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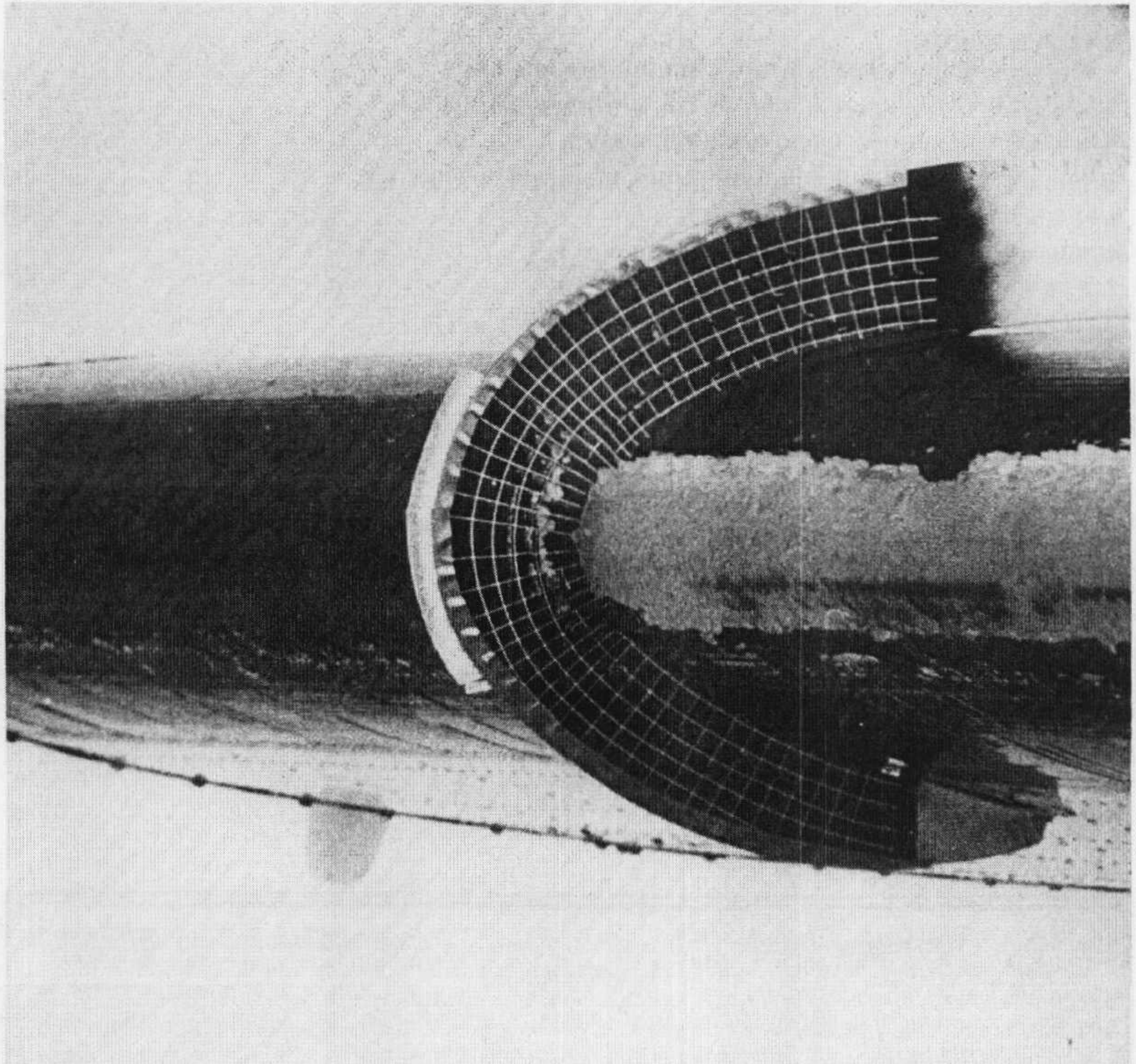


Aircraft Icing

(In-flight picture of ice accumulating on the horizontal stabilizer of the NASA Twin Otter Icing Research Airplane. The large circular protrusion is calibrated to aid in measuring ice accumulation.)

. . . See article on page12

Table of Contents

The purpose of The Designee Newsletter is to provide designees with the latest information concerning regulations, guidance material, policy and procedures changes, and personnel activities involving the certification work accomplished within the Transport Airplane Directorate's jurisdictional area. Although the information is the latest available at press time, it should not be considered "authority approved" unless specifically stated; neither does it replace any previously approved manuals, special conditions, alternative means, or other materials/documents. If you are in doubt about the status any of the information addressed, please contact your cognizant Aircraft Certification Office (ACO), Manufacturing Inspection District Office (MIDO), or other appropriate FAA office.

FAA Policy Refocused on Compliance and Education

During his term as FAA Administrator, **Admiral James Busey** initiated a revision to the agency's regulatory compliance and enforcement policy. Busey reaffirmed that the FAA expects pilots, airlines, and manufacturers to obey all regulations, but stressed that voluntary compliance, supported by counseling, education, and training, is the best way to ensure safety. He also stipulated that the agency's public responsibility to enforce the rules does not prevent the FAA from being reasonable and firm, but fair.

These changes are the result of a System Safety and Efficiency Review of the FAA's compliance and enforcement policies that Administrator Busey initiated last year. A number of substantive changes in FAA policies have been or will be made as soon as possible:

- **The FAA will make the application of compliance procedures more flexible, placing emphasis on promoting compliance through education and open communications.**
- **The FAA will re-energize its Accident Prevention Program, the primary means for communicating with and educating people in general aviation. Additional resources will be provided for better educational tools and marketing materials.**
- **The FAA will re-emphasize the need for inspectors to use discretion and judgment. Inspectors will be encouraged to consider all of the facts and circumstances, including mitigating factors, and then prescribe remedial training, counseling, or another remedy appropriate to the situation.**
- **New training programs for inspectors have been established, which focus on additional ways to handle compliance and corrective actions, developing better communications skills, and improving human relations.**
- **Existing rules and regulations will be reviewed and, if necessary, will be reviewed to enhance understanding and promote compliance.**
- **The FAA will seek to handle certain violations administratively rather than through legal enforcement action. In many cases, a warning letter or remedial training may be more effective than legal enforcement. The agency's compliance Sanction Guidance Table will be reviewed with these guidelines in mind.**
- **The FAA will establish procedures to purge records of violations after a reasonable period of time elapses.**

The FAA will make other changes, too. A total of 34 action plans to modify existing procedures and develop new ones have been initiated, all with the goal of improving safety.

The Administrator is committed to the idea that cooperation is the best path to follow:

"We believe the best way to get there [to safety] is by promoting cooperation, open communications, and compliance. . . Compliance is our objective. Improved safety in all phases of aviation is our continuing goal."

International Harmonization of Standards: FAR Part 25, JAR-25, and Chapter 525

Background

Joint Aviation Regulation (JAR)-25 was adopted by various European countries in the mid-1970's as a common code for certification of transport category airplanes. It was based on Part 25 of the Federal Aviation Regulations (FAR) and, at the time of adoption, was identical to Part 25 except where necessary to accommodate differences in administrative procedures and national variations. The national variants reflect areas in which the European countries were unable to reach complete acceptance of JAR-25 as a common code. In recent years, the European airworthiness authorities have made a concerted effort to eliminate or reduce the number of national variants. The JAA has two types of guidance material: "*Advisory Circular - Joint (ACJ)*" contains acceptable means of compliance, and interpretive material. "*Advisory Material - Joint (AMJ)*" is basically for general guidance, recommendations, and information on subjects which, in some cases, may be in the development stages.

Subsequent amendments to Part 25 are considered for adoption for JAR-25 in accordance with an amendment procedure. In most cases, amendments to Part 25 have become amendments to JAR-25, unless the airworthiness authorities of the member countries specifically voted to not accept them. JAR-25 has, therefore, remained identical to Part 25 in most respects since the time it was originally adopted.

Canada adopted Chapter 525 as their code of standards for transport category airplanes in July 1986. Like JAR-25, Chapter 525 is based on Part 25. In essence, Chapter 525 is the same as Part 25 except where necessary to accommodate differences in administrative procedures and Canadian variations. The Canadian variants are additional airworthiness requirements based on operational experience and environmental conditions in Canada. Advisory material is contained in Airworthiness Manual Advisories (AMA).

Although, with the one exception noted below, there have been no Part 25 rulemaking programs dedicated to the harmonization goal; each program undertaken by the Transport Airplane Directorate since 1982 has been conducted in a spirit of cooperation and harmonization. In this regard, the European and Canadian airworthiness authorities have made significant contributions to the development of Part 25 amendments, notably in the area of cabin safety. This close cooperation with the foreign authorities is undoubtedly a primary reason that the three codes have remained so similar.

Harmonization Efforts Underway

Regulatory managers of the FAA, the European Joint Aviation Authorities, and Transport Canada Aviation met in Hoofdorp (The Netherlands) on September 10 and 11, 1991, to begin a program to harmonize the three sets of standards related to transport category airplane certification: FAR Part 25, JAR-25, and Chapter 525. The differences in the standards themselves are minimal, largely because JAR-25 and Chapter 525 were both based originally on FAR Part 25. Subsequent changes have produced only minimal differences because of very thorough coordination between the FAA and the foreign authorities. The more significant differences are in the interpretation of these standards.

The first step in this "*harmonization project*" is to identify the differences among the three documents and related advisory material. The list of differences will be forwarded to the certification specialists in each of the three authorities for review. The specialists will be requested to add any other differences in interpretation they are aware of, particularly those that are not documented, and to recommend priorities. Upon receipt, the specialists' inputs will be added to the list of differences. Industry will then have the opportunity to add any differences they may be aware of and to offer their recommendations for priorities.

Upon receipt of industry comments, the regulatory managers of the three authorities will meet again to finalize the list of differences and establish priorities. It is anticipated that the consolidated list of differences and priorities will be finished by early 1992.

The consolidated list of differences will form the agenda for meetings of technical specialists from each of the three authorities. It is anticipated that several meetings of each technical specialty group will be needed to fully discuss the differences and develop proposed changes. This will probably take all of 1992 to complete. Procedures will be developed to escalate any issues that cannot be resolved by the technical specialists to their respective managements.

