Federal Aviation Administration

Transport Certification Update

Inside...

Fuel Tank Safety, Aging Airplane Safety Program, and more...

Cover photo courtesy of the Library of Congress
For more about this image, see page 1

Edition 25 Fall 2008

OK-09-0420

Northwest Mountain Region, Federal Aviation Administration,
Department of Transportation

Transport Certification Update

From the Directorate Manager: Going Back to Basics

Many of us in the aviation business, particularly those involved in certification, watched the Congressional Hearing on Eclipse 500 certification with great interest. Each one of us had a different reason for watching the five-hour proceeding. Some simply wanted to know what really happened, whereas others wanted to learn from the events with the intent to stay far away from the types of problems and issues that may have brought about the hearing and the investigation.

I, like many, watched the hearing. But my involvement in the Eclipse special certification review (SCR) gave me a perspective on the project and issues involved that many others did not have. Having gone through the SCR, it was much easier for me to relate to various statements and positions brought to the session by the witnesses.

I have since reflected on the hearing and issues that prompted it with the intent to see what we can do to prevent similar occurrences in the future. The harder I think about all that occurred, the more basic the lessons become. In fact, one could say that it is simply all about going back to the basics by following four basic principles:

- Communication among all involved – early and frequent
- Adherence to established processes
- Planning
- Respect – internal and external to the certification team

We can spend many more hours digging into complex specific issues, but I believe had we kept these basic principles in mind, there would not have been a need for the hearing. Many people within the FAA and Eclipse worked very hard to certificate the EA 500 and did a fine job. Unfortunately, occasional breakdowns in these four basic principles led to inaccurate perceptions.

Can we prevent the types of breakdowns that occurred for future projects? The answer is a resounding "yes." But we must not lose sight of the basics. Certification is a complex process. Conflicts and technical challenges are quite common and should be expected. We can deal with it all by simply "Going Back to Basics."

~Ali Bahrami

On the Cover

In an issue that deals with aging airplanes and fuel tank safety, it is good to remember how far we have come in finding the causes of and solutions for accidents.

The photo on our cover is of a Wright Model B bi-plane flown by aviation pioneer George W. Beatty. Beatty started his flight instruction on June 24th, 1911, with Al Welsh, an aviator employed by the Wright brothers. Beatty soloed on July 23rd, 1911, and, on that same day, flew as a passenger with Welsh to establish a new American two-man altitude record of 1,860 feet. Less than a year later, on June 11, 1912, Welsh died while testing a Wright Model C with Lieutenant Leighton W. Hazelhurst, Jr., Seventeenth infantry, U.S.A. According to the *Chattanooga Daily Times* of June 12, 1912:

Welsh and Beatty

> *The accident occurred while they were attempting to make the test [a climb of 2,000 feet] required by the government in a machine contracted for by the war department. Although an army board was immediately appointed to determine the cause of the accident, it is probable the real cause of the machine's failure never will be known. The crash came so suddenly and unexpectedly that the two men met their death without being able to make a single move to arrest their fall. Seven army air men were among the score of spectators, but they can not explain the accident.*

Features

Fuel Tank Safety: Lowering the Risks Page 3
New rule reduces the chance of a catastrophic fuel tank explosion
by Jill Byington
Mike Collins, Mike Dostert, and Joe Jacobsen contributed to this article

A Proactive Approach to Rulemaking: The Aging Airplane Safety Program Page 6
Two decades ago the FAA began taking a more proactive approach to safety and started the Aging Airplane Safety Program
by Mina Mitchell
Steve Edgar, Dionne Palermo, Greg Schneider, Walter Sippel, Stephen Slotte, and Frank Tiangsing contributed to this article

Synthetic Vision (SV): Part II Page 10
Challenges, limitations, and certification
by Marcia Walters and Jill Byington
Loran Haworth, Lou Volchansky, Terry Stubblefield, and Dale Dunford contributed to this article

FAA Employees on Team Presented with a Stratospheric Ozone Protection Award Page 13
A team that included a Transport Airplane Directorate employee was presented with an award for its work to end reliance on halon in civil aircraft

Departments

From the Directorate Manager Page 1

On the Cover Page 1

TAD Regulatory Radar Page 14

Featured Web Site: Federal Rulemaking Page 15

On the Web

Aircraft Certification (AIR) Web Site

AIR Draft Docs. Open for Comment

FAA Flight Plan Quarterly Report

Federal Rulemaking Web Site

Regulatory and Guidance Library

Transport Airplane Directorate Web Site

Contact Us:

If there is a topic you would like to read about, if you would like to subscribe to the *Transport Certification Update*, or if you have a question or comment, please e-mail us:

9-ANM-TAD-Update@faa.gov

Transport Airplane Directorate (TAD)

Ali Bahrami, Manager ✈ Steve Boyd, Assistant Manager

Technical and Administrative Support Staff,
John V. Barrett, Manager

Manufacturing Inspection Office,
Linda Navarro, Manager

Transport Standards Staff,
Mike Kaszycki, Manager

Denver Aircraft Certification Office,
Ron May, Manager

Seattle Aircraft Certification Office,
Bob Breneman, Acting Manager

Los Angeles Aircraft Certification Office,
Kevin Hull, Manager

Fuel Tank Safety: Lowering the Risks

New rule reduces the chance of a catastrophic fuel tank explosion

After 12 years of work and a major technical breakthrough, the FAA recently published a final rule titled Reduction of Fuel Tank Flammability in Transport Category Airplanes (73 FR 42444, July 21, 2008). The rule:

> *amends FAA regulations that require operators and manufacturers of transport category airplanes to take steps that, in combination with other required actions, should greatly reduce the chances of a catastrophic fuel tank explosion.*

The impetus for this rule was the TWA flight 800 accident. The National Transportation Safety Board's (NTSB) accident report regarding TWA flight 800 determined the most likely source of that accident to be "an explosion of the center wing fuel tank (CWT), resulting from ignition of the flammable fuel/air mixture in the tank," and identified fuel tank flammability as a critical safety issue. The NTSB directed its safety recommendations to the FAA.

The compliance timelines for this final rule are on page 4 for type certificate holders, and on page 5 for design approval holders (DAHs) and operators.

Examining Flammability

Combustion, by definition, is the reaction of fuel vapor and oxygen when heated by an ignition source. However, after the TWA 800 accident, the aviation community began to question the then-prevailing notion that fuel tank safety is best approached by eliminating the ignition source. At the NTSB's recommendation, the FAA began to examine fuel tank flammability.

