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Designee Newsletter

Aircraft Certification Division
Transport Airplane Certification Directorate

The question of professionalism is a sensitive subject and one which is difficult to define. Given the intertwined structure of the FAA organization, the certification system, and the designee system, questions may arise as to the potential for conflicts of interest. Early on, this was no doubt a reasonable concern, but on the basis of experience gained since the inception of the Civil Aeronautics Act (1938), such concerns have been shown not to be valid.

The benefits which have accrued to the FAA, the general public, and industry from the designee system are immeasurable, and the excellent safety record is the best testimony to its success. Nevertheless, considering the sharp eye of public scrutiny, it is in everyone's interest that we maintain a "squeaky clean" image for our system. Our best means to meet this end is to build together on a foundation of mutual trust, trust rooted in the professional integrity of both the designees and their FAA counterparts.

The success of the designee system is based on sound working relationships, conscientiousness, and open exchange of information and ideas between counterparts. If these components are lacking, the system won't work. If lack of trust develops between FAA and the designee at any time during the course of a project, it is ultimately the applicant who gets hurt most.

In times when FAA's budgetary funding is meager for such things as travel, designees will be called upon more and more to accomplish parts of the certification review usually performed by FAA personnel, for example, reviewing hardware and the physical changes to aircraft. Despite what may be additional work, I hope this will be accepted as a challenge to designees to continue to do a complete job on the portion of the project for which he/she is responsible and to keep the appropriate FAA project engineer informed of all aspects of the program.

We, collectively, are dependent upon each other for the success of the designee system; every person has an important contribution to make to the whole. I encourage each FAA employee and designee to commit themselves to strive for improvement in communication, cooperation, and coordination throughout our working relationships. We owe that commitment not only to each other, but to the aviation industry and the general public, as well.

LEROY A. KEITH, Manager
Aircraft Certification Division

NORTHWEST MOUNTAIN REGION
DESIGNEE NEWSLETTER

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Federal Aviation Administration
Northwest Mountain Region
17900 Pacific Highway So., C-68966
Seattle, Washington 98198

WAYNE J. BARLOW
Director
Northwest Mountain Region
Transport Airplane Certification Directorate

LEROY A. KEITH
Manager
Aircraft Certification Division

R. JILL DEMARCO
Technical Publications Editor
Aircraft Certification Division
Newsletter Editor

DESIGNEE LIABILITY

The liability of the U.S. for the acts of its employees is governed by the terms of the Federal Tort Claims Act, 28 U.S.C., Section 2671 et seq. With certain important exceptions, this act makes the government liable to the same extent as a private individual, under like circumstances, for the negligent or wrongful acts or omissions of its employees while acting within the scope of their employment.

In addition, the Act provides that, so long as the employee's actions were within the scope of employment, the government, rather than the employee, would be held liable.

"Employee of the government" is defined by 28 U.S.C., Section 2671, to include "persons acting on behalf of a Federal agency in an official capacity, temporarily or permanently in the service of the United States, whether with or without compensation." FAA project engineers, therefore, are Federally protected for the findings they make when acting within the scope of their official responsibilities.

The application of this definition to the designee situation depends on the many factors involved in determining whether an agency relationship exists between the FAA and the designee. The most important factor in this determination is the degree of control exercised, or the right of control retained, by the U.S. over details of the work performed by the designee.

The FAA and Justice Department have consistently held the position that, because of a lack of control over the actual work performed by the designee, the designee is not the agent of the FAA, but is an independent contractor. As such, the designee would not be considered an employee under the above definition, and would be personally liable for his own actions.

Designees, as private individuals, are covered by the general tort law. Under general tort law, individuals may be held liable for careless or intentional conduct which causes harm to others. The standards that courts apply to determine whether conduct is careless is whether, under the same circumstances, a reasonably prudent person would have done the same thing. Therefore, as applied to designees, the issue would be whether an engineer with the same type of expertise would have reasonably reached the same conclusion on a given engineering issue. A designee's best protection is to limit his exposure by being very clear and specific as to what he is approving, making sure his conclusions, and the reasons for them, are well-documented.

Advisory Circulars (AC)

The following is a list of Advisory Circulars (AC) recently issued by FAA. To obtain copies, contact the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; telephone (202) 783-3238.

AC No. 20-127, "Use of Society of Automotive Engineers (SAE) Class H11 Bolts," dated July 8, 1987, provides guidance on the use of SAE Class H11 bolts in primary structure on all aircraft, including gliders and manned free balloons, and on aircraft engines and propellers. The service history of H11 bolts used in primary structure indicates a higher than normal failure rate. These failures are attributed to stress corrosion cracking, and may become a safety problem. H11 bolts and companion nuts are more sensitive to environmental influence than bolts made from other materials. The use of H11 bolts in primary structure, therefore, is discouraged and should not be considered for use on new type design aircraft. For further information on this subject, contact your cognizant ACO.

