amendment to the airworthiness standards for transport category airplanes that adds improved design standards for the retention of engine cowling and nacelle skin. This amendment is the result of a review of a number of incidents of in-flight loss of engine cowling or nacelle skin and is intended to enhance airplane safety by ensuring retention of engine cowling and nacelle skin.

Status: This rule is in its initial drafting stage.

FAR Section Affected: 25.1193

Revised Seat Safety Standards

Purpose: This project involves developing a notice that proposes to amend the seat dynamic test requirements for transport category airplanes to relieve the requirement to test crew seats in the cockpit with floor warpage. This project also proposes to require that seat leg reaction loads be recorded during the dynamic tests. This proposed change is needed to accommodate the unique design features of crew seats when testing to the new dynamic emergency landing conditions. The seat leg reaction loads developed during the dynamic tests are needed to ensure adequate floor strength to support the seat loads.

Status: The notice is in its initial drafting stage.

FAR Section Affected: 25.562

Protective Breathing Equipment

Purpose: This project involves developing a notice that proposes to revise the standards for protective breathing equipment (PBE) to be used for crewmembers in transport category airplanes. Protective breathing equipment would be required to be installed at each flight crewmember work station, and portable PBE would be required for each crewmember that might be required to fight an inflight fire. This action is prompted by reports of crewmembers being unable to see to operate the airplane, or to have adequate protection to fight fires effectively, and is intended to ensure the adequacy of PBE in all environments that may be encountered.

Status: This FAA project has been canceled and a terms of reference (TOR) has been prepared to task this project to Aviation Rulemaking Advisory Committee (ARAC).

FAR Section Affected: 25.733

Low Fuel Quantity Indicators

Purpose: This project involves developing an amendment to the FAR that requires new transport category airplane designs to incorporate an alert to the flightcrew of potentially unsafe low fuel quantities. This action is the result of a review of fuel depletion incidents involving loss of power or thrust on all engines that could have resulted in forced landings and injury or loss of life. Most of these incidents resulted from improper fuel management. This amendment is intended to increase airplane safety by providing an alert to the flightcrew that would allow either correction of certain fuel management errors or the opportunity to make a safe landing prior to engine fuel starvation.

Status: This project currently is on hold.

FAR Section Affected: 25.1305

Public Information Concerning FAA Enforcement Actions

Effective February 1, 1997, FAA will issue press releases on newly issued enforcement actions in the safety and security area that seek civil penalties of $50,000 or more. The agency will also issue press releases on significant regulatory actions such as certification revocations.

In addition to issuing press releases on enforcement actions of $50,000 or more, quarterly lists of all enforcement actions will be made available effective April 1.

The Global Analysis and Information Network

The Global Analysis and Information Network (GAIN) is an analysis and information sharing framework that is intended to identify emerging safety concerns and disseminate significant safety information to the aviation community world-wide. The GAIN concept ties together data sources, such as voluntary disclosure reporting, incident reporting, digital flight data, and air traffic control (ATC) radar data, with analytical methods such as qualitative risk assessment, data mining, data visualization, and statistical methods. The proposed process which relates these data sources with the analytical tools and methods is described in the FAA's Office of System Safety's GAIN document dated May 1996.

Differences Between GAIN and Other Programs

One fundamental difference between the GAIN concept and other existing or planned programs is the system-wide scope of GAIN, which includes data sources from across the entire aviation system. Another difference is the GAIN emphasis on identification of emerging safety concerns though the analysis of voluntary disclosure reports in conjunction with the analysis of digital flight data and automated ATC data. An organization that analyzes voluntary disclosure reports, by having subject matter experts perform qualitative risk analysis, could focus on an emerging set of safety priorities (similar to the BASIS system used by British Airways).

Empirical digital flight data or ATC radar data has two potential uses:

- First, it could be used to validate the concerns raised by the analysis of voluntary reports; and
- Second, it could be used to create measures that describe system operations.

The second use would involve collecting and analyzing data from routine operations which would yield a baseline which is stated in terms of the most reliable system measures. Monitoring deviations from statistical norms in day-to-day operations in the National Airspace System (NAS) will increase the awareness of organizations about conditions or circumstances that may signal the onset of increasing safety risk.