Flammable fuel vapor from jet fuel in air is a function of temperature and altitude. If the temperature is too low, not enough vapor is created for combustion. If the temperature is too high, too much vapor is created, which prevents combustion. The range between these two points is called the "flammability envelope." The size and position on the temperature/altitude curve of the flammability envelope is affected by the type of fuel, the oxygen content of the air, and the ignition energy. As the oxygen content of air is naturally reduced at higher altitudes, the size of the flammability envelope is reduced. To reduce flammability on the ground and at all altitudes, the FAA knew that the concentration of oxygen in fuel tanks at all altitudes would need to be reduced to a level that will not support combustion.

Two Working Groups

In 1998, the Aviation Rulemaking Advisory Committee (ARAC) Fuel Tank Harmonization Working Group (FTHWG) — a group of world-class experts in fuel tank flammability and airplane design — was assembled to target flammability in fuel tanks. The group concluded that unheated fuel tanks in conventional aluminum wings had an acceptable level of safety, but heated center wing tanks are far more likely to explode than wing tanks. The working group set a goal, according to its final report in July 1998, to "find a way to reduce flammability in all fuel tanks to the level of the wing tanks on most airplanes." They "considered several concepts that were determined to be insufficiently advanced

(Continued on page 4)

Immediate Actions: Airworthiness Directives and Special Federal Aviation Regulation (SFAR) 88

Following the TWA 800 accident, the FAA took immediate action to begin addressing fuel tank safety and has since published over 200 Airworthiness Directives (ADs) that have significantly improved fuel tank safety. These ADs identify and correct equipment and installations that have the potential to become ignition sources in a fuel tank. The ADs apply to most transport category airplane models and cover a range of issues, including pump manufacturing discrepancies, wire chafing, protection of the fuel quantity indication system, and overheating solenoids. Work continues on additional ADs that address fuel tank safety to make fuel tank safety significantly better than it was in 1996.

The FAA and industry conducted inspection programs to assess the conditions of the fuel systems in the fleet and developed maintenance programs based on those inspection results. The FAA also initiated work on an SFAR to review system design and certification, and maintenance practices. The result was included in a regulation titled "Transport Airplane Fuel Tank System Design Review, Flammability Reduction and Maintenance and Inspection Requirements" (66 FR 23086, May 7, 2001). In addition to new airworthiness standards for transport airplanes and new maintenance requirements, this rule included SFAR 88 (Amendment 21-78, and subsequent Amendments 21-82 and 21-83). The major requirements of SFAR 88 for certain type design holders are to substantiate that the fuel tank systems can prevent ignition sources in the fuel tanks, and to develop design changes if ignition sources are identified that meet specific criteria warranting corrective action via an AD.

(Continued from page 3)

technically at this time, for transport airplane fuel tank use. These included ullage sweeping [a ventilation system] and explosion suppression systems." The working group stated that techniques such as on-board fuel tank inerting or installation of foam in the tanks would also achieve the goal, but at a cost estimated to be at least $20 billion over the next ten years, and would be very difficult to retrofit in current airplanes. Among the group's recommendations was that the FAA "continue to investigate means to achieve a cost-effective reduction in flammability exposure for the in-service fleet and newly manufactured aircraft."

As a result of the FAA's continued research into inerting systems, a second ARAC working group, established in the year 2000, investigated potential inerting systems and recommended rulemaking. This second working group found that an on-board inerting system – a flammability reduction system that is not as robust as that required by the military – showed promise; however, the second working group judged such a system to be too heavy, complicated, unreliable, and costly. Not all members of the ARAC Executive Committee agreed with the recommendations in this second report and the Executive Committee forwarded the report to the FAA without taking a position on the report's recommendations.

Inerting system installed on Boeing Model 747SP test airplane.

Breakthrough

The inerting system might have rested there; however, before the ARAC report was forwarded to the FAA by the ARAC Executive Committee, a team of engineers, scientists, and technicians, including some industry representatives on the second ARAC group, began to challenge assumptions about inerting systems. By the Spring of 2002 they had designed, built, and tested a relatively simple dual-flow design for generating nitrogen-enriched air. They installed their system on a 747SP at the William J. Hughes Technical Center. (The 747SP was purchased by the Technical Center and was restricted for use only in ground-based testing, not for use in-flight testing.)

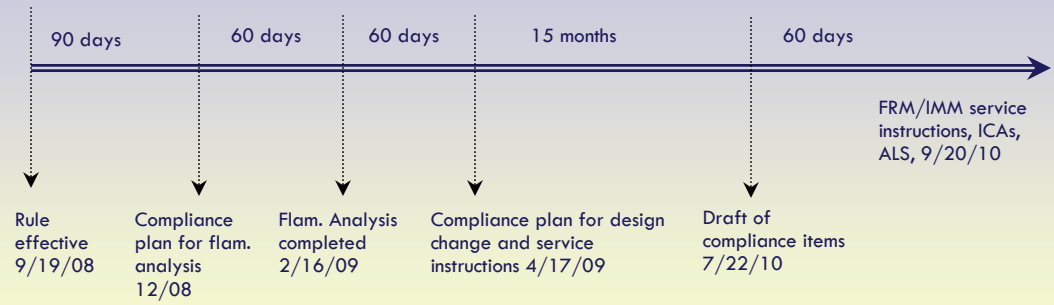
The system the team developed used engine bleed air that passes through an air separation module (ASM). The ASM separates air into two streams of nitrogen-enriched air (NEA) and oxygen-enriched air (OEA), which inerts the fuel tank with the NEA generated by the ASM and discharges OEA overboard. The system uses high-purity NEA at the low-flow rate during ascent and cruise and lower-purity NEA at the high-flow rate during descent. Experiments showed that if the tank was inert when the airplane landed, the fuel tank would continue to remain inert while the airplane was on the ground, which eliminated the need for ground operations to keep the tank inert.

Final Testing and Final Rule

The system was then installed on a NASA-owned

(Continued on page 5)