Upon completion of the work of the technical specialists, circa January 1993, the regulatory managers will meet again to develop the necessary rulemaking action and advisory material. It is likely that the rulemaking would require at least one to one-and-a-half years; therefore, complete harmonization could be accomplished by July 1994. In the meantime, the three authorities will work very closely to ensure that any new standards are harmonized as proposed.

Regulatory Projects

The only regulatory project currently dedicated to FAR-JAR harmony concerns rulemaking in the flight test area. FAA flight test specialists are working with JAA and Transport Canada Aviation counterparts to resolve issues and develop a Notice of Proposed Rulemaking.

Although not undertaken for the sake of harmonization, the following rulemaking projects are being developed in close coordination with the foreign authorities:

Standards for Approval of a Reduced V_1. This NPRM is in final FAA headquarters coordination.

Improved Access to Type III Exits. NPRM 91-11 was published April 9, 1991; the public comment period closed October 7, 1991. Because of differences in tests conducted in the U.S. and the United Kingdom, there currently are minor differences between the standards proposed in this NPRM and the corresponding proposed European standards. Further tests are being conducted by Civil Aviation Medical Institute (CAMI) to provide a basis for eliminating those minor differences.

Landing Gear Aural Warning. The Final Rule was issued on November 26, 1991. A corresponding change to JAR-25 is currently in process.

Flutter, Vibration, and Buffet Requirements. This NPRM is in final coordination at FAA Headquarters.

Airplane Lightning Protection. This NPRM is in preliminary coordination at FAA Headquarters.

1-G Stall Speed. This NPRM is in final FAA headquarters coordination.

Exit Rating Criteria, Type and Number of Passenger Emergency Exits in Transport Category Airplanes. The comment period on the NPRM closed on August 21, 1990; drafting of the final rule is in initial stages.

Miscellaneous Changes: Emergency Evacuation Demonstration Procedures. A final rule is in final coordination at FAA Headquarters.

Dynamic Braked Roll Condition. This NPRM is in the early drafting stage. A corresponding change to JAR-25 is also in process.

Fatigue Evaluation of Structure. This NPRM is in final executive review.

Gust Criteria for Airplanes Equipped with Active Flight Controls. This NPRM is in the final drafting stage.

Fatigue Test Requirements for Aging Aircraft. This proposed SFAR is in the preliminary drafting stage.

Type A Exit Passageway Requirements. This project, which is in the preliminary drafting stage, is based primarily on testing conducted in the United Kingdom.

Increased Aisles/Passageways to Accommodate Competitive Behavior. This project also is in the preliminary drafting stage and based on testing conducted in the United Kingdom.

Advisory Material

Airplane Flight Manual. This AC has been revised and will be published for public comment in early 1992.

Crashworthiness Handbook. This comprehensive AC has been issued and currently is awaiting publication.

Revision to AC 25.571-1A, Damage Tolerance and Fatigue Evaluation of Structure. This revision is predicated on the related rulemaking action described above.

Software Verification Validation. This AC is in the preliminary drafting stage.

Takeoff Configuration Warning Systems. The public comment period for this AC closed on August 1, 1991. Final drafting is in early stages.

Revision to AC 25.629-1, Flutter Substantiation of Transport Category Airplanes. This revision is predicated on the related rulemaking action described above.

Revision t AC 25-7, Flight Test Guide For Certification of Transport Category Airplanes. This AD is in the preliminary drafting stage.

Other Policy

In addition to coordination of specific rulemaking projects, Transport Category Directorate personnel meet periodically with their European and Canadian counterparts to discuss issues of common concern. The group concerning cabin safety has achieved outstanding success in harmonizing policy and interpreting existing standards.

Post-Crash Cabin Safety

Recent airline accidents have drawn public attention to the need to evacuate an airplane rapidly in any situation involving fire or a threat of fire.

Two different cabin fire situations are considered in the safety standards for transport category airplanes. The first scenario takes place when a fire starts in the cabin during flight; fortunately, that is a very rare occurrence. The other is a situation in which the airplane has come to rest and a fire outside the airplane enters the cabin, either by burning through the fuselage sidewalls or progressing through a break in the fuselage. Because it occurs more frequently, this post-crash ground fire condition demands the greatest attention.

The primary concern in a post-crash fire is to get people out of the airplane as quickly as possible, before a phenomenon known as "*flashover*" occurs. Burning cabin materials give off unburned gases that collect in the upper portions of the cabin. After a very short time, these unburned gases are heated to the point where they ignite and burn instantaneously. When this occurs, the temperature in the whole cabin becomes so hot that survival is impossible for anyone remaining in the cabin. Flashover also makes further survival impossible by consuming the oxygen in the cabin. The amount of time available for evacuation before flashover occurs varies, of course, depending on the severity of the fire; but it may be only a minute or so in many instances. Smoke inhalation and the emission of toxic fumes are also concerns; however, full-scale fire tests have shown that flashover typically occurs in airplane cabins before either of those conditions become fatal. Additionally, there is a secondary concern that smoke may obscure vision in the cabin and delay the evacuation.

The FAA has taken two approaches to get as many people as possible out of the airplane before flashover occurs. One, of course, is to enable the passengers to escape more rapidly. Airplanes operated by airlines are now required to have floor-level lighting to mark the pathways to exits when the passengers' vision is obscured by smoke. Also in progress is rulemaking that would require improved access to Type III emergency exits, such as window exits located over the wings.

The other approach is to provide more time before flashover occurs. The primary means to provide more egress time is to require that the cabin interior be made of less flammable materials. In this regard, the airplanes used by airlines are now required to have seat cushions and other components that meet much more stringent flammability standards. In theory, flashover could be further delayed by requiring the use of cabin materials that are even less flammable. Tests have shown, however, that the use of less flammable materials would not result in a significant additional delay in flashover because of all of the flammable personal items that passengers carry on board.

A cabin water spray system presents one possible means to delay flashover. Airworthiness authorities of the U.S., Canada and a number of European countries have been studying this concept for several years and have been conducting tests jointly to determine whether cabin water spray systems are a viable means to delay flashover. The proposed systems are similar to those used in buildings; however, they differ in some respects, because the environment in a burning airplane cabin is different from that of a burning building. For example, the water is discharged in a very fine mist rather than a liquid spray. Although the results of the testing completed so far are very promising, more tests must be conducted to ensure that the benefits of these systems are not outweighed by disadvantages. Among the possible disadvantages that must be considered is whether the escape paths would be more obscured by smoke, when the fine water mist is discharged. If so, it could take occupants longer to evacuate the airplane and negate the extra time gained for evacuation before flashover occurs. Also, there is a concern that accidental discharge of the system might result in a failure of some essential electrical system and actually cause a crash. Nevertheless, in spite of possible disadvantages, the spray system appears to be promising.

It has been suggested that smoke hoods should be provided for passengers. The benefits of smoke hoods are still under study, but they do not appear to be helpful at the present time. This is primarily because the occupants could be delayed in escaping from the airplane, due to the amount of time required to don their hoods, and their impaired vision while putting on the hoods.

It must be emphasized that the primary consideration in a post-crash situation is to get the occupants out of the airplane before flashover occurs. Every second counts!

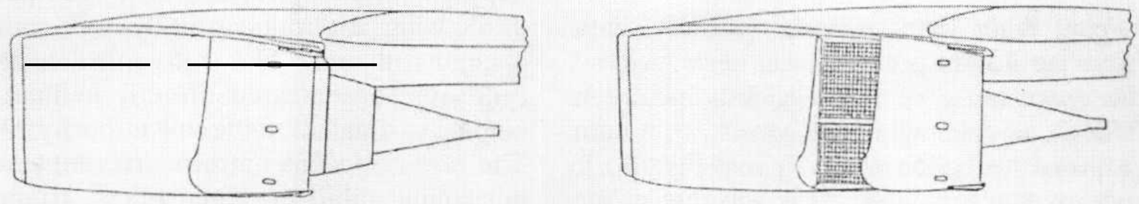
SPECIAL TOPIC
Thrust Reversers: An Overview

Background

Thrust reversers, as installed on transport category airplanes, serve to reduce brake wear and improved braking effectiveness during landing on slippery runways. Although they are not required by FAA regulations, thrust reversers are installed on almost all turbine engine-powered aircraft.

There are two types of thrust reversers:

- **"Target" type reversers: These are typically a "clamshell" arrangement with two sleeves that translate aft and redirect the fan and primary engine airflow forward.**
- **"Cascade" type reversers: This type of reverser is installed usually on larger fan type engines. On these installations, the airflow of the fan only is reversed by the use of translating sleeves which are linked to blocker doors that close and expose the cascades. The cascades are designed to direct the engine airflow forward with an efflux pattern, which avoids impingement on the fuselage or runway.** *(See Figure 1)*



Reverser stowed *Reverser deployed*

Figure 1
"Cascade type" thrust reverser

Thrust reverser systems in use today use either pneumatic bleed air or hydraulic power to drive the reversers into the commanded position. Power to the reverser system is isolated from the reverser system in flight by the use of an isolation valve. Downstream of the isolation valve is the directional control valve which directs power to the reverser system to either deploy or stow the reverser. Reverser position is controlled by separate levers in the throttle quadrant (piggyback levers) which can only be set to the deploy position with the engine power at idle. On many airplanes the reverser cannot be deployed in flight.

Recent Technology

Airplanes such as the Boeing Model 757, 767, and 747-400, and the McDonnell Douglas Model MD-11, incorporate new features such as:

- **lock-out of the reversers during flight;**
- **automatic reduction of the engine power to idle if deployment is sensed;**
- **automatic restow of the reverser if deployment is sensed.**

Additionally, on these airplanes, the isolation valve and the directional control valve are closed during flight, which prevents the reverser from being powered to deploy. The auto-restow automatically opens the isolation valve and directs the directional control valve to the stow position.