Data Management

The data management concept for GAIN is very flexible. For a number of reasons, including the large quantity of raw data available, we expect little or no raw data sharing. But the information resulting from analysis of raw data will be shared, and it is very unlikely that data or resulting information would be centralized. Raw data could reside with its owners while the information byproducts could be made available to users through networking. This dissemination concept is commonly known as a "virtual database".

The FAA's Office of System Safety could help facilitate the creation of GAIN by informing potential participants about the concept, and by bringing potential participants together, but the FAA will not own or operate GAIN, and will probably not fund its development. Instead, the FAA would be one of many users of the analytical results and supporting data from GAIN.

FOQA/APMS Relationship to GAIN

The objective of Flight Operational Quality Assurance (FOQA) programs is to enable proactive safety intervention based on analysis of exceedences and trends in digital flight data obtained on a routine basis from air carrier line operations.

The Automated Performance Measurement System (APMS) is a NASA research project sponsored by FAA that is intended to provide technical tools to ease the large-scale implementation of flight data analyses at both the air carrier and the national levels. APMS will develop and document methodologies, algorithms, and procedures for data management and analyses.

The APMS tools will be applied in support of the FAA's FOQA program and will be used to assist in evaluating the overall safety and efficacy of operational procedures.

APMS data will also be used to validate new training practices in ground-training devices and to provide line operational data pertinent to research tasks identified in the National Plan for Aviation Human Factors. The analytical results obtained with APMS tools should be able to identify faults in system procedures, airport operations, airspace structures, aircraft types and human-automation-interface.

Both of these programs, FOQA and APMS, are possible prototypes for the portion of the proposed GAIN analytical process that calls for the collection and analysis of digital flight data to monitor routine flight operations. In addition, the APMS research program may provide new "intelligent agent" analytical tools that could be used to analyze text of narrative accounts in reports for patterns and themes that might signal emerging safety concerns.

SPAS and GAIN Relationship

The Safety Performance Analysis System (SPAS) is an automated decision support system. This system, designed to aid the FAA in targeting its inspection and certification resources on those areas that pose the greatest aviation safety risks, is now operational at FAA Headquarters, the FAA Technical Center, and in the Eastern Region. SPAS can compare the current-to-past performance of an air carrier to its own records or to the industry average. Analysis which used to take days can now be done in a matter of hours.

The primary difference between GAIN and SPAS is the focus — SPAS is an internal tool designed for FAA inspectors, and the GAIN is an information sharing capability that is intended to detect emerging issues and disseminate significant safety information to the aviation community world-wide. SPAS capitalizes on information obtained through oversight and surveillance processes, but GAIN would rely on voluntary disclosure and empirical data from day-to-day operations to focus on emerging concerns sooner than would be possible with surveillance data alone.

ASRS Changes

The proposed GAIN analytical process calls for data from confidential reporting systems such as the Aviation Safety Reporting System (ASRS). While certain drawbacks are associated with any voluntary reporting system — motivation of the reporter, accuracy of the anecdotal information, lack of specific details, stimulation of reporting due to external events (e.g., accidents or media attention to an issue) — the information may give a very valuable "early warning" of safety concerns. ASRS reports taken together with other available empirical and anecdotal data could help the aviation community focus on emerging issues which merit in-depth analysis. The ASRS may also provide reporters a measure of confidentiality which would allay fears of disclosure and encourage reporting of significant situations that signal an increasing safety risk in the aviation system. The ASRS also provides a reporting avenue for the segment of the aviation community that may not have empirical data collection and analysis capability.

The value of ASRS data to the GAIN initiative lies in the immediate screening of incoming reports by an expert review panel and the use of the anecdotal information in documenting human factors associated with reported occurrences. Some changes in ASRS data management procedures might strengthen its value in a GAIN application.

Aviation Safety Information Website

The FAA recently initiated an Aviation Safety Information website on the World Wide Web, the purpose of which is to provide the public with access to several of the principal aviation safety data and information sources that the Federal Government uses for various purposes. A phased approach is being followed in constructing this website.

The website, activated on February 28, 1997, can be accessed by using the Aviation Safety Information button located on the FAA's internet homepage at address **www.faa.gov.** Or it can be accessed directly at **http://nasdac.faa.gov/internet/**.