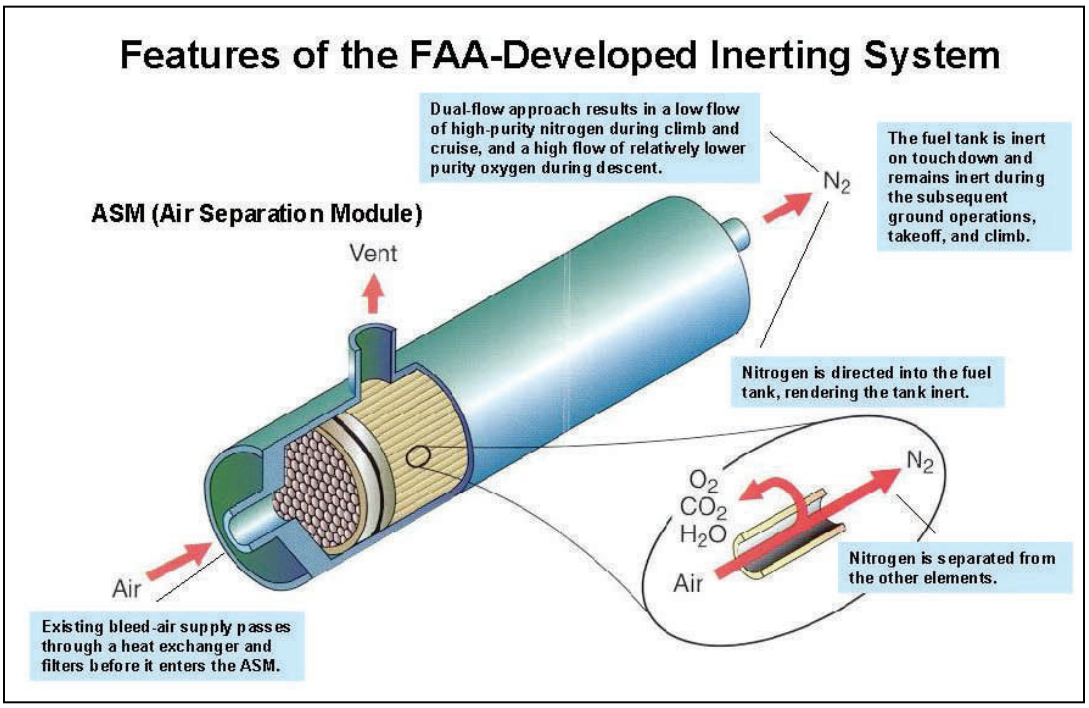
Compliance Timeline for Type Certificate Holders



(Continued from page 4)

Model 747SP airplane for ground and flight testing. The team subjected the system to several ground and flight test operations similar to that of a typical airplane operator. Later, in cooperation with Airbus, the system was installed on a Model A320 airplane for additional ground and flight testing. These tests proved that the inerting system is not only a simple and reliable design but also reduces the flammability of center wing tanks significantly.

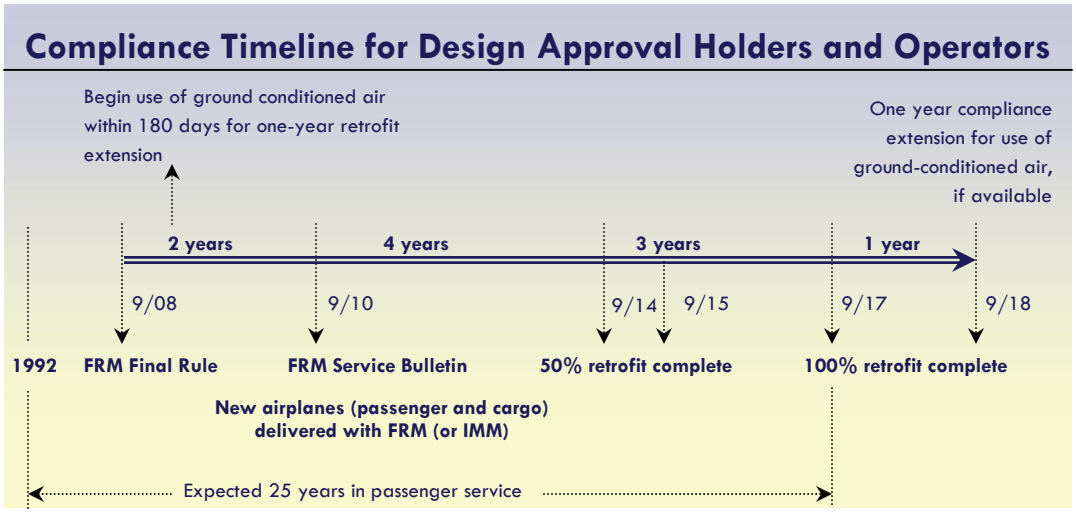
Boeing developed its own flammability reduction system based on the FAA design. Boeing installed the system on two Model 737 airplanes and two Model 747 airplanes for an extensive in-service evaluation during commercial operations. The evaluation put the systems through their paces and demonstrated that Boeing's adaptation of the FAA design was reliable. The Boeing design was the basis of the airworthiness requirements in the fuel tank safety rule.



The rule was first proposed in the Fall of 2005 and received over 100 comments. The FAA considered the comments, made necessary changes to the rule, and published the final rule on July 21, 2008, at nearly the twelfth anniversary of the TWA flight 800 accident.

Manufacturers of large transport category airplanes are required to do a study to determine their fuel tank fleet average flammability exposure. If the exposure is above a limit defined in the rule, the next step is to develop flammability reduction means or ignition mitigation means within the next two years. Operators would then have the following seven years to retrofit the solution, with half the fleet to be completed within four years. New airplanes with fuel tanks above the limit will have the solution installed in the factory within two years.

The FAA considers that the ultimate solution to fuel tank safety is a balanced approach that includes both ignition prevention and flammability reduction. As industry works toward using inerting systems or other methods to eliminate fuel tank flammability, we will continue to minimize potential ignition sources. ❖



If you have questions or comments about this article, please email us at: 9-ANM-TAD-Update@faa.gov

A Proactive Approach to Rulemaking

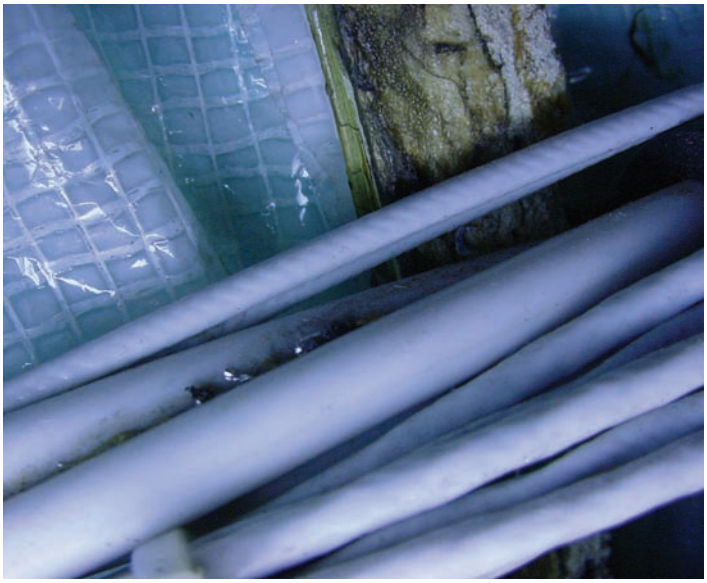
The Aging Airplane Safety Program

The objectives of the Aging Airplane Safety Program, as stated in the Aging Airplane Safety Final Rule (AASFR), are to:

- **Identify how to most effectively align rulemaking initiatives to ensure there are no overlapping or redundant requirements;**
- **Ensure that design approval holder data that support operator compliance are available and timely; and**
- **Ensure the resulting maintenance requirements allow operators to be more efficient in revising their maintenance programs when addressing multiple, similar initiatives.**

In 2007, about 800 million passengers traveled on U.S. commercial carriers, compared with 750 million passengers in 2005. Aviation experts say that during the year 2015, the number of U.S. passengers will be more than 1 billion. As our current fleet ages, new airplane models, such as the Boeing Model 787 and Airbus Model A380, are being built using innovative designs and ground-breaking technology. It is imperative that the FAA work together with industry to develop rules and guidance to ensure continued operational safety of both the new and aging fleet.