Previous Service Experience

Prior to the Lauda Airlines 767-300ER accident that occurred in Thailand last May, over 137 in-flight fan reverser deployments had occurred over the years in the worldwide transport airplane fleet. There had been four accidents during ground operation where four-engine airplanes had one outboard engine reverser fail to deploy, which resulted in airplane departure from the runway. One in-flight event is suspected to have occurred due to crew error when both reversers were deployed to begin ascent. Another accident, which occurred during training, is believed to have resulted from reverser deployment immediately following takeoff. Based on this type of service experience, in-flight thrust reverser deployment with the engine at idle power had been considered a non-hazardous event (except during takeoff and landing).

The Lauda Accident

Digital flight data recorder (DFDR) data from the Lauda accident was destroyed, so the exact cause of that accident has been difficult to determine. However, from data gathered during the on-going investigation, it appears that the likely cause was due to the in-flight deployment of a thrust reverser. Investigation has revealed that:

- **Electrical wiring separation may not be adequate; a single hot short, in conjunction with latent failure, could cause a reverser deployment.**
- **Contamination within the directional control valve could cause the valve to hang up in the deploy position.**
- **Position sensors that are used to initiate the auto restow function on many in-service airplanes have been found to be out-of-rig.**

In consideration of these issues, one possible cause for the inadvertent deployment could have been the undetected failure of the directional control valve due to contamination, followed by an auto-restow command from the out-of-rig sensors. Another possible cause could have been a hot short in the directional control valve circuit and a subsequent command of the auto-restow function.

Early simulation work at Boeing Commercial Airplanes showed that the deployment of a reverser during flight was a controllable event. However, after wind tunnel testing of the Model 777 (still in development) showed revised aerodynamics of reverser deployment, Boeing revised its simulation program accordingly. The revised simulation showed that reverser deployment can be uncontrollable, unless pilot intervention occurs within 3 to 4 seconds. Reverser deployment disrupts the airflow over the top of the wing, and reduces lift by 25%, causing a rapid roll rate. The roll control surfaces (ailerons) are located directly behind the engine, so that half of the roll authority is lost. The reverser efflux pattern also reduces the horizontal stabilizer effectiveness. Reduced roll and pitch authority causes the airplane to roll and pitch down. Recovery from this condition is not possible.

Not all airplane types are exposed to the same controllability problem. The susceptibility of other airplanes to this type of accident is dependent upon many factors, including:

- **location of the engine (tail, wing);**
- **location of control surfaces;**
- **reverser efflux pattern; and**
- **engine spooldown rate.**

Transport Airplane Thrust Reverser System Review

The Transport Airplane Directorate recently established a design review team that is working jointly with a thrust reverser working group established under the Aerospace Industries Association (AIA) to reassess the safety of thrust reverser systems. The team is comprised of representatives from the manufacturers of transport airplanes, engines, and thrust reversers; from groups representing pilots and airline operators; and from regulatory agencies.

The purpose of the team is to determine requirements for engine thrust reverser systems that will assure safe flight. The group will:

- **Determine requirements to validate system reliability.**
- **Determine requirements to demonstrate controllability of the aircraft in the event of inadvertent in-flight deployment.**
- **Recommend rulemaking or advisory material, as appropriate.**
- **Establish aircraft review teams to determine compliance of existing designs with the new requirements, and report results of this review to the airworthiness authorities.**
- **Review maintenance, documentation, and training programs to validate thrust reverser compliance retention.**

In order to accomplish these goals, the working group will undertake several tasks:

- **Review each thrust reverser system design and service history to determine if improvements in the existing system design are necessary in order to reduce the likelihood of inadvertent thrust reverser deployment.**
- **Evaluate each airplane model's thrust reverser system and determine if the original certification program adequately considered the effects of thrust reverser deployment on aircraft controllability.**
- **Review the airworthiness standards and recommend any needed revisions to assure that thrust reverser systems are designed to the appropriate system safety level in order to reduce the number of in-flight deployment events.**
- **Review the airworthiness standards and recommend any revisions needed regarding the acceptable level of controllability that should be required following an inadvertent in-flight deployment of a thrust reverser.**

The Aerospace Industries Association (AIA) agreed to assist the FAA in this task and provide a means to develop criteria and maintain consistency in these reviews. Two FAA/AIA meetings have been held during 1991, one in September and another in October. These were primarily organizational meetings to determine who should be involved and the scope of the design review. This AIA/FAA group is now known as the "*Steering Committee*" for the thrust reverser system review.

Two working groups have been formed under this Steering Committee to define what is meant by "*controllability*" and "*reliability.*"

The definitions of these terms that the groups finally agree upon will be used as criteria to assess thrust reverser systems' safety levels.

Concurrent with these activities, each transport airplane manufacturer was tasked with reviewing their respective thrust reverser system designs (including FMEA's, service history, and maintenance practices) to determine if any immediate changes are required to reduce the likelihood of inadvertent thrust reverser deployment. The results of the manufacturers' reviews will be reported to the Steering Committee in a meeting scheduled during January of 1992. The FAA will decide on the need for any subsequent mandatory action based on that information. In addition to this activity, the Steering Committee will make recommendations for any regulatory or advisory material needed for future approvals of thrust reverser system designs.

The Designee Newsletter will continue to *provide* updates on the activities of the Steering Committee.

SPECIAL TOPIC
Tailplane Icing in Turboprop Commuter Airplanes

Six Airworthiness Directives (AD) have been issued (two recently) affecting five different turboprop commuter airplanes. The common element in all these AD's appears to be a sensitivity to ice buildup on the horizontal stabilizer, resulting in an uncommanded pitch down, or other controllability problems during flap extension. As a result of these AD's, the FAA and NASA convened an International Workshop at the NASA Lewis Research Center in Cleveland, Ohio, in early November 1991. This workshop was designed to produce an exchange of ideas to provide the means to take a more proactive approach and prevent future occurrences of this problem. Approximately 100 representatives from various aviation-related manufacturers, key special interest groups, and the airworthiness authorities of Canada, China, France, Germany, Italy, Japan, The Netherlands, Sweden, the United Kingdom, and the U.S. attended this workshop.

The workshop attendees spent most of their time split into five working groups -- aerodynamics, the icing environment, maintenance, operations, and icing systems design -- and discussed various aspects of the problem. At the end of the workshop, each working group presented recommendations to the entire workshop audience. The FAA and NASA workshop organizers then consolidated these recommendations into a final report, which directs the recommendations to the three FAA services that could carry them out: Flight Standards, Aircraft Certification, and Air Traffic.

The problem of ice accretion on the horizontal tail of turboprop commuter airplanes is apparently widespread, but the phenomenon is not well understood by all manufacturers and operators. Current designs include stratagems which are generally effective; however, the following is a brief synopsis of the problem:

- The tailplane is generally a more effective collector of ice than the wing. Its effectiveness, compared to the wing, increases as speed and droplet size increase so that the thickness of the ice on the tailplane can be greater than on the wing.

- The aerodynamic effect of a given thickness of ice on the tail will generally be more adverse than the same thickness of ice on the wing because of the ratio of the thickness to the chord length and the leading edge radii.

- Ice can collect on the tail without ice being visible on the wing.

- The mechanical effectiveness of deicing boots to produce hoop stresses on ice on small radius surfaces is less than for large radius surfaces. The tail deicing system is generally less effective than the wing deicing system.

- The tailplane generally can not be directly viewed from the cockpit.

- Tailplane/elevator stall is a critical condition which may occur without warning.

- Tailplane/elevator stall may result in a condition which overpowers the crew's ability to change the elevator position, or occurs under conditions which are unrecoverable.

- Icing accretions that degrade the aerodynamic lift of the tail are more shape sensitive than thickness sensitive. Accretion of a "*small-critical*" ice shape can result in more adverse aerodynamic response than accretion of a "*large-non-critical*" ice shape. More efficient airfoil designs are more susceptible to degradation by contamination.

- There are conditions of ice accretion of very thin coarse layers (sandpaper ice) which can result in aerodynamic degradation disproportionate to the thickness. These conditions can be caused by freezing rain or runback ice. Sandpaper ice formed in flight is similar in appearance and effect to heavy frost formed on the ground.

- Only supercooled water droplets within statistically defined limits are used in airplane ice-protection system certification requirements for flight in icing conditions. These conditions do not include freezing rain, drizzle, mixed conditions, etc.

- Generally, flight crews have no quantitative means for in-flight determination of the existence of environmental conditions which exceed the limiting conditions for which the airplane was certificated, other than observing the ice-accretion from those environmental conditions.

- A National Transportation Safety Board (NTSB) survey of pilots from a certain airline that was involved in an ice-related accident revealed widely varying qualitative responses on which environmental icing conditions were approved for operation of a specific model airplane, and widely differing views on the use of the ice protection system of that airplane.

- Current aviation wisdom advises crews to wait until 1/4" to 1/2" of ice has collected on the wing prior to actuating pneumatic de-icing systems to prevent "*ice-bridging.*" There is no means to indicate to the crew when the limiting thickness has been exceeded on the tailplane. On some airfoils, 1/2" of critical ice shape may cause unacceptable aerodynamic penalties.

- Critical (not always severe or extreme in thickness) icing conditions occur infrequently. This may lead to crew complacency about the potential for critical ice accretion in certain operating areas or conditions.

- Tailplane ice protection systems are generally "*single-string*" systems without system redundancy (although there may be component redundancy).

- The commuter operator with shorter flights and fewer routing and altitude options is usually exposed to an icing environment for a greater percentage of the flight time than the non-commuter operator.

- Approach to landing at higher than normal speed to compensate for wing ice accumulation causes increased negative angle of attack for the tailplane which, with ice accumulation on the tail, may lead to separation of the flow on its lower surface, a sudden change in elevator hinge moment, and a forward stick force, which may overpower the pilot.

- Generally, the tail stall problem seems to be associated with airplanes that:

- **rely on aerodynamic balance in order to keep prescribed stick forces low without powered control surfaces;**
- **have high efficiency flaps producing relatively high downwash, which results in high angle of attack on the tailplane;**
- **have non-trimmable stabilizers and efficient airfoils; and**
- **have a stabilizer that is small with respect to the wing.**

The following recommendations are contained in the final workshop report. [NOTE: These recommendations are currently under consideration, and do not necessarily reflect the views of the FAA. To date, the FAA has not provided a formal response to these recommendations.]