The website is divided into separate sections that the public can access and explore:

- ***Learn About the Databases*** provides information on the scope and purpose of each of the available databases;
- ***Search the Databases*** takes you to a page from which you may select the database you wish to query;
- The ***Aviation Glossary*** defines commonly used aviation terms;
- The ***Federal Aviation Regulations (FAR)*** takes you to the FAA Website containing the FAR Parts 1-199;
- ***What's New*** tells you about the future phases of construction of the website; and
- ***Other Aviation Sites*** provides more aviation-oriented websites that may be of interest to you.

Databases Available

This website presents the most requested data elements from each of the following three databases. They are updated monthly. The website allows for selection of records by certain data elements, as well as a general text search capability. In addition, the Cross System Search capability allows the user to conduct textual searches across all three databases simultaneously.

- **National Transportation Safety Board (NTSB) Aviation Accident/Incident Database** is the official repository of aviation accident data and causal factors. In the database, an event is classified as an accident or an incident. "*Aircraft accident*" means an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and until all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage. The NTSB defines "*incident*" as an occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations. The NTSB database contains only selected incident reports.
- **FAA Incident Data System** contains a much more extensive collection of incidents, i.e., records of potentially hazardous events that do not meet the aircraft damage or the

personal injury thresholds contained in the NTSB definition of an accident.

- **NTSB Safety Recommendations to the FAA with FAA Responses.** The NTSB uses the information it gathers during accident investigations and the determination of probable cause to make safety recommendations to all elements of the transportation industry. While the recipient of a recommendation does not have to implement the proposed action, it does have to respond formally to the recommendation and specify what action is or is not being taken and why. This database contains the NTSB recommendations to the FAA and the FAA responses.

Future Plans

In future phases of construction of this website, additional databases will be available.

- Statistical data about airline activity, such as flight hours and departures, will be available;
- A narrative will be available describing the roles and responsibilities of the FAA, airlines, manufacturers, and other aviation entities who work together to keep aviation in the United States the safest in the world;
- Lists of all enforcement actions will be made available via a press release issued quarterly; and
- Near midair collisions statistics will be available.

Also under development is a "pull down" table that will enable the user to search the databases by clicking on the names of major airlines.

Cautions About The Analysis Of Aviation Safety Data

Broad Definition of Accident: The definition of an aviation accident is very broad. It can involve events that range in severity from a flight attendant receiving a broken ankle as a result of an aircraft encounter with turbulence at altitude, to the catastrophic loss of one or more aircraft and hundreds of lives. In order to give more meaning to accident counts, governmental authorities traditionally have categorized accidents as *fatal* and *non-fatal*. However, even this categorization can be misleading; e.g., the death of a ramp agent resulting from the push back of an aircraft from the airport gate still would be classified as an aviation accident.

The aviation insurance and aircraft manufacturing industries have taken an alternative approach to this issue by categorizing accidents as "*hull (aircraft) loss*" and "*non-hull loss*".

Recently, the National Transportation Safety Board introduced a new categorization system that divides accidents into either "*Major, Serious, Injury,* or *Damage*".

Accident Rates: Accident counts alone are not reliable indicators of the relative safety of airlines/operators, aircraft types, or segments of the air transportation industry because, all other things being equal, an airline with 500 airplanes will probably have more accidents than an airline with 10 airplanes. Similarly, the more frequently used aircraft types would tend to be involved in accidents more than the less frequently used types.

Moreover, the air transportation industry is dynamic, and the near 100% growth in airline activity over the past fifteen years can result in historical comparisons that are misleading.

The method most commonly used to address these issues is to calculate accident rates in terms of accident counts divided by some measure of aviation activity; i.e., accident counts divided by flight hours, departures, passengers boarded, etc. This is the methodology the NTSB uses to compare the historical accident record of the principal segments of the air transportation industry.

The calculation of accident rates for individual airlines would require access to individual airline activity. While that data is available now in hard copy, it is available in electronic format only on a fee basis from several commercial vendors. Individual airline activity for larger airlines are available on this website.

Statistical Bias: No two airlines fly identical aircraft fleets on identical routes. Some tend to fly larger aircraft on long routes while others fly smaller aircraft more frequently on shorter routes. Because more accidents occur during takeoff and landing than during other phases of flight, the selection of the measure of aviation activity that is used to calculate rates will bias the results.

For example, an airline that flies longer routes has fewer takeoffs and landings per hour and is thus favored by use of hours as the measure of activity, while an airline that flies shorter routes is favored by the use of departures as the measure of activity.