To that end, the FAA's Aging Airplane Safety Program, started in 1988 after the Aloha Airlines Boeing Model 737 accident, takes a proactive approach to rulemaking. That accident highlighted an industry-wide concern regarding the operation of airplanes beyond their initial design service goals. The requirements overseeing potential age-related issues like corrosion, widespread fatigue damage, and damage tolerance did not exist at the time for older airplanes.



The accumulation of debris, such as the metal shavings shown between the wires above, is one of the unsafe conditions addressed by EAPAS

The Aging Airplane Safety Act of 1991 requires that the FAA conduct inspections and records reviews for airplanes older than 14 years to ensure proper maintenance and condition for safe operation. Operators must demonstrate adequate and timely maintenance of age-sensitive parts and components. The initial objective of the Aging Airplane Safety Program was to maintain structural integrity through adequate inspection, modification, and maintenance of the aging airplane fleet.

Over the years, the Aging Airplane Safety Program expanded to include aging systems, and as a result, three significant rulemaking efforts emerged for transport category airplanes:

- Enhanced Airworthiness Program for Airplane Systems/Fuel Tank Safety (EAPAS/FTS).
- Widespread Fatigue Damage (WFD).
- Aging Airplane Safety Final Rule (AASFR).

EAPAS/FTS Final Rule

According to the EAPAS/FTS final rule, safety concerns about airplane wiring result from "a collection of common problems" that include

(Continued on page 7)

Links to rules discussed in this article

- Aging Airplane Safety Final Rule (AASFR), amendment Nos. 119-6, 121-284, 129-34, 135-81, and 183-11 (70 FR 5517, February 2, 2005). Final rule.
- Damage Tolerance Data for Repairs and Alterations, amendment Nos. 26-1, 121-337, and 129-44 (72 FR 70486, December 12, 2007). Final rule.
- Enhanced Airworthiness Program for Airplane Systems/Fuel Tank Safety (EAPAS/FTS), amendment Nos. 1-60, 21-90, 25-123, 26-0, 91-297, 121-336, 125-53, and 129-43 (72 FR 63363, November 8, 2007). Final rule.
- Widespread Fatigue Damage (WFD), (71 FR 19927, April 18, 2006). Proposed rule.

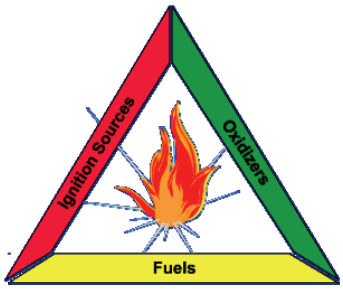
(Continued from page 6)

"deteriorated wiring, corrosion, improper wire installation and repairs, and contamination of wire bundles with metal shavings, dust, and fluids (which would provide fuel for fire)…." These conditions are common "in representative examples of the 'aging fleet of transport airplanes.'"

The problems EAPAS/FTS addresses include two of the three elements in the "fire triangle." The three elements are: oxygen, either heat or an ignition source, and fuel. The first element, oxygen, is always present. The second element, heat or ignition, can be created when wires are improperly installed or maintained; defective wiring from chafing and cracked insulation can cause an electrical short or arcing. The third element, fuel, includes dust, dirt, hydraulic fluid, fuel, and oil. All three elements are needed for a fire to occur.

To address the second and third elements of the fire triangle, the EAPAS/FTS final rule introduces "new maintenance inspection and design criteria for airplane wiring to address conditions that put transport airplanes at risk of wire failures, smoke, and fire."

The goal of EAPAS/FTS is to improve the design, installation, and maintenance of airplane electrical wiring systems and to align those requirements as closely as



Fuel vapor, air, and an ignition source form the "fire triangle."

possible with the requirements for fuel tank system safety. The alignment of EAPAS and FTS is crucial in limiting redundant tasks and undue disturbance of the electrical wiring interconnection systems (EWIS). If the system is unnecessarily aggravated due to excessive moving, pulling, and flexing of the wire bundles, stress on the system may lead to rapid wiring degradation and failures.

EAPAS/FTS addresses all EWIS on the airplane. The rule contains 73 new, revised, or renumbered regulations that include everything from certification requirements to operational requirements.

The EAPAS/FTS final rule requires, among other actions, that design approval holders develop EWIS Instructions for Continued Airworthiness (ICA), and also ensure that the EWIS ICA are compatible with ICA developed under the requirements of SFAR 88. The EWIS ICA are just one part of EAPAS.

Operators must incorporate ICA for wiring and fuel tank systems into their maintenance or inspection programs because airplane wiring is often inaccessible and, therefore, defects are difficult to detect.

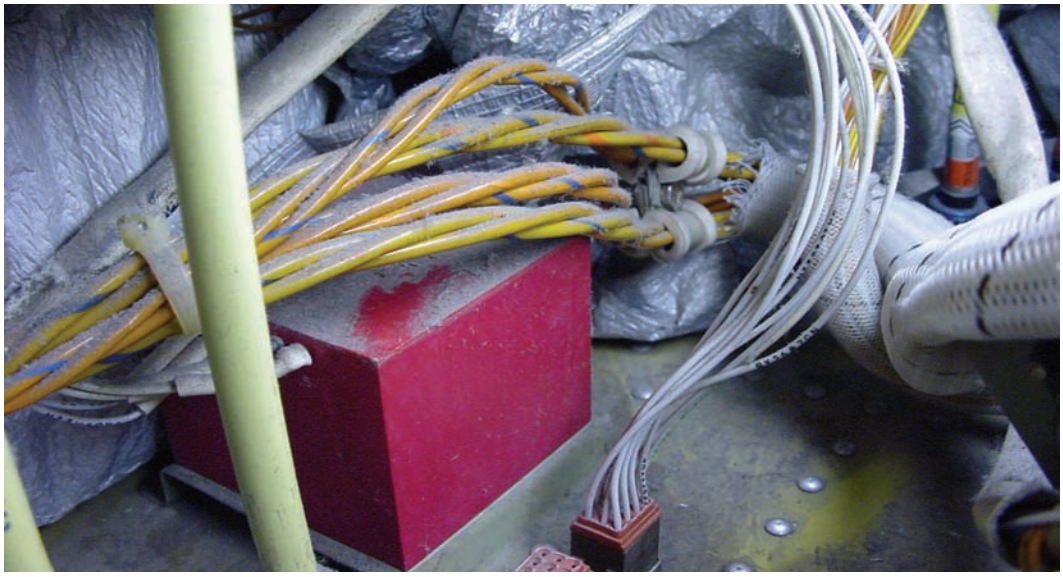
Widespread Fatigue Damage (WFD) Proposed Rule

During its service life, an airplane's fuselage structure is subject to fatigue damage when it is pressurized and depressurized during each flight. These repeated loads could cause cracks to develop in the structure. Over time, cracks could propagate, causing a failure before cracking is detected during an inspection. Often the cracks are too small to be reliably detected using current inspection methods.