AC No. 21-12A, "Application for U.S. Airworthiness Certificate, FAA Form 8130-6 (OMB 2100- 0018)," dated March 26, 1987, provides instructions on the preparation and submittal of FAA Form 8130-6 (Issue 6-86 and subsequent), Application for Airworthiness Certificate. The application should be completed not only to obtain an airworthiness certificate, but also for any amendment or modification to a current airworthiness certificate.

AC No. 21-15F, "Announcement of Availability: Aircraft, Aircraft Engines, and Propeller Type Certificate Data Sheets and Specifications," dated March 3, 1987, provides information concerning the availability of the subject publications. Type Certificate Data Sheets and Specifications (TCDS) set forth essential factors and other conditions which are found necessary for U.S. airworthiness certification. Aircraft, engines, and propellers which conform to a U.S. type certificate are eligible for U.S. airworthiness certification when found to be in a condition for safe operation and when ownership requisites are fulfilled. The TCDS's are provided in paper copy and microfiche editions.

AC No. 25-10, "Guidance for Installation of Miscellaneous, Nonrequired Electrical Equipment," dated March 6, 1987, provides, as the title suggests, guidance for installation of miscellaneous, nonrequired electrical equipment in transport category airplanes.

AC No. 25-11, "Transport Category Airplane Electronic Display Systems," dated July 16, 1987, provides guidance for certification of cathode ray tube (CRT) based electronic display systems used for guidance, control, or decisionmaking by the pilots of transport category airplanes.

AC No. 25-12, "Airworthiness Criteria for the Approval of Airborne Windshear Warning Systems in Transport Category Airplanes," dated November 2, 1987, provides, as the title suggests, guidance for the approval of airborne windshear warning systems.

AC No. 140-7E, "FAA Certificated Maintenance Agencies Directory," dated May 28, 1987, is a consolidated directory of all FAA repair stations and parachute lofts certificated as of April 7, 1987, under the authority of FAR Part 145 (Repair Stations) and FAR Part 149 (Parachute Lofts). Comments regarding this publication should be directed to the Federal Aviation Administration, Aviation Standards National Field Office, National Safety Data Branch (AVN-120), P.O. Box 25082, Oklahoma City, Oklahoma 73125.

AC No. 185-55, "FAA DAR, DAS, and DOA Directory," dated May 28, 1987, includes a consolidated directory of Designated Airworthiness Representatives (DAR) for both maintenance and manufacturing; Designated Alteration Stations (DAS); and manufacturing organizations with Delegation Option Authorization (DOA) as of March 13, 1987, designated under the authority of FAR Parts 21 and 183.

PROPOSED ADVISORY CIRCULARS

AC No. 25.812-1, "Floor Proximity Emergency Escape Path Marking." On July 20, 1987, a Notice was published in the Federal Register inviting public comment on a proposed revision of this AC. This revision clarifies the escape path and exit, and includes general system guidelines that have been approved. The period for public comment closed on November 17, 1987.

AC No. 25.1357-1, "Circuit Protective Device Accessibility." On September 19, 1987, a Notice was published in the Federal Register inviting public comment on a proposed AC that sets forth two specific methods of circuit protective device accessibility, either of which is considered to provide an acceptable means of compliance with the accessibility requirements of FAR 25.1357(d). That FAR requires that the circuit protective device(s) used for the power supply wire(s) of each load that is essential to safety in flight must be accessible, so that the flightcrew can readily restore power following its automatic disconnection during flight. The period for public comment on this proposal closes on January 18, 1988.

AC No. 25.785-1A, "Flight Attendant Seat and Torso Restraint System Installations," was published as a Notice in the Federal Register on October 8, 1987. This proposed AC provides information and guidance regarding an acceptable means, but not the only means, of compliance with the portions of FAR 25.785 and 121.311 which deal with flight attendant seats. The period for public comment on the proposed AC closes February 5, 1988.

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Notices

Notice 87-3, "Low Fuel Quantity Alerting System," was issued May 1, 1987. This Notice proposes an amendment to the airworthiness standards for transport category airplanes to require a means to alert the flightcrew of potentially unsafe low fuel quantities. There have been several recent fuel depletion incidents involving loss of power or thrust on all engines that could have resulted in forced landings and injury or loss of life. Most of these incidents resulted from improper fuel management techniques. This proposal would require new transport category airplane designs to incorporate a low fuel quantity alert to the flightcrew that would allow either correction of certain fuel management errors or the opportunity to make a safe landing prior to engine fuel starvation. This Notice appeared in the Federal Register on May 12, 1987. The period for public comment closed on September 9, 1987.