Ranking Airline Safety Performance: Airline accidents are very rare events and the risk of death or serious injury for air travelers is exceedingly small. Prof. Arnold Barnett of the Massachusetts Institute of Technology, using data from 1990 to the present, has calculated that a passenger faces a death risk of one in eight million. "Stated somewhat differently, if a passenger facing a death risk of one in eight million were to chose one flight at random each day, that passenger would, on average, go for 21,000 years before perishing in a fatal crash."

During the past decade, the large United States airlines as a group have experienced on average, one and one-half to two catastrophic accidents a year. The rarity of these events raises a number of statistical problems associated with the use of small numbers for analysis purposes. Because of these problems, it is difficult to compare the aggregate safety of the airline industry, even over time.

For example, a recent report prepared for the FAA by GRA, Inc., entitled "A Report on Issues Related to Public Interest in Aviation Safety Data," found that :

". . . there currently is no evidence in accident data that would support the ranking of individual airlines based on their safety records, at least not for U.S. domestic air carriers (airlines). While there may be apparent differences in carrier safety records at any particular time, due largely to the infrequent but catastrophic nature of an air accident, there is no evidence that such distinctions persist nor that they are predictive of future safety performance. Rankings of airlines based on past accident records therefore provide no information to consumers seeking to make safety-enhancing comparisons for current or future travel choices."

Time Issues: The aviation industry is characterized by rapid change. New technologies and operating practices are constantly being introduced - the aviation industry of 1997 is very different from the industry in 1987.

Because these changes can be relatively dramatic over time, care must be exercised to avoid comparing conditions or events spanning several years. This raises the issue as to what is the appropriate time frame to use when engaging in aviation safety analysis. While there is no definitive answer to this issue, the Federal Government frequently uses the most recent five years in its safety analysis and monitoring programs.

Notice 8110.66: Procedural Guidance for DAS and DOA

On February 20, 1997, the FAA released Notice 8100.66, *"Procedural Guidance for Designated Alteration Station (DAS) Authorization and Delegation Option Authorization (DOA)."* The notice serves as the specific reference document for guidance concerning these two types of delegated authorizations, since the issuance of FAA Order 8110.4A, *"Type Certification Process."*

Previously, the FAA made a decision to segregate all delegations and designee guidance that had been described in Order 8110.4, into separate FAA orders. For example, Designated Engineering Representatives guidance found in Chapter 5 of FAA Order 8110.4 has been removed from the current FAA Order 8110.4A and placed in a separate FAA Order, 8110.37A, *"Designated Engineering Representative Guidance Handbook."*

FAA Order 8110.4A, issued on March 2, 1995, canceled Order 8110.4. Since Order 8110.4A excluded procedural guidance pertaining to DOA and DAS, Notice 8100.66 provides for continuous guidance and procedures for the issuance and operation authorization for those facilities capable of operating as a DOA or DAS. The notice contains essentially the same material that was removed from Order 8110.4A. There are current ongoing projects that are intended to update portions of this material at a later date into an order (i.e., ACSEP, Delegation Working Group).

For a copy of this document, contact your local FAA office.

FAA To Distribute News Releases Via E-Mail

On January 14, 1997, the Federal Aviation Administration (FAA) started distributing news releases via Internet electronic mail to users who subscribe to this service.

Once a subscription has been received, all FAA news releases, fact sheets and media advisories will be automatically transmitted to the subscriber via e-mail. These electronic mailings will ensure that the news media and others interested in aviation issues receive all releases as quickly as possible.

To subscribe to the FAA's news release service:

1. Address an e-mail to:
   listserv@listserv.faa.gov
2. In the body of the message, type:
   subscribe faa-newsrelease Your Name
3. Send the message.

You may take your name off the mailing list at any time by:

1. Address an e-mail to:
   listserv@listserv.faa.gov
2. In the body of the message, type:
   signoff faa-newsrelease Your Name
3. Send the message.

In addition to the electronic news release service, the FAA will continue faxing its releases to all media outlets currently on its list. Agency news releases are also available on the FAA's web site at ***http://www.faa.gov*** under "News & Information."

New Publications Available

Following is a list of reports and other documents recently made available to the public. To obtain copies of any of these publication (available at no charge), please contact C. A. Bigelow at *Tel*:(609)485-6662, *FAX*:(609) 485-4569; *e-mail*:cathy_bigelow_at_ct27@admin.tc.faa.gov

Tire Test Correlation: Radial Versus Bias-Ply Tires Report DOT/FAA/AR-TN95/97

This report describes the test correlation of a radial tire with a bias-ply tire of identical size under controlled laboratory dynamometer conditions.