Fatigue damage to metallic structure occurs when the structure is subjected to repeated loads, such as the pressurization and depressurization that occurs with every flight of an airplane.

As noted in the proposed rule "Aging Aircraft Program: Widespread Fatigue

(Continued on page 8)



Installations that allow wiring to chafe against other installations, as shown above, is another unsafe condition that could result in failure of the insulation on the wires to prevent arcs and sparks.

(Continued from page 7)

Damage," (link on page 6) WFD is the simultaneous presence of cracks at multiple structural locations that are sufficient in size and density such that the structure will no longer meet the residual strength requirements. The WFD proposed rule describes the problem this way:

> *The likelihood of WFD in airplane structure increases with use…. The simultaneous presence of fatigue cracks that may grow together, with or without other damage in the same structural element, such as a large skin panel, is known as multiple site damage. The simultaneous presence of fatigue cracks in similar adjacent structural elements, such as frames and stringers, is known as multiple element damage. Some structural elements can be susceptible to both types of damage, which potentially could occur at the same time. If undetected, either type of damage could lead to catastrophic failure due to reduction of the strength capability of the structure.*

The rule proposes to require certain actions to prevent WFD from occurring by proactively managing it. Design approval holders and applicants would be required to establish a "limit of validity" (LOV) of the engineering data that supports the maintenance program, and demonstrate that the airplane will be free from WFD up to the LOV. The proposed rule states that "[o]peration of an affected airplane beyond the operational limit would be prohibited, unless an operator has incorporated an extended operational limit and any necessary service information into its maintenance program."

More information about the final rule will follow in a later issue of the *Transport Certification Update*.

This frayed fuel pump wire is a possible ignition source.

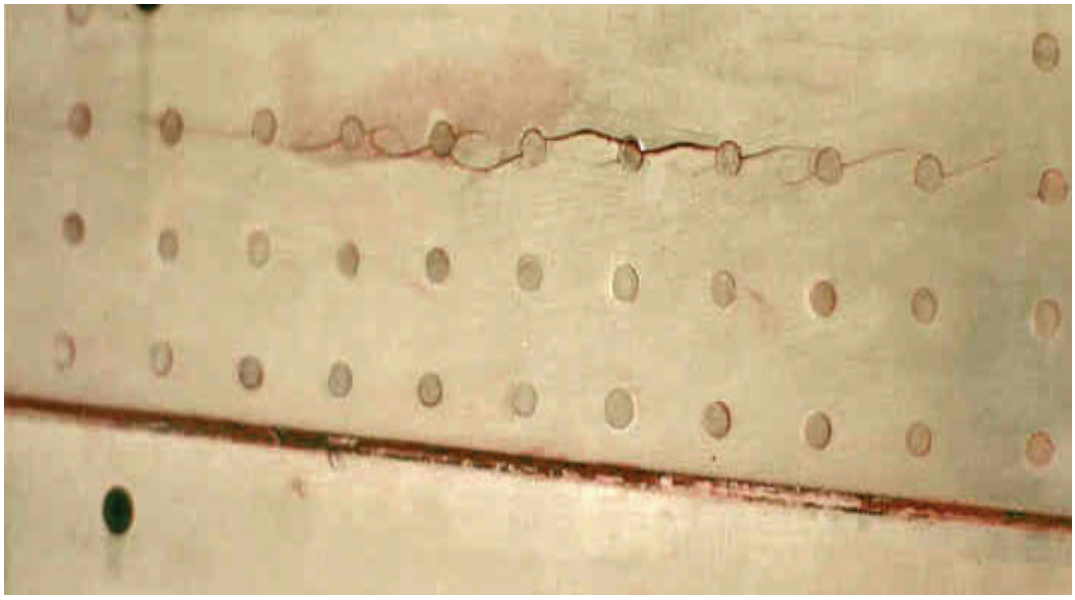
Aging Airplane Safety Final Rule

In response to the Aging Aircraft Act, which requires the FAA Administrator to initiate rulemaking, make inspections, and conduct reviews of maintenance records to ensure continued airworthiness of aging aircraft, the FAA issued the Aging Airplane Safety Final Rule (AASFR) on February 2, 2005 (link on page 6). The final rule requires repetitive inspections and records reviews every seven years for transport category airplanes older than 14 years. These actions ensure that the maintenance programs hold structure, skin, and other age-sensitive parts to the highest level of safety. Fatigue cracking is a significant issue as cracks, if not detected and repaired, can propagate and cause catastrophic failure of an airplane.

The AASFR has two aspects for ensuring the highest level of safety for age-sensitive parts and components:

1. Aging airplane inspections and records reviews. [14 CFR § 121.1105 (b) and (d)]. This section states that a certificate holder may not operate an airplane unless the FAA Administrator has notified the certificate

(Continued on page 9)



This photo shows multiple site damage, which is the simultaneous presence of fatigue cracks in the same structural element occurring about the same time.

(Continued from page 8)

holder that the FAA has completed the aging airplane inspections and records reviews; and that the certificate holder must make the airplane and records available to the FAA Administrator.

2. Supplemental inspections. [14 CFR § 121.1109 (c)(2)] This section requires that the maintenance program for the airplane include a means to address the adverse effects of repairs, alterations, and modifications on fatigue-critical structure and certain inspections. The compliance date for this section is December 20, 2010.

The Damage Tolerance Data for Repairs and Alterations Final Rule (link on page 6) supports operators in complying with the AASFR:

This final rule requires holders of design approvals to make available to operators damage tolerance data for repairs and alterations to fatigue-critical airplane structure. This rule will support operator compliance with the Aging Airplane Safety final rule with respect to the requirement to incorporate into the maintenance program, a means for addressing the adverse effects repairs and alterations may have on fatigue-critical structure. The intent of this final rule is to ensure the continued airworthiness of fatigue critical airplane structure by requiring design approval holders to support operator compliance with specified damage tolerance requirements.

The FAA places responsibility for identifying the fatigue-critical structure and the methods and frequency of the inspections on design approval holders, since they are the owners of the data and information for the affected airplanes. Without this requirement, operators might not have the necessary data to comply with the AASFR.