FLIGHT STANDARDS SERVICE:

- **Flight crew awareness of the hazards of tailplane icing:**

Problem: Information discussed by the 100 workshop participants and included in this article reflects the best information available at this date regarding tailplane icing. Some flight crews may not have this information, and since the winter season has started, this information should be disseminated as soon as possible.

Recommendation: Issue an immediate GENOT* to all commuter airplane operators, with information copies provided to all other operators. This GENOT should alert flight crews to the hazards of tailplane icing, especially flap operation at high speeds, and continued operation in icing conditions. *[* A GENOT is a one-time message, similar to a telegraph, sent from FAA Headquarters to Principal Operations Inspectors (POI) out in the field in order to disseminate critical information. The POI's then forward the message to operators for which they are responsible.]*

- **Flight Crew Training:**

Problem: A nearly unanimous consensus was reached on the subject of flight crew training relating to flight operations in icing conditions by turboprop commuter-type airplanes. The workshop noted that much training -- both initial and recurrent -- has been provided for recognition and proper actions related to windshear, but crew training for operations in icing conditions is rudimentary at best. In all probability, more incidents and hull loss accidents have occurred in recent years in this segment of the transport fleet due to icing than have occurred due to windshear. As stated above, current icing-related training focuses on the effects of ice accumulations on the wing or fuselage, and some suggested crew actions, *e.g.*, increased airspeed, may actually exacerbate an adverse situation at the horizontal tail.

Recommendation: Work with commuter operators to develop a training program that will highlight the problem of operations with ice on the horizontal tail. Emphasis should be placed on the different hazards due to wing and tailplane ice, and the possibly different flight techniques that may be required for each type. Simulator training should be included and, where simulators are not available, video tapes or other similar training techniques should be used.

- **Maintenance procedures:**

Problem: Pneumatic boot deice systems typically ingest moisture and other contaminants during the warm months due to partial vacuum applied to the boots in normal flight; this contamination causes operational problems in the fall when the systems are first used. Because of the warm surface temperatures, merely operating the boots on the ground or on approach may not reveal the presence of moisture in the system, which may freeze in icing conditions. Moisture may produce corrosion of critical pneumatic system components.

Recommendation: Work with operators to develop maintenance procedures to assure that the performance of the boot deicing system is not degraded during the warmer months. Routine checking and/or operation of deice systems should be performed year around. Develop ground test procedures that will determine the presence of foreign matter (including ingested water) in the system, and increase emphasis on proper repairs (patches).

- **Availability of installation and maintenance instructions:**

Problem: In many cases information, from the component manufacturer (pneumatic boots, selector valves, sensors, etc.) is not provided to the end user, *i.e.*, the operator. This information is necessary for the correct installation and the continued airworthiness of the deice system. The useful life and overall performance of deice systems could be compromised by the lack of documentation from the component manufacturer.

Recommendation: Work with operators to ensure that documentation needed for proper installation and continued airworthiness of deicing system components is provided by the component manufacturer, and is filed and kept up-to-date by the operator. (Note: One component manufacturer seals the required information inside a heat-seal bag with the component so that it does not become separated; similar procedures could be evaluated and adopted.)

- **Minimum Equipment List (MEL) Repair Categories:**

Problem: Most deicing components on the MEL are Category C ("repair within 10 days"). This exposure time is too long. In one accident, the operator departed with inoperative ice protection equipment and, in spite of the accumulation of visible ice and contrary to the conditions of the MEL, continued flight; this resulted in a non-fatal crash.

Recommendation: Review existing MEL's for commuter category turbopropeller airplanes, and revise appropriate Category C items to Category B ("repair within 3 days").

AIRCRAFT CERTIFICATION SERVICE:

- **Determine if an unsafe condition exists on the various airplanes in the current fleet:**

Problem: Some airplanes are undoubtedly more susceptible to ice accumulations on the tailplane than others. An investigation should be conducted to assess the scope of the problem.

Recommendations:

1. Investigate the JAA flight test procedure for detecting tolerance to

tailplane ice accretions, and determine if this approach would be acceptable for use in general testing for sensitivity to ice accretions.

2. Survey turbopropeller commuter airplanes (either by flight test or by analysis) to determine if certain models are sensitive to ice accretions, and if those models should be modified by AD to remove an unsafe condition. Assess and correct deficient airplane flight manual (AFM) information.

- **Detection of ice on the horizontal tail**

Problem: Each of the five working groups independently reached a consensus on the need for detection of ice accretion on the horizontal tail. It was agreed that, if the flight crews were aware of an ice accumulation, they could be better prepared to deal with the problem, either by shedding the ice or by altering flight procedures, as necessary.

Recommendations:

1. Request the FAA Technical Center to perform a literature search for a listing of current ice detector technology that could be applied to this problem.

2. Work with airframe manufacturers to determine if a viable tailplane ice detection system could be provided that would give a reliable indication of the presence and amount of tailplane ice.

- **The Icing Environment (Appendix C of FAR Part 25) and Icing Certification Procedures**

Problem: The icing requirements of Appendix C were established in the late 1940's and early 1950's. Appendix C is not intended to be an exhaustive description of the icing environment, but is a statistical representation of the likely icing conditions that may be encountered. There are several icing situations that are not addressed by Appendix C: freezing rain, snow, frost, and mixed conditions.

Recommendations:

1. Expand the envelopes of Appendix C to include droplet diameters up to 1,000 microns (from the current upper limit of approximately 40 microns), so as to include freezing drizzle and freezing rain. While it may be impossible for any airplane to provide protection under such extreme conditions, if these limits were included in the certification basis, the applicant would have to show that all possible precautions were taken to **minimize** the hazard. This approach would be analogous to engine certification for rotor burst, where the event cannot be precluded, but the consequences must be shown to be minimized.

2. Review current analysis methods relating to ice shapes, and determine if the various assumptions and procedures used in this category of airplane are valid.

- **Non-standard Deice System Operation and Indications**

Problem: Flight deck controls and displays of deice systems are not always consistent between airplane models. This may cause problems if flight crews routinely fly different airplanes and must adjust to different procedures. In addition, ice lights and controls may be located on the pilot's side of the flight deck, which makes operation by the co-pilot difficult. The most critical time for operation of the deice system is during the approach, a high workload period when attention by the co-pilot would be beneficial.

Recommendation: Review flight deck deice system displays and controls, and determine if there are differences that could cause an unsafe condition due to flight crew confusion or the use of the wrong procedure for the airplane being flown.

- **Special Requirements for Certification of Tailplanes for Flight in Icing Conditions**

Problem: Information gathered at the icing workshop has revealed that the phenomenon of ice accretion on tailplanes and the resultant performance and handling qualities penalties may not be fully understood.

Recommendation: Consider imposing Special Conditions* for future certification projects involving turbopropeller commuter airplanes that would address the special problem of ice accretion on the tailplane. Assure that newly-designed airplanes comply with the requirements of FAR 23/25.1309.

*[*Special Conditions are additional requirements for certification which are imposed if a novel or unique design feature exists, or if the current regulations are inadequate to assure the required level of safety.]*

- **Deicing Systems Should be Designed for Easy Maintenance and Improved Life/Reliability.**

Problem: Operators would like to participate more fully in the design of deicing systems. They consider that these systems are often optimized for low weight and low initial cost at the expense of ease of maintenance. It has been suggested that operators would accept a reasonable increase in weight and cost in exchange for lower recurring maintenance costs and more reliable system operation.

Recommendation: Encourage airplane manufacturers to work more closely with potential customers to determine if a better balance between weight, cost, and maintainability can be achieved.

- **Revision of Advisory Information**

Problem: Existing advisory material does not adequately address the problem of tailplane icing.

Recommendation: Advisory Circular (AC) 23.1419-1 should be amended to include new information relating to tailplane icing. A companion AC 25.1419 should be created to provide complete information for the transport fleet. The information contained in the Aircraft Icing Handbook, DOT Document DOT/FAA/CT-88/8-1, dated March 1991, should be reviewed for its applicability to the two AC's.

AIR TRAFFIC SERVICE:

Problem: Air traffic controllers often do not have the information needed to understand the crew procedures that may be required for airplanes operating in icing conditions. Pilots may request diversions to escape icing encounters, and varying airspeeds may be required, depending on the situation. Conditions critical for one model of airplane (unlike turbulence) may not be critical for another model. Non-severe conditions may be hazardous for some models of airplanes.

Recommendation: Establish training for air traffic controllers which will provide them with working knowledge of airplane limitations and procedures while flying in conditions that are conducive to the formation of airframe ice.

CONCLUSION:

The FAA is determined not to lose the momentum generated at the workshop. The recommendations discussed in this article are the international response to the problem of tailplane icing from over 100 experts in the field. A follow-up workshop is planned for the Spring of 1992 to assess progress and provide for any needed mid-course correction.

Establishing Compliance Times for Airworthiness Directives

In Fiscal Year 1991, the FAA issued over 400 airworthiness directives (AD). AD's are Federal Aviation Regulations that are issued to correct unsafe conditions that have been identified to exist in aircraft and aeronautical products.

Each AD contains procedures for corrective actions that affected operators are required to accomplish in order to eliminate or prevent the identified unsafe condition. Each of these corrective actions is assigned a specific period ("*the compliance time*") in which the operator must comply.

Many times, the FAA has been asked to address the question, "*What method does the FAA use to determine how long operators should be given in order to fix the identified problem?*"

There is no simple equation that the FAA can use to simply plug in figures and come up with an answer. Instead, determining an appropriate compliance time for an AD involves a complex procedure that requires more than merely engineering analysis.

The FAA considers a number of factors when establishing compliance times for each AD issued. In every case, the FAA is required by law to take into consideration the following factors:

(1) **Applicable Federal regulations, such as:**

- **14 Code of Federal Regulations (CFR) 39, Federal Aviation Regulations; Part 39, Airworthiness Directives;**
- **Federal Aviation Act of 1958;**
- **FAA Order 8040.1B, Airworthiness Directives;**
- **FAA Order 8040.4A, Regulatory Policy and Procedures;**
- **FAA Order 8100.5, Aircraft Certification Directorate Procedures;**
- **Executive Order 12291**

  (Does the AD rulemaking action constitute a "major" or "minor" rule, i.e., is the total annual economic impact of the rule on the U.S. economy likely to be more than $100 million?)