Automated Inspection of Aircraft Report DOT/FAA/AR-95/48

This report describes the development of a robotic system designed to assist aircraft inspectors by remotely deploying nondestructive inspection sensors and acquiring, processing, and storing the inspection data.

Certification Methodology for Stiffener Terminations Report DOT/FAA/AR-95/10

This report describes an experimental program and analyses conducted to evaluate the failure mode, static strength, and fatigue life of stiffened composite skin with stiffener termination details. Recommendations for a certification approach for commercial aircraft composite structures with stiffener termination are given.

The Effects of Stiffener/Rib Separation on Damage Growth and Residual Strength Report DOT/FAA/AR-95/12

This report presents a damage tolerance certification approach for composite structures with stiffeners and ribs.

Structural Integrity Evaluation of the Lear Fan 2100 Aircraft Report DOT/FAA/AR-95/13

This report describes a systematic evaluation to determine the damage tolerance capability of the two upper wing surfaces (skins) and the upper fuselage skin of the Lear Fan 2100 aircraft.

Survey and Analysis of Rotorcraft Flotation Systems Report DOT/FAA/AR-95/53

This report evaluates rotorcraft flotation system performance in water-related incidents, and identifies areas of potential improvements.

The Effect of Preloading on Fatigue Damage in Composite Structures: Part 1 Report DOT/FAA/AR-95/79

This report describes the effect of preload on damage development in unnotched graphite/epoxy laminates.

Comparative Evaluation of Failure Methods for Composite Laminates Report DOT/FAA/AR-95/109

This report presents a comprehensive and objective study of lamina and laminate failure criteria used for unidirectional fiber composites and their laminates.

Fiber Reinforced Structures for Small Turbine Engine Fragment Containment (Phase II) Report DOT/FAA/AR-95/110

This report describes the development and spin pit testing of two fiber reinforced structures for the lightweight containment of turbine rotor failures.

Development of a D SIGHT Aircraft Inspection System: Phase II Report DOT/FAA/AR-95/15

This report presents the results of an international project to develop and test a nondestructive inspection system for aircraft corrosion detection in fuselage lap splice joints.

Feasibility Study of a Rotorcraft Health & Usage Monitoring System (HUMS):Results of Operator's Evaluation Report DOT/FAA/AR-95/50

Usage and Structural Life Monitoring Evaluation Report DOT/FAA/AR-95/9

These reports present the evaluation of two techniques for using monitoring and assesses the potential benefits of extending the retirement intervals of life-limited components. Results for the operators' perspective are presented in the second report.

Transport Water Impact, Part II Report DOT/FAA/AR-95/12

This report documents the second part of a program intended to study the overwater operating environment of jet transport aircraft.

Transport Water Impact and Ditching Performance Report DOT/FAA/AR-95/54

This report reviews worldwide transport accident data relative to water impacts and ditching performance.

Landing Parameter Data for Typical Transport Operations

by Terrence J. Barnes FAA's National Resource Specialist for Flight Loads/Aeroelasticity

Background

The sinking speed design criteria for transport airplanes have been unchanged since the early days of commercial aviation, and very little operational landing data have been collected to assess the validity of these criteria.

With the introduction of jet transports in the late 1950's, a comparison was made between the landing sink speeds of propeller driven transports and the new commercial jet aircraft (see Reference 1, below). Although the study concluded that jet transport descent velocities were approximately 25% higher, no changes were made to the criteria because the operational landing sink speeds were typically significantly lower than the design values.

The FAA is interested in evaluating the relationship between normal operations and design criteria for both strength and repeated loads. The data will be used by the FAA and industry to both look back at how current transports are being landed for comparison with their design load spectra, and forward in terms of developing realistic spectra and criteria for new transports.

Utilizing a technology transfer partnership with the Navy, the FAA has developed a four-camera muliplexed system, which can view approximately 2,000 feet of runway, spanning the expected touchdown location for most commercial transports. This new video system, and the availability of new tracking software for data analysis have provided the FAA with an opportunity to revisit the landing impact criteria for transport airplanes.

The new video survey technology does not require the installation of any instrumentation on the aircraft, nor does it affect normal aircraft or airport operating procedures.