Moving Forward, Looking Ahead

The need for the Aging Airplane Safety Program became evident after investigators discovered that airplanes were operating beyond their original design service goals. The program emphasizes the importance of the continued operational safety of the entire fleet of U.S. airplanes. The main goals of the rules are to preserve the continued operational safety of aging airplanes by requiring structural modifications and inspections that address specific design discrepancies, and to establish operational limits on transport category airplanes. The rules include oversight of design, inspection, and maintenance of non-structural systems, such as electrical wiring and fuel tank safety.

By taking this proactive approach to rulemaking, the FAA is increasing its focus on research and development as a way to foresee and mitigate age-related problems before an unsafe condition occurs. ❖

If you have questions or comments about this article, please email us at: 9-ANM-TAD-Update@faa.gov

This year marks the FAA's golden anniversary. For more information, see the 50th Anniversary Web Site. The web site includes a 50-year timeline as well as a place for you to contribute your thoughts. Recent events included a 50th Anniversary Gala banquet, "Flying High at 50," held Thursday, October 30, at the William J. Hughes Technical Center.

Synthetic Vision (SV): Part II

Challenges, limitations, and certification

In the previous edition of the *Transport Certification Update*, we presented a description and brief history of this emerging technology as well as a discussion of Enhanced Flight Vision Systems. This article continues the description by presenting the challenges and limitations of SV as well as certification issues.

Challenges

Certificating SV systems has proven to be no small hurdle for industry and the FAA.

Challenge: Intended purpose. For the FAA to certificate any product, we must consider the product's intended function or purpose. Applicants for certification face the tough task of fully defining the intended purpose of the SV product so the FAA can determine whether the system's design is appropriate for that purpose. Applicants should plan to describe the intended purpose of the SV system with measurable values similar to those used to describe the intended purpose or purposes of required systems.

Someone who applies to certificate a product must present the product's intended purpose clearly and accurately with enough detail that it can be evaluated for compliance, using methods that are clear, repeatable, and consistent. In other words, an applicant must explain the function of the SV system, whether the system will be adequate for that function, and whether the system is reliable for that function.

It is difficult to define the intended purpose (function). For the SV products the FAA has reviewed, the intended purpose most often cited is situation awareness. "Situation awareness," broadly defined, is the process of acquiring the perception of the elements in the environment within a volume space, the comprehension of their meaning, and the projection of their status in the near future.

The words "situation awareness," though, are as difficult to measure and evaluate as the intended purpose of SV is to define. What is "awareness"? How much awareness is necessary? How do we know if the SV system provides the right level of awareness?

Another often-cited intended purpose is terrain awareness, which could be integrated with an approved (TSO-C151b) Terrain Awareness and Warning System (TAWS). The SV terrain might or might not be the same as the TAWS terrain since the two use different databases. In this case, the applicant must demonstrate terrain awareness that is consistent with the actual terrain, which applies both to SV and TAWS databases. Although terrain matching is certainly desired, there could be cases where the display does not exactly match the terrain. However, the display must not mislead the pilot.

Challenge: Database resolution. Other challenges for certification – such as how much database resolution is needed on the SV display, how pilots will use the terrain database information, and how the database will be updated – also depend on the SV product's intended purpose. Since a high-integrity terrain database is critical to the safe implementation of SV, the quality and integrity of the database should be in proportion with the product's intended purpose.

(Continued on page 11)

NASA Langley Research Center/Jeff Caplan

Researchers at NASA's Langley Research Center evaluated an integrated Synthetic Vision System flight deck technology in 2005 that included enhanced weather radar that can help pilots spot traffic and obstacles that are not part of the SV terrain computerized atlas.

(Continued from page 10)

SV systems in general will use aircraft position data that are integrated with a terrain database and then graphically generated (a graphics "processor") to provide a display to the pilot. Since terrain depiction (external scene topography) is a key feature of SV, another concern is whether terrain depiction is used only for general terrain awareness or also for maneuvering to avoid impact with the terrain. The FAA is also concerned with the effects and mitigating factors of system malfunction.

Challenge: Maintaining safety. For SV products, it is critical that the existing level of safety is maintained. Another challenge for the applicant is to show if the system, combined with the primary flight information, provides a level of safety at least as good as that on any conventional flight instruments the system would replace or supplement. In other words, the SV display should not reduce the effectiveness of the primary flight display (PFD) information that is required by regulations.

The terrain display on an SV-PFD system should not be hazardously misleading – a definite possibility unless the terrain depiction reflects a database with appropriate accuracy, resolution, and integrity commensurate with its intended purpose.

There is also potential for SV information to interfere visually with PFD information and affect the ability of the pilot to interpret the information he or she sees when looking at both the PFD and SV in the same view. The pilot must be able to separate and interpret information such as primary flight information when it is overlaid or combined with the dynamic graphics representing terrain, grid lines, and other information represented by the SV part of the display. Also, the SV-PFD configuration might not provide enough depth or field of view; for example the pilot might miss important information to the left and right of the display. The field of view will have to match the intended purpose.

Challenge: Standardization. Currently, each manufacturer can graphically display the outside world differently: colors and the meaning behind colors, obstacles, terrain, spacing, sizing, and the orientation of grid lines. The lack of standardization has resulted in variability in design of the SV system, and differing interpretations of policy guidance. Any pilot who changes from one SV system to another might have to re-learn system operation and symbology, which could affect safety.

Manufacturers, aircraft operators, and modification centers have requested industry standards. Approvals for these systems will be based on their intended purpose.

NASA Langley Research Center/Jeff Caplan

Researchers at NASA's Langley Research Center are evaluating whether lightweight headsets equipped with full-color display devices can be used to show pilots SV Systems information.

Limitations

Database integrity is not only one of the greatest challenges for certificating SV systems, it is also potentially one of SV's greatest limitations. Currently SV relies on a database of obstacles. Even the best database can have some limitations in accuracy or even have obstacles missing from the database. In addition, the SV database features on the PFD need to update at a rate sufficient for a smooth depiction of motion, which could be limited by the speed of the processor. All things considered, without a current, accurate database, an SV program's usefulness is limited.

While SV might create an awareness of the terrain, the ultimate effectiveness of any SV product is necessarily limited to its intended purpose, as described previously. The FAA has determined that an SV-PFD system adds to and alters the conventional intended functions of the PFD. While a PFD is essential, required equipment and information, SV is a supplemental component and must not compromise the intended function of any certificated feature of the PFD.

It is possible for SV to be so compelling that a pilot would tend to rely on it instead of charts or information provided by other flight deck systems. Using SV beyond its intended purpose certainly runs the risk of endangering the pilot and passengers.