Notice 87-11, "Fire Protection Requirements for Cargo or Baggage Compartments," was issued on October 28, 1987. This Notice proposes changes to FAR Part 121 to upgrade the fire safety standards for cargo or baggage compartments in certain transport category airplanes used in air carrier, air taxi, or commercial service. Ceiling and sidewall liner panels that are not constructed of aluminum or rigid fiberglass and used in Class C or D compartments greater than 200 cubic feet would have to be replaced with improved panels prior to a specified date. These standards are similar to the new requirements in FAR Part 25 relative to cargo compartment liners (Amendment 25-60). This Notice is the result of research and fire testing, and is intended to increase airplane fire safety. The Notice appeared in the Federal Register on November 5, 1987. Comments must be received on or before May 3, 1988.

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FINAL RULES

Amendment No. 25-62, "Standards for Approval of an Automatic Takeoff Thrust Control System (ATTCS)," was issued on November 4, 1987, by the Administrator of the FAA, and becomes effective on December 9, 1987. (It appeared in the Federal Register on November 9, 1987.) This amendment provides new airplane and equipment airworthiness standards for the installation of ATTCS on Part 25 transport category airplanes. As the current regulations do not provide airworthiness standards for this novel and unusual system, special conditions have been developed and issued to provide appropriate standards for installation of the system. This amendment eliminates the need for special conditions.

General News

TECHNICAL REPORTS AVAILABLE

The FAA has published a list of 79 scientific and technical aviation reports available to the public, covering the period from July 1986 through December 1986, and updates an earlier list released on October 29, 1986. Subjects include: aircraft safety and airport technology, aviation medicine, communications and surveillance, environment, navigation weather, and other items. Reports may be ordered from the U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161.

COMPOSITE STRUCTURE

Report No. NADC-87042-60 (DOT/FAA/CT-86/39), entitled "Certification Testing Methodology for Composite Structure," dated October 1986, was prepared by the Northrop Corporation for the Naval Air Development Center and the FAA Technical Center. The researchers developed a testing methodology for composite structures. Existing composite static strength and fatigue life data are analyzed statistically to determine the influence of test parameters on the scatter of composite data. Recommended guidelines for use of composite data in structural certification are included. Various approaches to composite structures certification are analytically evaluated: scatter factor approach, load enhancement factor approach, ultimate strength approach, and change in system approach. The capability, advantages, and disadvantages of each approach to determine the minimum life and/or strength are fully discussed.

USE OF COMPUTER PROGRAMS FOR DEVELOPING TYPE CERTIFICATION DATA

There has been much discussion between FAA, industry, and designees concerning the use of computer programs to generate type certification data intended to show compliance with the Federal Aviation Regulations.

It is recognized that there are many computer programs in existence that are well-established as to their applicability and ability to produce consistently sound data from appropriate inputs. The problem that occurs is the application of these programs to specific type certification projects.

The NASTRAN program, for example, is a program that industry uses on a regular basis. As such, it is accepted that, if proper input is made to the program, the answers will be acceptable. The key in using the program is whether or not the person who is proposing its use in certification is appropriately trained in the use of the program, understands the limitations of the program, and can appropriately model structure.

In certification programs, it is FAA's policy that the applicant must demonstrate, at least initially upon use of a program and to some degree upon recurrent use of a program, that the modeling or the techniques used and the choices made within that program structure are appropriate and yield consistent, conservative results.

Again, using NASTRAN as an example, the secondary bending loads in beam elements are a function of the endfixity that are assumed by the applicant. The secondary loads in some of the elements of truss structure could cause that element to go from one that complies with the rules to one that has a negative margin. In addition, the way particular structure is divided into rectangular plates and/or triangular plates has a significant impact on how the loads are computed internally.

It is imperative that all certification personnel who deal with computer programs (structural programs or otherwise) require the applicant to demonstrate his capability of using that program within the limits that the program was designed to be used.

FAA acceptance of a program for use in analyzing structures is granted only on a case-by-case basis. Computer programs, such as the MSC finite element analysis, may be used for structural substantiations only after the DER has demonstrated that the program is appropriate for the analysis of those particular elements of the structural design under examination.

This demonstration could be accomplished by the DER by (1) running a parallel analysis to another "known" program (i.e., Boeing Atlas, NASTRAN, etc.), (2) before-and-after static testing of the modified aircraft section to compare computed/actual stress levels or deflections under load, (3) running a long-hand analysis using standard engineering techniques, etc.

In order to streamline this process, individual DER's may wish to develop a portfolio of test cases for a given computer program for use by the FAA in evaluating particular structural applications.

In conclusion, FAA is not (yet) in the business of approving computer programs for certification use. FAA's job is to evaluate and accept the finished product or design (as indicated by our issuance of the STC/PMA).