Procedure

A single video camera system, which was adequate for measuring Navy carrier landings, has been expanded to four cameras to cover approximately 2,000 feet of runway in the normal touchdown zone. These cameras are mounted at fixed locations close to the runway edge to provide overlapping fields of view. As the airplane nears touchdown, the images are observed on video monitors, and each landing recorded on video disk for later playback analysis.

Each camera is calibrated separately using temporary targets set on the runway. Airplane geometry is obtained from the manufacturers for scaling purposes, and data describing each landing are collected during the survey to determine the appropriate data for use in the analysis.

The data analysis software package tracks specific airplane geometric parameters, e.g., wing tips, nacelles and landing gear, and digitizes the track video image, so that sink rate, forward speed, roll, pitch and yaw rates, and angles at initial main gear wheel contact can be calculated and summarized. Reference 2 describes the system in detail, and reference 3 provides additional descriptive material.

Data Collection

In addition to the video images, from which the ground contact parameters are derived, other data describing each landing are collected during the video survey to determine which set of geometric values to use in the analysis. Detailed hourly weather summaries are also obtained. Landing weights are obtained from the airlines.

Survey Results

Three surveys have been conducted to date:

- JFK, New York, June 1994.
- Washington National, June 1995.
- Honolulu, Hawaii, April 1996.

Each survey collected approximately 1,000 landings.

The results of the first two surveys are included in this article; however, the results of the third survey are not available at this time.

At JFK, the survey equipment was installed on the north side of runway 13L. This is a 10,000 foot displaced threshold runway 150 feet wide and was selected after reviewing historical JFK usage records. Once the survey cameras are installed and calibrated, they cannot be moved to adjust to changes in operation caused by wind shifts.

One important point which must be stressed is the high volume of flight operations at John F. Kennedy Airport. This made it necessary for aircraft to land on 13L with significant cross wind components (up to twenty knots). However, this is a "real world" operational situation and, as the sink speeds indicate, result in some interesting landings. The approach to runway 13L requires a right turn onto final approach, and the cross winds did appear to contribute to lineup difficulties for some pilots. Discussions with airport operations personnel indicated that this was a normal operating condition during the summer months.

An unexpected number of high sink speed landings were observed during this survey.

A trend that was identified was the increasing sink speeds and the wider dispersion of sink speeds of aircraft with higher landing weights. The mean value of sinking speed increases with aircraft category. The commuters landed at a mean value of 1.5-ft/sec, the narrow-bodied jets at 2.1-ft/sec, and the wide-bodied jets at 2.7 ft/sec. This is a statistically significant difference and warrants additional investigation. Note that since the commuter aircraft operated intermixed with the wide-bodied and narrow-bodied jets, this may have influenced their landing performance. Since these landings were on a 10,000-foot runway, the results may not be representative of the landing performance of these aircraft.

At Washington National, the cameras were set up along the edge of runway 36 (Potomac River side). Historical records indicated that this would be the primary landing runway at this time of year. The survey team also set up an anemometer near the survey site to get an indication of the local wind speeds.

The results of this process revealed a similarity in all of the narrow-body jet results. This was surprising, considering the differences in approach path and weather conditions.

Conclusions

Results from the commercial transport landing parameter surveys at JFK and Washington National indicate that:

- the design criteria for current transports are adequate;
- new data will be available for the airplane manufacturers to update fatigue spectra; and
- there does appear to be a trend towards higher sink rate at higher gross weights, and this could be a factor in the certification of future large transports.

Due to the potential impact of an increase in design landing descent velocity, future plans include additional survey system calibrations to confirm the accuracy of the survey results.

Future Plans

- Analysis of the Honolulu survey results
- Static and dynamic calibration of the survey system.
- Survey of commuters at true commuter airports

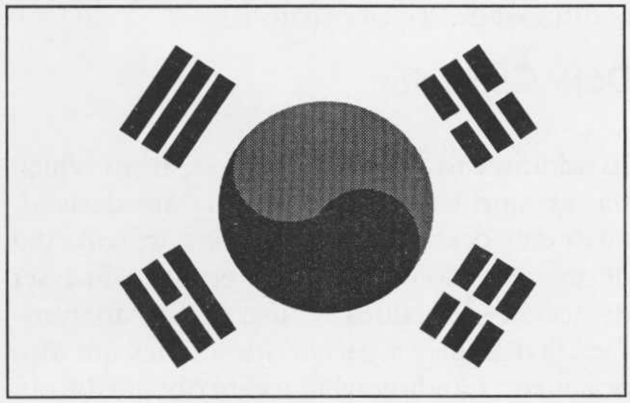
For further information, contact Terence J. Barnes, National Resource Specialist, Flight Loads/Aeroelasticity, ANM-105N, at (206) 227-2761; or Thomas de Fiore, Manager, Flight Loads Research, AAR-432, at (609) 485-5009.