- **Regulatory Flexibility Act (Public Law 96-354)**

  (Will the rule's cost impact have a significant effect on a substantial number of small entities?)

- **Administrative Procedure Act**

  [Can the FAA justify the emergency nature of the circumstances so that the rule can be issued without notice and opportunity for public comment (and made effective in less than 30 days)? (Input/comments received from the public, including domestic and foreign manufacturers and aviation industry groups, in response to published Notices may provide information that FAA will consider when establishing compliance times.)

- **Department of Transportation (DOT) Regulatory Policies and Procedures**

  [Does the AD rulemaking action constitute a "*significant*" rule (a rule that is not an emergency regulation, but concerns a matter on which there is substantial public interest or controversy, and has a substantial impact on other agencies, state governments, major transportation safety problems, etc.). Or does it constitute a "*non-significant*" rule?]

- **Executive Order 12612, Federalism**

  (Does the AD rulemaking action have substantial direct effects on the states, distribution of power between Federal government and states, etc.? Is a Federalism Assessment warranted?)

(2) Identification of the existence of an unsafe condition in aircraft:

- **What are the safety risks/consequences involved?**

- **Is this condition likely to exist or develop on other planes of the same design?**

The answers to these questions normally involve engineering analysis and judgment, and will be based on facts available at the time, including test data, formal analysis, and other information pertinent to the design detail. Issues considered are:

- **Potential loss of the airplane due to failure of flight and/or ground control systems; failure of primary structure, including cabin depressurization, uncontrolled fire, engine explosion, or fuel leakage; and failure to follow appropriate procedures, *i.e.*, flap not set, door not latched, etc.**

- **Reduced airworthiness operating capability due to loss of part of a redundant system, *i.e.*, engines, hydraulic system, fuel system, electrical/navigation system, etc.**

- **Reduced level of safety required by regulations due to a loss of significant warning system, non-functioning of equipment necessary after an emergency, *i.e.*, deployment of oxygen masks, emergency lighting, etc.**

- **Hazard to life on the ground due to separation of airframe or engine parts from the airplane.**

(3) **Service difficulty history:**

An identified problem is examined within the context of other service difficulties for trends and developing patterns. A review of data, submitted as part of the original certification, is conducted to determine the degree of risk involved for the service difficulty and its possible variations, in all modes of airplane operation. Depending on the type of service difficulty, the data reviewed might include failure modes and effects analysis, system safety assessment, or structural analysis. For example, fatigue or structural cracking problems have defined methods of predicting growth and hazard levels.

Other types of service difficulties are more random and may involve human factors; for this type of service difficulty, a probabilistic approach is used.

In both cases, an estimation of the remaining safety margins are made and the consequences on the ability of the airplane or crew to cope with adverse operating conditions are considered.

(4) **Necessary corrective action** *(i.e.,* required inspection and/or design change):

How much manpower is required? How much downtime/disruption of service is involved? This is normally determined based on input from the manufacturer and operators, such as:

- **Degree of difficulty in preparing the aircraft, conducting the inspection, and accomplishing the required modification. Location of aircraft (maintenance base *vs.* field) also is considered.**
- **Maintenance requirements include consideration of the operators' maintenance programs to permit the required actions to be accomplished during regularly scheduled maintenance (an improved inspection and/or modification could be accomplished when the aircraft is in for scheduled work).**
- **Availability of required parts: Will enough parts be available so that all affected operators will be able to install them in a timely manner? This is normally determined based on input from the airplane or parts manufacturer.**

It must be emphasized that, throughout this process, the FAA is obligated to weigh several factors:

- **the safety consequences,**
- **the impact on the public transportation system, and**
- **the legal constraints related to each AD.**

After considering those factors, the FAA then must make a decision, on a case-by-case basis, as to what constitutes an appropriate and realistic compliance time requirement.

Restricted Category Airplane Weight Increase

In the past, operators were allowed to fly small restricted category airplanes above the certificated maximum weight shown on the type certificate data sheet (TCDS). Although Part 8 of the Civil Air Regulations (CAR) contained only basic objective criteria for certification of restricted category airplanes, guidance for approving operation at higher weights was provided in Civil Aeronautics Manual (CAM) 8. (CAM's were equivalent to today's advisory circulars in that they provide interpretive material and guidance for showing compliance with the corresponding Part of the CAR.)

The guidance in CAM 8 concerning such operations at higher weights was based, in part, on the certificated load factor of the airplane. After recodification of Part 8 into Section 21.25 of the Federal Aviation Regulations (FAR) on February 1, 1965, the FAA issued Advisory Circular (AC) 20-33 stating that the guidance contained in CAM 8 could also be used in showing compliance with Section 21.25.

This AC was revised (20-33A) March 7, 1975, to eliminate CAM 8 as a source of guidance for compliance with Section 21.25; however, it was quickly corrected (20-33B) on May 1, 1975, to indicate that CAM 8 could be used as a source of guidance for restricted category certification of small agricultural airplanes only. In that regard, it was recognized that CAM 8 was never intended to be used in the certification of large restricted category airplanes. Advisory Circular 20-33B also states that CAM 8 may be used as guidance for the airworthiness certification requirements of Sections 21.185 and 21.187.

FAA Order 8130.2, including Change 4, dated July 6, 1981, was the first document that stated that CAM 8 could no longer be used for certificating new restricted category airplanes; however, it appears that that document was not well known to the operators or even within the FAA. New airplanes were certificated using FAR Section 21.25 and Part 23 as the certification basis, but "Notes" in the TCDS showed provisions for weight increases referencing the provisions of CAM 8 and AC 20-33B. Some of the confusion was generated by AC 20-33B which said,

"*...the reference to CAM 8 has been reinstated for small agricultural airplanes.*"

That AC has never been canceled and is still valid for those airplanes that were certificated using (FAR) Part 8 as the basis. Since Order 8130, Change 4, dated July 6, 1981, was issued, the use of CAM 8 in approving gross weight increases has only been appropriate for airplanes for which Part 8 was the certification basis.

The issue of increased gross weight surfaced again with the Air Tractor Model AT-802, when the applicant asked for certification of the airplane at a gross weight of 12,500 pounds, but wanted to operate at 15,500 pounds using the provisions of CAM 8. That practice is no longer allowed for new airplanes and the applicant's request was denied.

The FAA will work equitably with the agricultural industry on the issue of weight increases, and is exploring the possibility of developing simplified procedures for obtaining engineering approvals for gross weight increases for restricted category airplanes. The ultimate objective will be to replace the CAM 8 weight increase procedure with simplified engineering procedures. The FAA's Small Airplane Directorate (located in Kansas City, Missouri) will be developing those procedures for small airplanes up to 19,000 pounds gross weight.

Airplane Certification of Operations on Unpaved Runways

There are no specific regulatory requirements or established guidance material pertaining to transport category airplane certification of operations on runway surfaces other than those that are smooth and hard. However, several transport category airplanes have been certified by the FAA for operation on various kinds of unpaved runways including sod, dirt, and gravel.

The following general guidance for airplane certification for operation on unpaved surfaces is presented, reflecting the experience and policy developed during those certification programs.

(a) Surface Definition. Each type of surface should be defined so that it can be recognized, controlled and maintained in service. The definition should include specification characteristics of the surface necessary for safe operation, such as:

(1) Surface and sub-base bearing strength, usually expressed as "*California Bearing Ratio (CBR).*" Measurements wet and dry every 500 feet along the runway centerline and 15 to 30 feet either side of the centerline have been used;

(2) Thickness, aggregate size, and depth of the surface material;

(3) Presence, or otherwise, of rutting;

(4) Drainage;

(5) Presence, or otherwise, of surface vegetation; and

(6) Runway friction measurements.

(b) Airplane Performance. If special equipment (e.g., low pressure tires, shields, deflectors) or special procedures are required, the effect of such equipment and/or procedures on airplane performance should be determined and presented in the Airplane Flight Manual (AFM); for example, landing gear retraction time may increase if deflectors are installed on the landing gear necessitating changes to AFM first segment climb data.

(1) Takeoff, accelerate-stop, and landing performance should be demonstrated and scheduled, in accordance with the appropriate airworthiness requirements, based on each type of unpaved runway surface for

which approval is requested. The flight test demonstrations should be conducted on both wet and dry surfaces.

An abbreviated series of test conditions, relative to the test requirements for a conventional smooth, hard surface flight test program, may be acceptable if reliable adjustments for all flap settings can be established between these data and the smooth, hard surface performance data. However, a minimum of four conditions each for takeoff, accelerate-stop and landing should be conducted, and the heaviest weight demonstrated for takeoff and landing will establish the weight limitations for those modes of operation.

(2) The test runway should be the actual runway for which approval is requested, or be chosen to represent the worst characteristics (i.e., high rolling friction, low braking friction, etc.) of each type of unpaved runway for which approval is sought. In this regard, it may not be sufficient to conduct these tests from a runway with a low CBR.

Previous tests have shown that rolling friction is primarily a function of CBR, but braking friction is primarily a function of runway surface characteristics. Braking friction is largely independent of CBR and, in some cases, whether the surface is wet or dry. The effects of other variables such as airplane weight and tolerances on recommended tire pressure should also be determined.

(3) A V_{MCG} demonstration should be conducted. Rudder pedal nose wheel steering may be used provided the runway surface for the test represents the "*worst case*" anticipated for operation. If the test is conducted with rudder pedal nose wheel steering, dispatch without it is prohibited.

(4) Landing flare and touchdown characteristics should be evaluated during the landing performance tests.

(5) Climb performance should account for any additional drag or thrust loss due to special equipment installations.

(c) <u>Aircraft Handling:</u> Aircraft handling characteristics must meet the appropriate airworthiness requirements in each configuration specified for operation. Any special procedures or techniques associated with unpaved runway operation, such as use of thrust reversers, brakes, nose wheel steering, etc., should be identified.

(d) <u>Systems, Engines, and Structure.</u>

(1) It should be demonstrated that systems whose normal functions may be affected by operation from unpaved runways (e.g., anti-skid, nose wheel steering) continue to perform their intended function under all conditions for which approval is requested. It should be determined that the aircraft can be operated on each defined surface without hazard from likely impingement or engine ingestion of gravel or other surface material.