Until policy or practice is changed otherwise, the FAA will continue to evaluate each computer program for each structural application on a case-by-case basis.

SOFTWARE DEPENDABILITY

The increasing application and criticality of digitally implemented flight control functions dictates a need for highly dependable software. A variety of methods for creating reliable software have been developed (e.g., software engineering, higher order languages, testing and debugging procedures, etc.). However, these methods do not inherently provide a measure of reliability improvement obtained using the methods. Systems which provide functions critical to the safe transportation of passengers must be more than reliable; they must be dependable. The concept of dependability encompasses the notions of reliability, availability, and safety.

Software reliability models have been developed which can predict the reliability of software based on various input parameters, and many of these studies attempted to analyze an existing data base to derive a prediction methodology. Data bases were files of historical significance, and were not real-time, airborne software systems developed using higher order languages. Consequently, many researchers have found that the popular software reliability models are invalid. Recent work involved carefully designed and controlled software development experiments, using a limited number of programmers programming a limited number of problems. That work, in turn, has been criticized as not representative of real-time digital avionics software.

In November 1986, Battelle (Columbus Division) prepared a technical report for the FAA's Technical Center in Atlantic City, entitled "Software Dependability Assessment Methods," (DOT/FAA/CT-86-27). This document identifies various software reliability models, defines the interface between software reliability model with a fault tolerant system reliability model, and provides a software dependability model (capable of evaluating availability, reliability, and safety) that can predict the reliability of software prior to and throughout its development. The software reliability data and development of software reliability is also discussed.

The report is available from the U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161. The point of contact is W. E. Larsen, M/S 210-2, Ames Research Center, Moffett Field, California 94035.

NEW NRS FOR AIRCRAFT COMPUTER SOFTWARE

The FAA Director of Airworthiness has announced that Michael P. DeWalt has been appointed as the National Resource Specialist (NRS) in the area of Aircraft Computer Software (Engineering). His responsibilities, as part of the NRS team, will include management of overall activities of aircraft computer software and evaluation of the effectiveness of current software practices, as one of the new engineering technologies applicable to all types of aircraft. He will serve as a technical advisor and consultant in the area of aircraft software, develop and oversee research and development programs, and assess the need for and develop technical training opportunities for certification engineers in his area of expertise.

Mr. DeWalt may be contacted at the following address:

Mr. Michael P. DeWalt
Aircraft Computer Software (Engineering)
National Resource Specialist, ANM-106N
Federal Aviation Administration
Seattle Aircraft Certification Office
17900 Pacific Highway South, C-68966
Seattle, Washington 98168

TAKEOFF AND LANDING WITH 15 KNOT TAILWINDS

The FAA has had a policy for some time of not approving 15 knot tailwind limitations in the Airplane Flight Manual (AFM) for domestic operators, but has approved these limitations on behalf of foreign airworthiness authorities. This process has recently been reviewed and is being changed. The Office of Flight Standards (FAA Headquarters) has issued new procedures which affect certification and operational approval for these conditions. When an airplane has been shown to comply satisfactorily with the demonstration requirements given below, the AFM can now contain a 15 knot tailwind limitation, accompanied by a statement as follows:

"The capability of the airplane has been satisfactorily demonstrated for takeoff and manual landing with tailwinds up to 15 knots. This finding does not constitute operational approval to conduct takeoff and landings with tailwind components in excess of 10 knots."

With regard to certification, the airplane must demonstrate satisfactory controllability, glide path control, flareability, and ground handling characteristics with tailwind components of at least 22.5 knots (150 per cent of 15 knots). The engines must also be shown to have satisfactory operating characteristics, thrust reversing characteristics, and thrust setting ability with this tailwind component.

The thrust setting demonstration need only be shown for the initial part of the takeoff, to the point where the power is set (approximately 80 knots). Airplanes that are equipped with automatic takeoff power setting systems must be demonstrated capable of satisfactory power settings, unless the system is specifically prohibited from use with 15 knot tailwinds, or it can be shown that autothrottle power sets are less critical than manual power sets. New engine installations on airplanes that have previously demonstrated the controllability requirements must be shown to have satisfactory operating characteristics, thrust reversing characteristics, and thrust setting ability.

With regard to operations, the Office of Flight Standards is developing a new Standard Operations Specification which would permit, under tightly controlled conditions, takeoffs with 15 knot tailwinds in certain unique cases when an equivalent level of safety can be successfully demonstrated. Operations with 15 knot tailwinds would be approved on a runway-by-runway basis.

The AFM's for some U.S. operated airplanes currently have a 15 knot tailwind takeoff and landing limitation. Where these airplanes have been demonstrated to possess satisfactory characteristics in a 22.5 knot tailwind, this limitation can be allowed to remain. However, at the first revision to the AFM for any reason, the statement (quoted) above should be added.