There is a further concern that misleading altitude and distance estimations can result from cumulative input errors (from, for example, global positioning system [GPS] and the SV terrain database) or from the large-scale scene being "compressed" into a small display and distorting the scene. It is possible that the terrain picture would not have

(Continued on page 12)

(Continued from page 11)

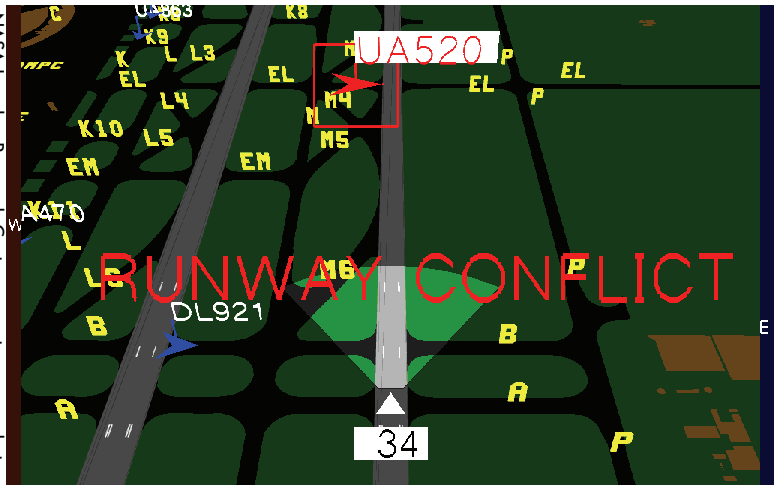
the same level of integrity as the instrument (flight path) information, and could adversely affect flightcrew decisions and actions.

Certification

The pace of change in technology presents significant challenges in the development of appropriate standards and compliance methods. Possible safety or operational benefits and risks are often unknown or speculative during the initial certification programs. The FAA's Advanced Displays Steering Group (ADSG) addresses the challenges of developing appropriate standards and compliance methods for new avionics technologies on flight deck displays.

The ADSG does not set certification policy or find compliance for advanced displays. Instead, ADSG members identify new and emerging technologies being developed by applicants. When that technology reaches "critical mass," the ADSG appoints a working group for that specific technology to monitor the progress of the technology, address certification and operations issues, and make strategic recommendations for policy development. The recommendations might include launching an RTCA committee or developing an Advisory Circular.

The RTCA and some relevant Advisory Circulars and other regulations that provide general guidance for



NASA Langley Research Center computer screen shot

According to NASA researchers, an integrated Synthetic Vision System would include information for pilots on the ground and in the air. It could include a Runway Incursion Prevention System that would show and sound an alert if a plane was in danger of colliding with another vehicle during airport surface operations.

certification are as follows:

Federal Aviation Regulation 25.1301(a). This regulation describes the criteria for the function and installation (intended function) of any equipment installed on a transport category airplane.

Federal Aviation Regulation 25.1309. This regulation describes the implications of equipment, systems, and installations on transport category airplanes.

Advisory Circular (AC) 25-11A. This AC provides general guidance for airplane and avionics manufacturers, modifiers, and operators of transport category airplanes for showing compliance with certain requirements of Title 14, Code of Federal Regulations (CFR), part 25 such as primary flight displays, as well as general guidance for the design, installation, integration, and approval of electronic flight deck displays, components, and systems installed in transport category airplanes.

AC 25.1309-1A. This AC describes guidance for the engineering and operations judgment that must form the basis for compliance findings.

AC 25.1329-1B. Approval of Flight Guidance Systems. This AC provides guidance on flight guidance systems, which can be used with synthetic vision systems.

RTCA SC-213. This special committee develops minimum aviation system performance standard (MASPS)-level guidance for Enhanced Vision Systems/Synthetic Vision Systems/Combined Vision Systems (EVS/SVS/CVS), and Enhanced Flight Vision Systems (EFVS) architectures to identify the intended operations and system architectures and enable development of minimum operational performance standards (MOPS) for appropriate system components.

The Future

The FAA and industry are working to find benefits SV offers over conventional flight instruments. What is the benefit? Does it decrease minimums? Will it provide the current level of safety or better?

The technology continues to progress rapidly as do FAA and industry efforts to certificate and make the best use of SV. Future editions of the *Transport Certification Update* will report on ongoing progress. ❖

If you have questions or comments about this article, please email us at: 9-ANM-TAD-Update@faa.gov

FAA Employees on Team Presented with a Stratospheric Ozone Protection Award

A team that included several FAA employees was presented with an award for its work to end reliance on halon for fire extinguishing in civil aircraft. The award was presented in Washington, DC on May 19, 2008. A halon is a bromine-containing compound with a long atmospheric lifetime whose breakdown in the stratosphere causes depletion of ozone. Halon is used in fire extinguishing systems in areas such as airplane lavatories and cargo holds. Steve Happenny of the Transport Airplane Directorate provided technical assistance on current applications of non-halon fire extinguishing systems on commercial transport category airplanes. Below is the Environmental Protection Agency's summary of the award.

The United States Environmental Protection Agency (EPA) founded the Ozone Layer Protection Awards in 1990 to recognize outstanding contributions to the protection of the Earth's stratospheric ozone layer. Since then, 533 individuals, companies, organizations, and teams from 49 countries have earned this honor. This year's recipients have demonstrated originality and public purpose, persuasive moral and organizational leadership, and elimination of emissions of ozone-depleting substances. The winners are from Argentina, Australia, Bahrain, China, Fiji, Italy, India, Japan, Kuwait, Lebanon, Mauritius, Netherlands, Sri Lanka, Sweden, Thailand, and the United States. EPA's Ozone Layer Protection Awards are particularly prestigious because nominees compete globally against the notable accomplishments of many other potential winners, and winners are selected using previous winners as judges.

The Civil Aviation Halon Transition Team's effort ensures an end to reliance on halon in civil aircraft. Concerned that uncertainties in availability and quality of halon, worldwide aircraft production growth, and lag in adoption of substitutes may leave the civil aviation sector unprepared, the United Nations Environment Programme (UNEP) Ozone Secretariat and the International Civil Aviation Organization (ICAO) Secretary General inspired team members to go before the ICAO General Assembly to request they approve a mandate that halon alternatives be introduced within the next few years. Duncan Monaco, ICAO, was able to persuasively raise the urgency of this as an agenda item for the ICAO Assembly, moving consideration of the issue from 2010 to 2007. With ICAO support, Jennifer Arquilla and Lauren Inman from the U.S. Federal Aviation Administration (FAA), the UNEP Halons Technical Options Committee, and the U.S. Environmental Protection Agency developed a U.S. Working Paper for the Assembly. The Paper's recommendations, which the Assembly adopted, address the use of halon alternatives for new aircraft designs and for those already in production. This was made possible by validation testing of halon alternatives against new standards under the leadership of the FAA's Technical Center. In accordance with the Assembly resolution, ICAO is making changes to its Standards and Recommended Practices to require halon alternatives in lavatories and hand-held extinguishers for new production aircraft and in new designs, and for engine nacelles and auxiliary power units in new designs. This effort places the aviation industry with other halon users who overcame significant technical challenges in the search for alternatives that protect the public and the environment. ❖