In demonstrating that there is no hazard, consideration should be given to immediate effects such as mechanical damage, and to longer term effects such as accumulation of loose runway material. These accumulations could cause jamming of flight controls, prevent configuration changes, or cause blockage of cooling ducts or drains. Also, sandblasting effects from materials thrown by the wheels on the wings and fuselage may penetrate the clad surface allowing eventual metal corrosion damage.

(2) It should be demonstrated that any special equipment such as gravel deflectors or low pressure tires do not adversely affect the previously established water spray and ingestion characteristics of the airplane.

(e) Maintenance. Any revised maintenance procedures, such as increased frequency of inspections, which are necessary to ensure safe operation, should be determined and scheduled.

(f) Airplane Flight Manual (AFM). The limitations, procedures, and performance for unpaved runwayoperation must be presented in an AFM appendix or supplement.

(1) The **Limitations Section** should include runway surface definitions as established under paragraph (a) above for which the airplane has been approved to operate and for which suitable performance data has been determined and scheduled according to paragraph (b). Approved airplane configurations, including any special equipment required, along with system limitations, should also be included.

(2) The **Procedures Section** should include any special procedures, e.g., use of thrust reversers, nose wheel steering, rolling takeoff, and air conditioning/pressurization configuration.

(3) The **Performance Section** should include the performance determined and approved under paragraph (b), accounting for any special procedures required.

Access to Type III Emergency Exits

This Directorate has been requested to clarify the guidance concerning access to emergency exits, particularly Type III exits. (The guidance discussed in this article is a reiteration of the previous policy and is stated in Advisory Circular (AC) 25-17 "*Crashworthiness Handbook*".)

There apparently has been confusion regarding the impact of the regulations on existing approved arrangements, particularly those of small transport airplanes.

A major difference between the requirements for transports of 19 passengers or less and the larger transports lies in the variation between allowable limits for incursion by interior furnishings, affecting accessibility to Type III exits. Basically, no such incursion is permitted for larger transports.

Since smaller transports are frequently used in non-commercial service, *i.e.*, corporate operations, the interior arrangements are often quite different from those seen on an air carrier. These arrangements include the use of special seats and divans that sometimes have multiple adjustment features that allow the seat to be moved to several positions. It is not unusual for there to be seating positions (*e.g.*, seatback reclined or seats swiveled) that encroach into the projected opening of the exit; in some cases, this can result in some physical interference when the exit is opened.

However, while encroachment and even interference can be acceptable under the regulations, the exit should be openable. The regulations do not make a distinction in this regard.

Unlike galleys and other interior features, seats are not directly controllable by the crew. A passenger's seat is susceptible to the passenger's actions after the cabin crew (when there is a cabin crew) has completed its preparatory duties. For this reason, seatback recline and breakover are *fixed by design* in the larger transports to prevent blocking an exit. That is, crew procedures or placards are not considered adequate to maintain the proper access. This situation is analogous, except that rather than having the design preserve an access requirement, the main concern is to maintain the openability of the exit.

Confusion also may exist regarding galleys and closets that are located near floor level exits. Frequently, these units have compartment doors or drawers that, under certain conditions, could impede the opening of an emergency exit. Where practical, these units incorporate springs or other features to compensate for doors that are left open. However, in this case, crew procedures supplemented by special emphasis placards are considered adequate when a design solution is not practical, since these areas are remote from passengers and are not subject to tampering after crew procedures have been completed.

Guidance for "Movable Aisle Armrests," as Required by FAR Part 382

The recently adopted standards for non-discrimination on the basis of handicap adopted in FAR Part 382 may impact type certification requirements. Specifically, the requirement to have movable armrests on one half of the aisle seats in Section 382.21 could impact the required aisle width. There are currently approved seats with movable armrests, usually at one or two locations in the airplane. The most common type of movable armrest has hinges at the back and moves upward. This situation has been considered acceptable, even if the raised armrest protrudes slightly into the required aisle width, provided there are placards on both the seat and aisle side of the armrest, requiring the armrest to be down for takeoff and landing. In addition, the armrest must not pose a hazard to occupants traversing the main aisle, and has typically had no more than a two-inch encroachment (usually less).

With the promulgation of the new requirement, at least half of the aisle seats will have the feature as described above, and we understand that a more common practice may be to have movable armrests on all of the aisle seats, to avoid spares problems and reservations problems.

The FAA does not consider it acceptable to have all, or even half, of the aisle seats encroaching into the required aisle. In this case, not only is the likelihood of a raised armrest increased, but the amount of protrusion will be doubled when both sides of the aisle are affected. Therefore, placards should not be accepted as means to preserve the required aisle width when a significant number of armrests can encroach into the required aisle.

The FAA has reviewed this situation, and believe that there are several design options that could be accepted:

- **If the movement of the armrest were not into the required aisle space, there would be no compliance problem;**
- **If the armrest were to return to the down position, unless held upward by a person, the impact on evacuation would be negligible;**
- **The armrest could be removable (provided it was positively latched when installed);**
- **If the hinged armrests were normally fastened down, but had a discreetly located release that a flight attendant could operate in order to accommodate a disabled passenger, the situation would be equivalent to the pre-Part 382 fleet and would be acceptable.**

Lavatory Smoke Detector Equipment Qualification

In the interest of standardization and in response to an inquiry regarding certification of smoke detectors in transport category airplane lavatories, the following provides policy for determining approval criteria for the lavatory smoke detectors that are required by Amendment 25-74 to the Federal Aviation Regulations (FAR). (This guidance, like other advisory material, does not constitute regulatory requirements.)

FAR Section25.854 requires the installation of lavatory smoke detectors on all transport category airplanes with a passenger capacity of 20 or more. The preamble to the amendment contains the following statement:

"*...A commercially available smoke detector, such as the type commonly used in residential buildings, which is demonstrated to serve its intended function as installed, could be considered adequate under the proposal of Notice 89-1.*"

When the economic evaluation was performed in support of the rule change, the cost impact was based in part on costs associated with inexpensive smoke detectors, such as those mentioned above.

When Section 25.854 was added to the FAR by Amendment 25-74, the justification used followed that which was contained in the preamble to the relevant Part 121 amendment, which was already in force. Section 121.308, effective March 29, 1985, requires lavatory smoke detectors for all airplanes operating under Part 121. The original intent of the Part 121 rule was to discourage passengers from smoking in the lavatories, and the smoke detectors were perceived as a cost-effective way to provide that deterrent.

Now that virtually all U.S. commercial flights are "*smoke free,*" the incentive to smoke in the lavatory is even greater because passengers cannot smoke at their seats.

The FAA's primary concern is to ensure that smoke from a lavatory fire is detected in a timely manner. The most likely location for a fire in the lavatory is in the waste bin containing paper towels; for that reason, the smoke detectors currently in use in lavatories are tested using burning paper towels, and are not necessarily optimized for the particulate size contained in tobacco smoke. However, the detectors continue to be effective as a deterrent to smokers because they will detect most tobacco smoke, as evidenced by continuing reports of lavatory smoke alarms sounding, due to smoking in lavatories. In fact, the public and the Congress perceive that the primary function of lavatory smoke detectors is to detect cigarette smoke; this is technically inaccurate, however.

To the extent that smoke detectors many times do not detect cigarette smoke, there is a perception that they are not properly designed and/or functioning. Therefore, it is the FAA's position that industry be encouraged to do all it can to ensure that lavatory smoke detectors not only function well to detect smoke from lavatory fires, but also function to effectively discourage lavatory smoking, by efficiently detecting cigarette smoke as well.

When the airframe manufacturers were approached by their customers to install smoke detectors as part of the type design, the FAA was requested to provide certification requirements covering installation. The following guidance was provided:

- **The detectors had to meet Sections 25.1301(a) and (d) and 25.1309(a). This meant that environmental, as well as performance, standards had to be considered.**
- **Testing had to be performed during flight, and the combustible material used for testing had to be representative of what would be expected to burn in a lavatory waste bin. The smoke source used was burning paper towels.**
- **As a design goal, the detector was to provide a warning within one minute after a fire started.**
- **If unpressurized flight was to be allowed, testing under those conditions had to be performed.**

It has been suggested that Technical Standard Order TSO-C1c might be appropriate for use in approving lavatory smoke detectors. TSO-C1c provides standards for approval of detectors that are used in cargo compartment smoke detection systems. TSO requirements are not considered appropriate for lavatory smoke detection systems because the environment and products of combustion to be detected in a lavatory fire are different from those that would be expected to be in a cargo compartment fire.

This is not to imply, however, that a TSO-C1c detector would be unacceptable. On the contrary, with appropriate testing, and recognition that the environment in a lavatory is different from a cargo compartment, a detector authorized under the TSO might be the best choice.

The FAA does not consider that TSO-C1c authorization should be a requirement for lavatory smoke detector certification. The certification basis for the lavatory smoke detector installation must include Sections 25.1301 and 25.1309, as discussed above, along with any other appropriate sections,such as those addressing structural or electrical supply requirements.

If application for certification occurs after the effective date of Amendment 25-74 (April 15, 1991), Section 25.854 also would be applicable. For these installations, the intended function is to detect smoke resulting from a fire occurring in a lavatory.Advisory Circular 25-9, "*Smoke Detection, Penetration, and Evacuation Tests and Related Flight Manual Emergency Procedures,*" currently is being reviewed. When a revision is released, the guidance discussed above will be incorporated.

Use of Autopilot with a Single AHRS Unit

During past certification projects, whenever dual Attitude Heading Reference Systems (AHRS) have been used to provide attitude and heading information, it has been the FAA's policy to prohibit the use of the autopilot during periods of single AHRS operation. This is intended to provide protection against an unannunciated slowover (softover) failure that may occur in the second AHRS unit.