The FAA plans to include this policy in the next revision to Advisory Circular 25-7, "Flight Test Guide for Certification of Transport Category Airplanes."

GUIDANCE ON REQUIREMENTS FOR FAA APPROVAL OF BRAKE COMPONENTS

Recently, the Northwest Mountain Region Aircraft Certification Division received a request from an ACO for guidance concerning applications received for supplemental type certificates (STC) for new replacement brakes. The following is the Division's response:

In order to obtain such an STC, the applicant may either:

(1) demonstrate identicality with the existing TSO-authorized parts, or

(2) if the applicant is is unable to do so, be required to conduct additional testing.

In any event, the applicant would be required to apply for a separate TSO authorization in accordance with FAR 21.611(c). Once approval is given, the applicant could then mark the brake assembly with his own nameplate, indicating the method of approval (STC number), without altering the existing TSO nameplate.

If the applicant intends to show identicality with existing TSO-authorized parts, he must consider not only the form and fit of the parts, but also the chemical and/or metallurgical characteristics (including micro-structure, surface and cross-sectional hardness, and material spectrum analysis), and process and manufacturing specifications. Previous experience with various brake manufacturers has shown that it is extremely difficult to duplicate the physical and chemical characteristics of brake lining materials. For example, two linings with similar hardness or other measurable characteristics could have been produced using different process specifications.

If the applicant can show to FAA satisfaction, however, that his parts are indeed identical to the originals, the change could then be considered to be a "minor change," as discussed in FAA Order 8110.8, paragraph 89.b.(4)(c)(9). Five non-instrumented landings would be sufficient to demonstrate compatibility between the airplane, pilot, brake, and antiskid systems on the airplane. With respect to the TSO, a statement of conformance and submittal of the data showing identicality would be sufficient.

If the applicant is unable to demonstrate identicality, the change must be considered to be a "major change," since the coefficient of friction and wear rates may be different, and the new parts could, therefore, cause a significant variance in the heat sink capacity, the torque characteristics, or the kinetic energy absorption characteristics of the brake. It will be necessary, therefore, that the applicant demonstrate compliance with the pertinent parts of TSO-C26c, including the 100 landing stops and one accelerate-stop described in Table III of § 4.2 of the TSO.

In addition to the TSO requirements, a maximum kinetic energy rejected takeoff (RTO), as described in Order 8110.8, must be conducted on the airplane, as well as six functional takeoffs and landings. In addition, fuse plug substantiation tests (melt and no-melt) must be conducted, unless the applicant can demonstrate that heat transfer from the brake stack to the wheel is identical to the original. Also, antiskid-on and antiskid-off tests, qualitative taxi tests, and wet runway tests (antiskid-on) must be conducted.

These test procedures are described in FAA Order 8110.8, paragraph 89, and are required to demonstrate adequately the performance of the new lining material.

If the applicant successfully demonstrates that the performance of the brake with his parts installed is identical to the original, he may mark the brake as described above.

If the demonstrated performance is greater than that of the original, however, concurrence by the airplane manufacturer is essential, since original landing gear designs are based on structural analysis, which could be adversely affected by a brake system change.

CERTIFICATION TESTING OF BRAKES: DEGREE OF WEAR

Two certification regulations deal with the stopping performance of transport airplanes:

- FAR 25.109, Accelerate-Stop Distance;
- FAR 25.125, Landing.

FAR 25.109 contains a statement that runway stopping performance must be demonstrated on a dry, hard surface runway, and must be demonstrated by using wheel brakes only. Means other than wheel brakes may be used under both regulations if the "means" is (1) safe and reliable, (2) used so that consistent results can be expected under normal operating conditions, and (3) does not require exceptional skill to control the airplane.

To date, the FAA has not accepted the use of reverse thrust in stopping performance demonstrations because we have remained unconvinced that such demonstrations are sufficiently reliable. In addition, reverse thrust credit has not been utilized for certificated performance, since contaminated runway braking performance has not been required in the certification process. As a result, certificated braking performance has been demonstrated with new brakes, on dry runways, with no credit for reverse thrust.

Braking degradation due to worn brakes and runway contamination is offset or compensated for by a combination of the reserve braking force due to reverse thrust, and Flight Manual factored landing distances and allowances for wet runways. Also, in-service maintenance records do not indicate that there are failures associated with worn brakes not meeting rejected takeoff energy levels. Wear indicators on the brakes and required maintenance checks ensure that brakes are replaced prior to the point at which they are no longer capable of absorbing the maximum kinetic energy. Thus, an acceptable level of safety has been maintained due to the conservatism of this approach.