References

1. NASA TN D-1392, *"Operational Experience of Turbine-Powered Commercial Transport Airplanes,"* October 1962.
2. DOT/FAA/CT-93/7, *"Methods for Experimentally Determining Commercial Jet Aircraft Landing Parameters from Video Data,"* August 1993.
3. *"Landing Survey: Discussion of Landing Parameter Data for Typical Transport Operations,"* by T. Barnes, FAA; T. de Fiore, FAA, and R. Micklos, U.S. Navy, presented at the FAA 18th Annual Airports Conference, Hershey, Pennsylvania, March 1995.

Erratum

Flag of South Korea



In the article entitled "International Airworthiness Programs Activity Update" in the Fall 1996 edition of *The Update*, a picture of the flag of Taiwan was erroneously displayed in the section of that article concerning South Korea. That picture should have been of the flag of South Korea. We regret the error.

New Mystery Photo ➔➔➔

Well, back in the FAA archives we found yet another photograph that we need your help in identifying. Can you tell us anything about:

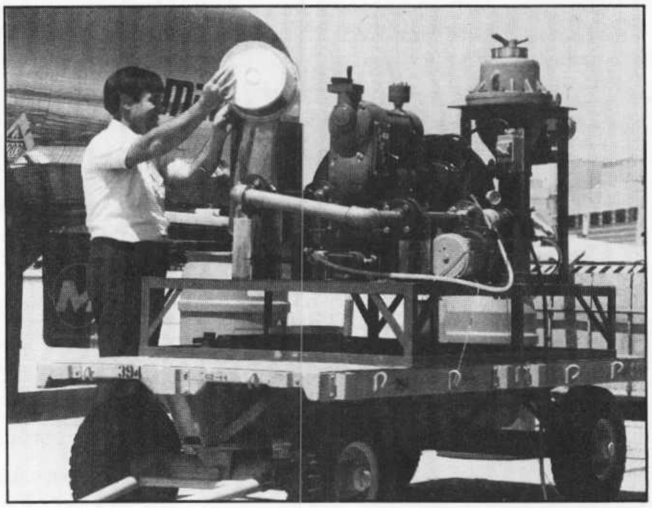
- When and where the photo was taken;
- Who the individual is; and
- What it is he is doing.

Please send any information you may have to:

Rose Upton, Editor-in-Chief, ANM-103
Transport Airplane Directorate
1601 Lind Avenue SW
Renton, Washington 98055-4056

Mystery Photograph Exposed!

We received several responses to our mystery photo that appeared in the last edition of the Update. (Apparently, it wasn't as much of a mystery to others as it was to us!) Thanks goes especially to Ken Knopp and Bruce Fenton, both engineers at the FAA's Technical Center, for revealing the story behind the mystery photo. As Bruce Fenton tells it:



"That's me in the picture on the flight line at Edwards Air Force Base [California] in the summer of 1984, preparing for the Controlled Impact Demonstration that took place in December of that year. The machine is a high flow rate fuel blender and it is preblending AMK [anti-misting kerosene] in its slurry form. The tanker in the background is probably full of the raw fuel.

I normally didn't do that particular type of work, but at the time that the photographers were ready to start shooting and needed a body in the pictures, it was late in the afternoon and everyone else on the flight line had gone home. So, I posed as the body."

Bruce was an instrumental FAA player in the 5 years of planning for the joint FAA-NASA "Controlled Impact Demonstration (CID)" that took place on December 1, 1984. That project involved a full-sized, four-engine Boeing 720 that was intentionally flown into the ground to collect data on various crashworthiness and fire safety experiments, including the utility of AMK. Ten years later, Bruce appeared on a segment of the Discovery Channel's "World of Wonder" program, and discussed the value of the data garnered from the CID as it relates to today's airplane safety issues.

Testing the effect of "I Love Lucy" reruns on pilot performance(?)

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