The Transport Airplane Directorate considers that it is acceptable to continue use of the autopilot when a single AHRS unit is providing attitude information to both pilot and copilot attitude indicators. This position, however, is predicated on the following conditions:

- **At least two attitude systems are functioning properly at the time of dispatch.**
- **Each AHRS unit contains independent/external monitoring to annunciate all slowover failures.**
- **The above monitoring system integrity is automatically checked before dispatch.**
- **The probability of failure of the first AHRS unit, combined with the probability of a second AHRS failure to a softover condition, must be shown to be extremely improbable.**
- **Any AHRS software associated with critical functions shall be developed in compliance with RTCA/DO-178A Level 1 requirements.**

Of course, other combinations of monitoring and annunciation of failures can be considered, but must be evaluated on their own merits.

Airborne Windshear Detection Systems

Current performance standards to show compliance with FAR Section 25.1301(a) for the airworthiness approval of reactive windshear systems have used Advisory Circular (AC) 25-12, "*Airworthiness Criteria for the Approval of Airborne Windshear Warning Systems in Transport Category Airplanes*," and AC 120-41, "*Criteria for Operational Approval of Airborne Windshear Alerting and Flight Guidance Systems*," as a guide.

Together, those documents delineate the intended performance standards for these systems and establish methods such as windshear profiles, aircraft simulation considerations, flight demonstrations, and Airplane Flight Manual coverage for demonstrating intended function.

The recent release of Technical Standard Order (TSO) C117, "*Airborne Windshear Warning and Escape Guidance Systems For Transport Airplanes*" has presented some inconsistency with the current certification standards as referenced above. Since certification under AC 25-12 may not meet the more stringent requirements of TSO-C117, the need for standardization dictates that TSO-C117 should become the performance standard for certification of these systems.

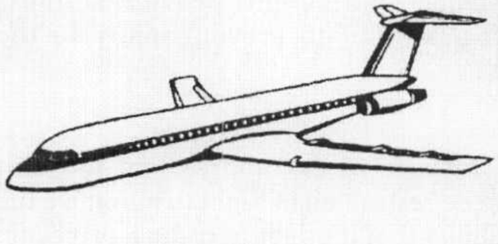
There also is growing activity in the development of predictive (forward looking) windshear detection systems:

Three airlines have been granted exemptions from compliance with Section 121.358 to evaluate this method of windshear detection. This could lead to certification of the first predictive system in 1992.

Industry groups are already being developed to address the requirements and guidelines that will be necessary for certification of predictive windshear detection systems.

The FAA plans to form a national team composed of key aircraft certification representatives who can address subjects such as the differences between certification requirements under AC 25-12 and TSO-C117, and the future need of certification standards for predictive windshear systems.

The team's goals and philosophies will be centered on maintaining standardization, while developing certification requirements that fully exercise the intended function of both the reactive and predictive windshear systems.



Guidance for Incubators and Emergency Equipment

The Transport Airplane Directorate has received a request for guidance for certain items of emergency equipment with respect to protection under emergency landing conditions. Specifically, guidance was requested for incubators, used for transporting infants requiring medical care, and emergency systems installed in areas where cargo is otherwise not required to restrained.

With respect to the incubator issue, we understand the need to balance the occupant protection aspects of the requirements with the need to provide necessary medical care. With that in mind, the following is offered as guidance.

If the incubator is part of the airplane type design, we consider that every design measure practical should be taken to comply with all of the occupant protection requirements in the regulations. In particular, the incubator itself should be restrained to the applicable emergency landing loads, and should not pose a hazard to other occupants. The design of the incubator should account for in-flight turbulence, and should provide suitable padding/restraint to prevent injury to the infant..

With respect to decompression, the unit should be restrained in flight to minimize the probability that it might become a projectile in the event of decompression. Regarding the effects of decompression on the incubator itself, the medical purpose of the unit to isolate the atmosphere around the infant and the possible effects of decompression are in direct conflict. That is, it is likely that a decompression may render the unit medically ineffective. While this is undesirable, the regulations do not address this aspect of the installation. We consider that the requirements of Part 25 [Section 25.365(g)] are satisfied if the incubator remains intact following a decompression, such that no other occupants would be injured.

Assuming that there is only one incubator on board the airplane, we do not consider the amount of oxygen that might be introduced in the event of a cabin fire to pose any additional hazard. Installation of additional incubators would require more in depth study to determine if the regulations are adequate to account for the potential fire hazard.

In response to specific questions raised regarding off-wing escape systems, the FAA has reviewed the relevant requirements for emergency equipment, and retention of cargo and other items of mass. While it is correct that FAR Section 25.787 does not require that cargo below or forward of all occupants be restrained to the full emergency landing loads, Section 25.1411 does require that emergency equipment be protected from inadvertent damage. Thus, while there is no explicit requirement to restrain cargo in this case, there is a requirement to protect the slide inflation bottle, since it is part of the emergency escape system.

Bungee Jumping from Balloons

In early 1991, the Aircraft Certification Service received several requests for approval of equipment which would permit bungee jumping from hot air balloons. After careful consideration of all aspects of this matter, a decision was reached not to attempt to regulate bungee jumping, a sports activity in which persons indulge at their own risk.

By policy letter dated May 29, 1991, the Director of the Aircraft Certification Service directed that:

"*. . .Aircraft Certification personnel shall not act on requests for approval of bungee jumping equipment or modification to type certificated balloons.*"

We recently learned that, contrary to this policy, a Designated Engineering Representative has approved data pertinent to the installation of bungee jumping equipment.

Designees are not to conduct evaluations, inspections, or approvals on behalf of the Federal Aviation Administration in regard to bungee jumping equipment.

If you have further questions about this subject, please contact your cognizant Aircraft Certification Office (ACO).

Reminder for Manufacturing Inspection DAR's

The Manufacturing Inspection organization is reminding all of its Designated Airworthiness Representatives (DAR) of the requirements of FAA Order 8000.62, "*Designated Airworthiness Representatives Qualification Criteria, Selection, and Appointment Procedures,*" dated October 1, 1985. Included in the order is a requirement:

> **"Each DAR must contact the managing office prior to taking any action leading to the issuance of any airworthiness certificates or export airworthiness approvals for Class I products or conducting any inspection leading to the issuance of a TC or STC ...."**

The requirement is intended to serve two purposes:

- **First, it keeps the managing MIDO office informed of field activities.**
- **Second, and probably more important, it provides an opportunity for the managing MIDO to pass on any special information or concerns regarding particular products of which the designee may not be aware.**

In short, it is intended to prevent problems from happening.

This process requirement will be prominently included in Manufacturing DAR's limitations when they are reissued later this year.

Field Evaluations of Manufacturing Inspection Designees

The managing offices for Designated Manufacturing Inspection Representatives (DMIR) have the responsibility for conducting periodic evaluations of designees by accompanying each designee during the inspection of a product or part. The evaluation is necessary to ensure that satisfactory inspection techniques, methods, and procedures are being used.

Field evaluations are required annually for each DMIR, and semi-annually for each Manufacturing Designated Airworthiness Representatives (DAR).

We ask your assistance in tracking approaching field reviews and discussing potential projects and scheduling with your supervising MIDO inspector.

Recently Issued FAA Orders

The following FAA Orders were issued within the last six months and pertain to process and procedures related to Designees:

Order 8130.21, "*Procedure for Completion of FAA Form 8130-3, Airworthiness Approval Tag,*" was issued June 21, 1991. It establishes a procedure for use and completion of FAA Form 8130-3, Airworthiness Approval Tag, and issuance of export airworthiness approvals of new or newly overhauled Class II and Class III aircraft products. The tag may also be used for conformity certification of prototype products.

Order 8130.23, "*Aircraft Certification Service Representatives of the Administrator - General,*" issued September 26, 1991, consolidates numerous expired Action Notices and other Notices concerning Designated Manufacturing Inspection Representatives (DMIR), Designated Airworthiness Representatives (DAR), and Organizational Designated Airworthiness Representatives (ODAR), including:

- **AN 8120.6,** "*Use of DMIR's at Supplier's Facility*"
- **AN 8130.8,** "*Duration and Renewal of DMIR Designations*"
- **AN 8130.9,** "*Use of DMIR's During Type Certification Programs and at Suppliers*"
- **AN 8130.12,** "*Distribution and Maintenance of Designee Kits*"
- **AN 8130.23,** "*Use, Selection, and Appointment of DMIR's at Suppliers*"
- **AN 8130.29,** "*Appointment of ODAR's (Manufacturing)*"

- **N 8130.58,** *"Expansion of Individual DAR Geographical Restrictions"*

- **N 8130.59,** *"ODAR's Qualification Criteria, Section, and Appointment Procedures for Issuance of FAA Form 8130-3"*

Order 8130.24, *"Procedures for Termination/Nonrenewal of Aircraft Certification Service Designations and Delegations,"* was issued October 21, 1991. This Order establishes FAA procedures for the termination or nonrenewal of the certificate of Designees (DMIR, DER, DAR, ODAR, DAS, DOA). These procedures are intended to ensure that due process is accorded before a final decision is made on termination or nonrenewal. Although these procedures do not specifically address termination of Special Federal Aviation Regulation (SFAR) 36 authorizations, Parts Manufacturer Approval, or Technical Standard Order authorizations, they are to be used as guidance.

Advisory Circulars (AC)

Advisory Circulars Issued

Advisory Circular (AC) 21-30, *"Quality Control for the Manufacture of Non-Metallic Compartment Interior Components,"* was issued November 15, 1991. This AC provides information and guidance concerning Federal Aviation Regulation (FAR) Part 21, *"Certification Procedures for Products and Parts, Compliance Requirements."* The specific aspect of the AC is quality control (QC) systems for the manufacture of non-metallic compartment interior components. Non-metallic components obtain the majority of their attributes directly from their fabrication process, more so than metallic components. Many QC systems established for the manufacture of metallic parts may not be adequate to provide the additional controls necessary to assure conformance to design requirements of non-metallic parts. This AC addresses those areas of a QC system that may require further expansion to adequately accommodate the manufacture of non-metallic parts.

Advisory Circular Projects in Progress

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 public comment period closed May 15, 1989. The AD is being revised to provide harmonization with similar guidance material being issued by the European Joint Aviation Authorities (JAA), and to include acceptable means for certification of computerized airplane flight manuals. The revised AC is expected to be released for public comment in early 1992.