The British Civil Aviation Authority (CAA) has taken a different approach. JAR 25.109 requires demonstration of the greatest of four accelerate-stop conditions, including wet runways. CAA Specification No. 17, which is the counterpart to FAA's TSO-C26c (Aircraft Wheels and Wheel-Brake Assemblies), specifies that the accelerate stop test (KERT) be carried out on a brake in which the usable wear range of the heat sink has been consumed by not less than 90 percent. For this test, and for the airplane test noted above, allowance may be made for the decelerating effects of available power plant thrust reversers (or propeller reverse pitch). The British, therefore, achieve the conservatism in their analysis by a means different from that of the FAA. Both methods, however, have been proven by service history to be acceptable, rational approaches.

CONTROL SYSTEM OPERATIONS TEST, FAR SECTION 25.683

This is in response to a request that FAR 25.683 be clarified to reflect current U.S. practice relative to application of 80 percent pilot effort during the operation tests on flight control.

The regulation in question was last amended in 1970 by Amendment 25-23. The amended rule specifically addressed powered control systems. Its predecessor rule (4b.328) required testing to 80 percent limit load specified for the control system.

In response to a commenter on the proposed Amendment 25-23 to FAR 25.683, the preamble to the final rule stated, "The amendment to FAR 25.671 requires that adequate proof be provided to show that the control system can be operated sufficiently for continued safe flight and landing after any single failure in the control system. This will include the effects of the loads resulting from the failure." Both FAR 25.671 and 25.672 address power operated systems.

Although a feel system may not produce 80 percent of pilot effort, certain malfunctions or failures, not considered extremely improbable, could create high pilot effort loads. The test with pilot effort of 80 percent should assure sufficient stiffness in the control runs to prevent bottoming of the controls before adequate input to the powered portions is achieved. It is conceivable that a control system could have an extremely soft cable run and have low pilot forces for normal operation, and still pass the limit load static tests.

Operation tests with 80 percent pilot effort load are also necessary for powered control systems to assure that the airplane is controllable for all conditions not shown to be extremely improbable.

ICING CERTIFICATION: FREEZING RAIN

Ice protection systems are designed to provide protection when the aircraft is exposed to atmospheric conditions conducive to icing that are likely to be encountered in service. These conditions are defined in Appendix C of FAR 25. The meteorological data in Appendix C are the results of analyses of the atmosphere and aircraft icing encounters of a time period of several years. The icing envelopes defined in Appendix C are, therefore, based on statistical analyses and are not intended to include all possible icing conditions.

The meteorological data in Appendix C are defined in terms of liquid water content, droplet diameter, and temperature, along with the additional factors of altitude and horizontal extent of the icing encounter. The determination of the most severe conditions within this envelope, for which an icing system is to be designed, involves consideration of the operational characteristics of the aircraft. Operational regimes, such as climb, cruise, hold, and descent, are usually investigated at various altitudes. Certification of ice protection systems usually requires a combination of analysis, dry air flight tests, airborne tanker tests (usually reserved for special purpose approvals or initial investigation of system performance), and natural icing flight tests.

Due to the random nature of icing encounters, it would be impossible to collect data at the various corners of the icing envelope. Therefore, sufficient data points are taken to ensure that the system analysis and dry air flight tests are validated and that the system will perform adequately within the defined icing envelope.

Freezing rain is defined by a large droplet size and high liquid water content which is outside the icing envelope described in Appendix C. This is not to say that it can never occur, but, rather, that statistically the event is rare. During certification of ice protection systems, encounters with freezing rain must be considered, but no attempt is made to demonstrate proper system operation in these conditions.

Freezing rain can have serious consequences for an aircraft which has shown to be satisfactory in normal icing encounters. For example, the large droplet sizes found in flight through freezing rain can result in ice accumulations on parts of the aircraft that might normally be ice-free. While a freezing rain situation may extend horizontally for a hundred miles or more, it is usually between sea level and 5000 feet altitude; any exposure, therefore, is usually quite brief. In addition, its presence is quickly discovered by other aircraft and Air Traffic Control, and if it cannot be avoided (as during initial climb or approach, the exposure can be minimized by routing or altitude change.

Advisory Circular 20-73, "Aircraft Ice Protection," dated 5/71, and Technical Report ADS-4, "Engineering Summary of Airframe Icing Technical Data," dated 12/63, contain discussions of freezing rain in relation to the Appendix C icing envelopes.

LOCATION OF PASSENGER CENTER OF GRAVITY ABOVE THE COMPRESSED SEAT CUSHION FOR COMPLIANCE WITH FAR 25.561 AND TSO-C39

The Aircraft Certification Division has been requested to issue a position on the practice of placing the passenger center of gravity (C.G.) 8.20 inches above the compressed seat cushion when calculating the aircraft interface reactions for the 9-g forward load condition. Our position is that this practice is acceptable.