Source: http://www.epa.gov/ozone/awards/

ICAO Working Paper on this subject: http://www.icao.int/icao/en/assembl/a36/wp/wp207_en.pdf

Team Members:

Mr. Marco González, Executive Director, United Nations Environment Programme (UNEP) Ozone Secretariat
Dr. Taïb Chérif, Secretary General, ICAO
Mr. J. Duncan Monaco, Secretariat, ICAO
Mrs. Nagwa el Aasar, Former Secretary of the Airworthiness Panel (retired), ICAO
Mr. David V. Catchpole, Co-Chair, UNEP Halons Technical Options Committee
Dr. Daniel P. Verdonik, Co-Chair, UNEP Halons Technical Options Committee
Mr. Thomas A Cortina, Expert Advisor, UNEP Halons Technical Options Committee
Ms. Bella Maranion, Member, UNEP Halons Technical Options Committee
Mr. Andrew B. Steinberg, Formerly Assistant Secretary for Aviation and International Affairs, U.S. Department of Transportation (DOT)
Mr. Nicholas A. Sabatini, Associate Administrator for Aviation Safety, FAA
Mr. John Hickey, Director, Aircraft Certification, FAA
Ms. Jennifer Arquilla, International Policy Office, Aircraft Certification, FAA
Ms. Lauren Inman, Formerly of the International Policy Office, Aircraft Certification, FAA
Mr. Stephen Happenny, Transport Airplane Directorate, Aircraft Certification, FAA
Mr. Richard Hill & Mr. Constantine (Gus) Sarkos, Aviation Research & Technology Development Office, Airport and Aircraft Safety Group, FAA Technical Center
Mr. James Filippatos, Assistant Administrator for International Aviation, FAA

Transport Airplane Directorate (TAD) Regulatory Radar

Current Rulemaking

The following rulemaking actions have been published in the *Federal Register* since the last issue of the *Transport Certification Update*. For full text of these and other actions see: regulations.gov.

Final Rules:

Revisions to Cockpit Voice Recorder and Digital Flight Data Recorder Regulations. Docket No. FAA-2005-20245; Final Rule (FR) issued 02/19/08. Amendment Nos. 23-58, 25-124, 27-43, 29-50, 91-300, 121-338, 125-54, 129-45, and 135-113.

This final rule amends cockpit voice recorder (CVR) and digital flight data recorder (DFDR) regulations affecting certain air carriers, operators, and aircraft manufacturers. This final rule increases the duration of certain CVR recordings, increases the data recording rate for certain DFDR parameters, requires physical separation of the DFDR and CVR, improves the reliability of the power supplies to both the CVR and DFDR, and requires that certain datalink communications received on an aircraft be recorded if datalink communication equipment is installed. These changes to CVR and DFDR systems are intended to improve the quality and quantity of information recorded, and increase the potential for retaining important information needed for accident and incident investigations.

Reduction of Fuel Tank Flammability in Transport Category Airplanes. Docket No. FAA-2005-22997; FR issued 07/09/08. Amendment Nos. 25-125, 26-2, 121-340, 125-55, and 129-46.

This final rule amends FAA regulations that requires operators and manufacturers of transport category airplanes to take steps that, in combination with other required actions, should greatly reduce the chances of a catastrophic fuel tank explosion. The final rule does not direct the adoption of specific inerting technology either by manufacturers or operators, but establishes a performance-based set of requirements that set acceptable flammability exposure values in tanks most prone to explosion or require the installation of an ignition mitigation means in an affected fuel tank. ❖

Advisory Circulars (ACs) and Policy

The following final and draft ACs and Policies have been issued. For full text see: http://www.faa.gov/aircraft/draft_docs.

Part 25 Final AC issued:

The following AC was issued on 07/29/2008:

AC 25.856-2A, Installation of Thermal/Acoustic Insulation for Burnthrough Protection. We revised the AC to update acceptable methods of compliance and add criteria for an alternative test burner.

Part 25 Final Policies issued:

Clarification of Maximum Payload Capacity Definition in Design Approval Holder (DAH) Rules.

ANM-08-113-00I, issued September 12, 2008. This policy memorandum clarifies the maximum payload capacity criterion when used with regard to several DAH rules and their corresponding operational rules.

Part 25 Draft ACs issued:

No new draft ACs have been issued since the last edition of the *Update*.

Part 25 Draft Policy issued:

Policy Statement on Access to and Opening of Type III and IV Exits on Airplanes with Passenger Seating Capacities of 19 or Fewer.

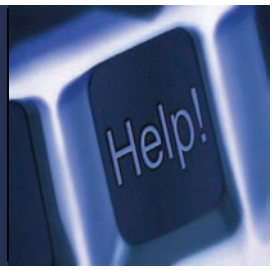
The public comment period closed on 05/27/08. This draft policy memorandum clarifies the conditions for which access to Type II and IV exits must be evaluated.

Policy Statement on the Certification of Flight Management Systems (FMS) that Include Takeoff or Approach Reference Speed Calculations.

The public comment period closed on 04/13/08. This draft policy memorandum establishes guidance for the airworthiness approval of flight management systems (FMS) that include takeoff or approach reference speed calculations. ❖

If you have questions or comments about the regulatory radar, please email us at; 9-ANM-TAD-Update@faa.gov

Featured Web Site: Federal Rulemaking



From the web site: "Regulations.gov is your source for all regulations (or rulemakings) issued by U.S. government agencies. *Regulations.gov* includes regulations that are open for public comment (i.e., proposed) and closed for comment (i.e., final). . . . *Regulations.gov* is therefore your one-stop source to find and view all Federal regulations and related materials. Through *Regulations.gov* you may also comment on proposed regulations open for comment and related documents."

U.S. Department of Transportation
Federal Aviation Administration

Transport Airplane Directorate,
1601 Lind Avenue SW,
Renton, WA 98057-3356

Produced by:
Airworthiness and Technical Communications Branch, ANM-114, Transport Airplane Directorate

Editor-in-chief: Jill Byington

Email:
9-ANM-TAD-Update@faa.gov

Phone: 425-227-1047

Contributing writers: Jill Byington, Meghan Gordon, Mina Mitchell, Marcia Walters

Editors: James Johnson, Mina Mitchell, Rose Opland, Cristina Peterson, Marcia Walters, Andrea Zachary

We welcome comments and questions. We might edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses might not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Send letters to the address above or e-mails to: 9-ANM-TAD-Update@faa.gov

NOTE: The links in the *Transport Certification Update* are current at the time of publication, but they are subject to change at any time. The target documents may be moved to another location, or the links may not remain active due to other factors beyond our control. We regret any inconvenience this may cause.

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