Related Rule: Section 25.1581

Crashworthiness Handbook

Description: This AC provides acceptable certification methods for demonstrating compliance with the crashworthiness requirements of Part 25 of the FAR for transport category airplanes. This AC consolidates relevant old policy and guidance material on crashworthiness into one document. It covers the crashworthiness regulations through Amendment 25-59.

Status: AC 25-17 was issued on July 15, 1991.

Related Rule: Subparts C, D, F and Appendix of Part 25.

Minimum Flightcrew

Description: This AC provides guidance on assessing flightcrew workload for new flight deck design and modifications to existing flight deck configurations.

Status: The notice of availability of the draft AC is in FAA coordination and is expected to be issued in 1992.

Related Rule: Section 25.1523.

Hydraulic Systems Certification and Analysis

Description: This AC provides guidance for acceptable methods and means of complying with the requirements of Section 25.1435 and related regulations pertaining to hydraulic systems.

Status: This AC is still in the coordination stages within the FAA.

Related Rule: Section 25.1435.

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 IMC operations.

Status: The draft is expected to be published for public comment by early 1992.

Related Rule: Sections 25.1309, 25.1333, and 25.1351.

Revision of AC 20-57A, Automatic Landing Systems.

Description: This project updates existing AC 20-57A. The existing AC was written for and is based upon 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.

Status: Action on this project currently is deferred.

Related Rule: Various sections of the FAR.

Pilot Compartment View Design Considerations.

Description: This project includes current guidance concerning the geometric characteristics of the pilot compartment and the properties of transparent materials necessary to assure adequate visibility from the flight deck. A study of the clear vision field was made by the Aerospace Industries Association. The findings resulted in recommendations that were subsequently adopted by the Society of Automotive Engineers (SAE) and published in Aerospace Standard AS-580B. Some of the SAE criteria have been adopted and modified as guidance in this AC for validating the pilot compartment view.

Status: The AC is in the final stages of coordination for issuance, which is anticipated by early 1992.

Related Rule: Section 25.773.

Takeoff Guidance

Description: This project was originally initiated to develop airworthiness approval criteria for takeoff guidance systems.

Status: This project has been deferred for some time pending completion of research and development (R&D) work, which currently is approximately 50% complete. With the new thrust in synthetic vision, this project has been overtaken by events and may be canceled.

Related Rule: None.

Continued Airworthiness

Description: This AC provides instructions to ensure continued airworthiness of transport category airplanes. It addresses the approval procedures to follow when making structural repairs. Special consideration is given to structure certified to the damage tolerance requirements of the FAR.

Status: AC 25.1529-1 was issued August 1, 1991.

Related Rule: Section 25.571, Amendment 25-45; and Section 25.1529, Amendment 25-54.

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

Description: The revision of Advisory Circular 25-7 will accomplish three major goals: 1) Update the existing AC 25-7 guidance material addressing Subpart B (FLIGHT), 2) Update and add flight test guidance material related to other subparts of Part 25 that is currently contained in Order 8110.8, and 3) Reflect the outcome of FAR Part 25 and JAR 25 harmonization efforts. When this revision to AC 25-7 is complete, Order 8110.8 will be cancelled.

Status: This project was re-initiated in July, 1991 after an 18 month deferment due to the team's involvement in the FAA/industry task force review of rejected takeoff (RTO) safety issues. The preliminary draft rewrite has been completed and was distributed to the responsible team members in late 1991. The revised draft of AC 25-7 is scheduled to be available for public comment in late 1992.

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

Flight Attendant Seat Changes.

Description: This is a project to revise AC 25.785-1 to provide guidance concerning flight attendant seat head strike zones and restraint system installation.

Status: A final draft AC is complete. Issuance is expected in early 1992.

Related Rule: Section 25.785.

Certification Methods for Full Authority Digital Electronic Engine Control System (FADEC)

Description: This AC provides guidance and acceptable methods for demonstrating compliance with the regulations for approving full authority digital electronic engine control systems.

Status: The draft AC is in the final stages of completion.

Related Rule: Sections 25.901 and 25.903.

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

Description: This is a project to revise AC 25.571-1 to clarify the damage tolerance assessment for the operational life of an airplane. The FAA is proposing to amend the fatigue requirements for damage-tolerant structure on transport category airplanes (as set forth in FAR Part 25) to require full-scale fatigue testing. This revision of AC 25.571-1 will provide guidance for demonstrating compliance with the new Part 25 rule, if adopted. Guidance is included for demonstrating compliance with the full-scale fatigue test requirement, establishing thresholds for initial inspections for fatigue damage, establishing the minimum overall reliability of the structural fatigue inspection program, and accounting for likely quality flaws and accidental damage incurred during manufacture.

Status: This AC is scheduled to be published for public comment concurrently with the proposed Part 25 rule, which currently is in the final stages of coordination within the Office of the Secretary of Transportation (OST). A date for publication has not yet been determined.

Related Rule: Section 25.571.

Takeoff Configuration Warning Systems

Description: This AC provides a means of compliance with the existing FAR pertaining to takeoff configuration warning systems for transport airplanes.

Status: The notice of availability of the draft AC was published in the Federal Register on April 3, 1991. The period for public comments closed August 1, 1991. The team leader currently is drafting the final AC.

Related Rule: Sections 25.703, 25.1301, 25.1309, 25.1357, 25.1431.

Widespread Multiple Site Damage

Description: This AC describes a shift in FAA policy regarding the maintenance of structure subject to metal fatigue. The old policy relied equally on inspection or modification to maintain safety. The new policy places much greater reliance on modification for old structure. This AC also summarizes the history of the FAA's aging airplane program to show how this policy change came about.

Status: The AC is in the final stages of drafting.

Related Rule: Section 25.571.

Software Verification Validation

Description: This AC is intended to supplement the software verification guidance provided by RTCA Document DO-178A and AC 20-115A. This AC is intended for use by applicants in preparing test strategies and by certification offices and Designated Engineering Representatives (DER) in reviewing verification of software.

Status: This project is dependent upon activities of RTCA Special Committee 167, whose charter is to review and revise RTCA DO-178A, "*Software Considerations in Airborne Systems Equipment Certification.*" A schedule will be established when the team has identified the issues that need to be addressed in this AC.

Related Rule: None.

Auxiliary Power Unit (APU) Installation

Description: This AC provides guidance concerning APU installation approvals for transport category airplanes.

Status: This project is scheduled for completion near the end of 1992.

Related Rule: Sections 25.901, 25.903, 25.1142, 25.1181, 25.1207, and Part 36.

Airborne Data Link Systems

Description: This AC provides guidance material for the airworthiness approval of ATN Airborne Data Link Systems.

Status: A team has been formed to redraft the AC based on public comments received. No schedule has been established for completion.

Related Rules: None.

Contaminated Runway Accountability

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

Status: Action on this project is deferred, pending completion of work concerning RTO safety issues (wet runway rulemaking).

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.

Certification Maintenance Requirements.

Description: This advisory circular provides guidance on the documentation and control of certification maintenance requirements (CMR). Included is a discussion concerning the philosophy behind the CMR concept, and acceptable methods for documenting and managing changes to established CMR's.

Status: The subject of CMR's is being thoroughly reinvestigated at this time. The current draft AC will be completely rewritten and resubmitted within the FAA for comment before proceeding with publication for public comment. A revised draft is due by the end of 1991

Related Rules: None.

Airworthiness and Operational Approval of Traffic Alert and Collision Avoidance System (TCAS II).

Description: This advisory circular will update existing AC 20-131 to provide guidance for the airworthiness and operational approval of TCAS II systems.

Status: This AC is being revised, based upon public comments received, and is slated to be presented for FAA coordination/comment by early 1992.

Related Rules: Various sections of Parts 25, 121, and 135 of the FAR.

Revision of AC 25.629-1, Flutter Substantiation of Transport Category Airplanes

Description: The fail-safe design criteria for control surface actuators which must retain stiffness in failure conditions have been developed on a case-by-case basis and have varied with each design presented. These criteria are not established in a general form which can be used as guidance for present and future designs. This AC will be revised to include this guidance.

Status: This document is in the early drafting stages. Although a schedule has not been established, an initial draft is expected by mid-1992.

Related Rules: Sections 25.629, 25.671, 25.1309.

Fuel Tank Access Covers

Description: This AC sets forth means of compliance with the provisions of Part 25 dealing with the certification requirements for fuel tank access covers. Guidance information is provided for showing compliance with the impact and fire resistance requirements of Section 25.963(e).

Status: The period for public comment closed October 14, 1991. A finalized AC is in the early stages of drafting.

Related Rules: Section 25.963(e).

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.

Status: This project is in the very early planning stage. A schedule has not been established.

Related Rules: Section 25.903.

Transport Category Airplanes Modified for Cargo Service

Description: This AC provides guidance for demonstrating compliance with the FAR pertaining to transport category passenger airplanes converted for use in all cargo or combination passenger/cargo service and the relationship of those regulations to the requirements of Parts 121 and 135 of the FAR. This AC is based on the assumption that there are no changes in airspeed, weight or center of gravity limitations, and that there are no major structural changes such as a stretched fuselage or added cargo door.

Status: The notice of availability of the draft AC was published for public comment on

October 11, 1991. The comment period closes February 10, 1992.

Related Rules: None.

Engine Torque Loads

Description: This AC project sets forth means of compliance with the certification requirements of Part 25 of the FAR for engine mounts and supporting structure. Included is guidance concerning the structural requirements for engine mounts and supporting structure for sudden stoppage conditions.

Status: The document is in the early drafting stage. A schedule for completion of this project is being developed.

Related Rules: Section 25.361.

Flammable Fluid Drainage

Description: This AC provides guidance for demonstrating compliance with Section 25.1187, Flammable Fluid Drainage

Status: This project is in the early development stage.

Related Rules: Section 25.1187

Engine Fire Extinguishing Concentration Testing

Description: This AC provides guidance for demonstrating that the engine fire extinguishing system will provide protection throughout the operating envelope.

Status: This project is in the early development stage.

Related Rules: None.

Automated Fuel Management Systems

Description: This AC provides guidance defining the requirements for new technology automated fuel loading and management systems.

Status: This project is in the preliminary drafting stage. Although a schedule has not been established, the preliminary draft is due by mid-1992.

Related Rules: None.

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