It was noted that this method of analysis is documented in certain static test reports and comparative analysis reports when showing interface reactions for the forward load condition. It was further noted that the seats are actually tested to fully comply with all the requirements of National Aeronautical Standard (NAS) 809 (i.e., application of the load 10.5 inches above base of body block).

The only document directly approved by the FAA which specifies C.G. locations for static testing of passenger seats, is NAS 809. It has recently come to our attention that DER's have approved documents which specify C.G. locations different from those in NAS 809. We are correcting this interpretation of the rules by informing all DER's to use 10.5 inches for the vertical C.G. location.

The static 9-g forward load condition does not attempt to duplicate the dynamic test case with respect to peak load factors, C.G. locations, or distortions under dynamic loads. The static load conditions specified in FAR 25.561 are intended to provide an acceptable level of safety when applied using the TSO-C39 (NAS 809) body block.

The FAA considers a vertical C.G. location 10.5 inches above the base of the NAS 809 body block acceptable for use in showing compliance with the static test requirements of FAR 25.561.

REQUIREMENTS FOR PROCESS SPECIFICATIONS

Process specifications must include enough information to accurately define the materials and fabrication processes used in the design. Complete and acceptable manufacturer's specifications (not just the manufacturer's brand name and part number) must be called out and submitted for critical parts. Critical processes may include detailed receiving inspections for raw materials and post-fabrication testing of laminates or parts.

DEVELOPMENT OF MATERIAL ALLOWABLES

All material allowables used in substantiating primary aircraft structure must be FAA-approved. Use of material allowables specifications described in MIL-HDBK-5 is recommended.

FAA approval for all structural allowables, other than those listed in MIL-HDBK-5, must be obtained on a material-by-material basis. The qualification testing or data requirements for these materials should be considered and agreed upon as early in the project scheduling as possible.

FLAP SETTINGS

An increased use of landing flap setting restrictions is being experienced on amended and supplemental type certificate (STC) projects as a means to satisfy the provisions of FAR Parts 25 and 36. Two foreign airplane models have landing flap restrictions due to unacceptable flight characteristics when using the maximum landing flap in icing conditions. An increasing number of quiet nacelle projects are being approved without the use of the original maximum landing flap, and some without the original alternate landing flap as well, in order to meet the provisions of Part 36.

Since there have been reports that flightdeck placards restricting the use of unapproved flap settings have not provided an adequate limitation, a more positive method of control and detection is desired. The following would restrain the use of unapproved flap settings and would provide consistency.

In order to approve a design that involves the restriction of the original landing flap settings, it is recommended that the following steps be taken, in addition to any other requirements:

1. Where permitted, remove the performance information that is relevant to the unapproved flap setting from the Performance Section of the Airplane Flight Manual (AFM). STC applicants, however, are not authorized to modify the basic AFM.

2. State in the Limitations Section of the AFM that the unapproved flap setting cannot be used, except in emergencies.

3. Place appropriate placards in the cockpit.

4. Provide a "softguard," such as a crushable cover plate, over the slot in which the flap selector handle travels, to restrain normal use of the unapproved flap setting.

The two foreign airplane models mentioned earlier have a "softguard," which makes it obvious to the flightcrew that the maximum flap setting is not to be used for normal operation, and indicates any use of the unapproved setting by its deformation.

This is now also recommended for unapproved landing flap settings resulting from Part 36 certification, when an applicant elects not to comply with the provisions of Part 36 at previously approved flap settings. It is particularly important for STC projects where the basic AFM may not be modified, only supplemented, allowing the unapproved maximum flap performance information to remain intact and available. This procedure also provides an additional part number which would be a basis for an STC in those cases where only the modification to the airplane may be a flap limit.

CABIN OZONE CONCENTRATION REQUIREMENTS

The cabin ozone limits specified in FAR 25.832 were first introduced in February 1980 (Amendment 25-50), and were simultaneously placed into FAR 121. When the FAR 25 rule went into effect, it was expected that many of the existing airplanes in the fleet would not be modified with ozone filters; since FAR 25.832 was not part of their type design, these planes did not have to comply with this rule. Most operators of these planes chose, instead, to comply with the ozone limit requirements of FAR 121.578 by way of operational considerations, i.e., reduced cruise altitudes, amended routes of flight, etc. For the existing airplanes at that time, this solution was deemed the most economical method of compliance, and AC 120-38 was written to help with this option.

The operational method of compliance was never envisioned as being applied to newly-designed airplanes, for which FAR 25.832 would be part of their certification bases. Such airplanes must comply with FAR 25.832 without reliance on an operational procedure.

Compliance with FAR 25.832 will require a demonstration (by test or analysis) that the cabin ozone concentration will not exceed the stated limits at the maximum atmospheric ozone concentration expected in service. If an ozone filter or other device is installed, it must be shown that this device, plus the natural ozone dissociation which occurs in the engines and in the airplane air conditioning system, will meet the requirements of the rule at the airplane's certificated altitude ceiling. If an ozone filter or other device is not used, however, certification testing may reveal that the cabin ozone concentration may exceed the limits at the airplane's certificated altitude ceiling, and this would cause the certificated ceiling of the airplane to be lowered to whatever altitude would allow compliance with FAR 25.832.

FAA FORM 8110-3

The Northwest Mountain Region Aircraft Certification Division regularly receives many DER approval submittals, FAA Form 8110-3, concerning modifications, which either were filled out incorrectly or had omitted pertinent information.

FAA Orders 8110.37 and 8110.4 stipulate that DER's are responsible for listing all of the applicable regulations within their DER authority of the Form 8110-3 approval forms for the modification under review. If the DER decides not to approve his data in accordance with these applicable regulations, or if he elects only to recommend approval, he is then required to explain why he is not approving his data for each of these regulatory requirements. This process assures that (1) all of the applicable regulations are being considered and that no program gaps arise, and (2) the FAA project engineer is alerted to the need for further consideration and approval for those requirements not being approved by the DER.

DER's are encouraged to state, directly on the Form 8110-3, all their reasons for not approving their data to each of the applicable regulations within their DER authority. Further, all of the applicable regulations within the DER's areas of authority should be included on the approval form. All descriptive drawing lists, installation drawings and instructions, and substantiating reports should be identified on the Form 8110-3 by title, number, revision letter, and date.

With this information clearly identified on the Form 8110-3, the FAA project engineer is assured that the entire job has been assessed and that the DER has approved the details, assembly, and installation of the modification and its compatibility to all analyses.

FLIGHT TEST DER'S

Advisory Circular (AC) No. 183.29-1U, Designated Engineering Representatives, Dated July 2, 1986, lists the Designated Engineering Representatives who are available for consulting work.

DER's, as direct representatives of the FAA, are privileged to approve engineering or flight test information that complies with the FAR within particular categories and subject to prescribed limitations.

Flight test DER's differ from DER's of the other disciplines in that:

1. A Type Inspection Authorization (TIA) must have been issued for the project or aircraft before the flight test DER's may begin test flights, as required by FAA Order 8110.4, Chapter 5, paragraph 202.

2. The flight test DER must be authorized by the FAA in writing (either by letter or by notations included on the TIA) and in advance of testing of the specific items to be accomplished under their DER authority;

3. The flight test DER must have performed the actual testing of the airplane in order to sign the FAA form 8110.3 approving the flight test results, e.g., the flight test pilot must have actually manipulated the aircraft controls if a handling qualities test is being performed. The reason for this is that many items are based on pilot opinion and experience which does not lend itself to post review or evaluation from a distance. This policy is stated in FAA Order 8100.4, Chapter 1, Paragraph 4.b.

Flight test DER's are similar to the DER's of other disciplines in that:

1. All DER's must wait until a satisfactory conformity inspection has been accomplished before initiating an approved testing program. DER testing prior to the issuance of the TIA is generally invalid because no conformity of the aircraft to type design has been established.

2. All DER's are guided by the same policy and guidance concerning the Federal Aviation Regulations as are FAA personnel. DER's are not authorized to interpret Federal Aviation Regulations, as is explained in FAA Order 8110.4, Chapter 5, paragraphs 193 and 201.a

3. All DER's should contact the FAA early and often during the certification and/or testing program in which they are participating.

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FAA EMPLOYMENT OPPORTUNITIES

The Northwest Mountain Region Aircraft Certification Division currently has a number of vacancies at the GS-5 through GS-13 levels ($19,268 to $50,346 per annum) for qualified aerospace engineers in the following specialties: airframe, systems and equipment, propulsion, flight test, and modifications.

These positions are located in Long Beach and Hawthorne, California; and Seattle, Washington. They require, as a minimum, a B.S. degree in engineering for the GS-5 entry level. Further education and/or certification experience may qualify an applicant for higher grade levels.

If you or anyone you know is interested in more information about FAA employment, please contact:

Federal Aviation Administration
Northwest Mountain Region
Aircraft Certification Division,
ATTN: Vicki J. Harrell, ANM-103
17900 Pacific Highway South
C-68966
Seattle, WA 98168

Telephone: (206) 431-2144

(The Federal Government is an equal opportunity employer.)

NOTE FROM THE EDITOR

If you would like a copy of any of the previous editions of the Northwest Mountain Region's Designee Newsletter, or if you have a name that you would like added to our mailing list, please submit your request to:

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