# AIRWORTHINESS DIRECTIVE 2006–15–15

## Process Review Technical Report

A review of the development, implementation, and compliance determinations associated with AD 2006–15–15

**June 3, 2009**

*Prepared for*
**FAA Acting Administrator**
**FAA Headquarters**
**Washington, DC**

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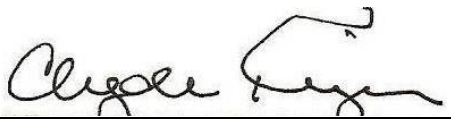

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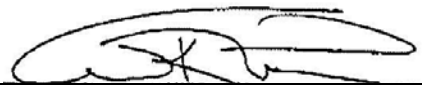

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— Photograph on the cover of airplane wiring provided by the Federal Aviation Administration.

— Photograph on the cover of MD80 airplane provided by and used with permission from Galen Burrows.

# 1.0 INTRODUCTION TO THIS TASK

## 1.1 AD Compliance Review Team Task

The Federal Aviation Administration (FAA) Acting Administrator Robert A. Sturgell created the Airworthiness Directive (AD) Compliance Review Team (Team) and tasked it to—

- Study the development, implementation, and FAA compliance determinations of AD 2006–15–15[1], Airworthiness Directives; McDonnell Douglas Model DC–9–81 (MD–81), DC–9–82 (MD–82), DC–9–83, DC–9–87 (MD–87), and MD–88 airplanes (task 1), and
- Review the development and implementation of ADs and recommend improvements to the overall AD process (task 2).

The tasking by the Administrator arose, at least in part, out of the removal of aircraft from service by several airlines; however, the Administrator did not ask the Team to evaluate the appropriateness of those removals from service. Accordingly, this report should not be construed or interpreted as an opinion or evaluation of that situation by the Team.

The Team also believes it is important to reiterate that the FAA does not expect its aviation safety inspectors (ASI) to conduct a risk assessment before taking action on AD noncompliance of an airplane. However, in coordination with the appropriate aircraft certification office (ACO) and Aircraft Evaluation Group (AEG), they should use their professional judgment in determining whether the workmanship and configuration of a particular "fix" complies with the AD. Our position mirrors the assessment by the Independent Review Team[2] appointed by the Secretary of Transportation on May 1, 2008.

This report covers the Team's findings and recommendations under task 1.

## 1.2 AD Compliance Review Team Composition and Activity

The Team is composed of the following:

- FAA Flight Standards Service personnel;
- FAA Aircraft Certification Service personnel;
- Industry representatives from air carriers, airline associations, and the airplane original equipment manufacturer (OEM); and
- Independent aviation subject matter experts.

[1] The AD requires part 121 of Title 14, Code of Federal Regulations, operators (air carriers) to conduct a one-time inspection for chafing or signs of arcing of a wire bundle for the auxiliary hydraulic pump and install flexible sleeving and wraps over certain portions of the auxiliary hydraulic pump wire assembly, and hard sleeving over other portions.

[2] On April 18, 2008, the U.S. Secretary of Transportation tasked the Independent Review Team to evaluate the FAA's implementation of the aviation safety system and its culture of safety, and to develop recommendations for improvements.

The Team held its first meeting April 29 and 30, 2008, at FAA Headquarters in Washington, DC, to discuss AD 2006–15–15. During the meeting, the Team heard presentations from representatives of four U.S. air carriers that operate MD–80 series airplanes. Each air carrier detailed the problems it encountered in demonstrating compliance with AD 2006–15–15. Representatives from the FAA certificate management offices (CMO) with safety oversight responsibility for each air carrier also participated in each air carrier's presentation and discussions.

The Team met again May 20 through 22, 2008, at Boeing Longacres in Renton, Washington, to continue its analysis and further develop findings and recommendations for this report. During that meeting, the Team also met with members of the Independent Review Team to discuss each team's tasking. The Team met a final time June 18, 2008, at FAA Headquarters to finalize the contents of this report.

In addition, the Team participated in a number of teleconferences during the drafting of this report.

During its review, the Team assessed difficulties associated with implementing AD 2006–15–15, including the following:

- The clarity of the AD and the service bulletin (SB) mandated by the AD.
- The processes used by the OEM, air carriers, and the FAA to develop the SB and AD.
- Communication and coordination among the OEM, the ACO, air carriers, and the CMO after compliance issues surfaced during the FAA special emphasis validation of AD 2006–15–15.

Based on its review, the Team developed findings and recommendations to improve the development, implementation, and compliance determinations of ADs. The Team will conduct a detailed review of the entire AD development process as task 2 of this project.

## 1.3 Scope of This Report

This report is divided into seven major sections. This section discusses the Team's tasking and composition. Section 2.0 discusses information on AD requirements, the relationship between air carriers and the FAA, the FAA AD audits, the history of AD 2006–15–15, and the atmosphere in the aviation industry surrounding the FAA audits conducted after the removal of numerous aircraft from service. Section 3.0 describes the classes and categories of findings the Team used to analyze the air carriers' compliance with AD 2006–15–15. Section 4.0 discusses the five major findings areas and section 5.0 presents the Team's specific findings. Section 6.0 contains the Team's recommendations regarding those findings. Finally, section 7.0 presents the Team's overall conclusions regarding compliance with AD 2006–15–15.

This report also contains appendixes that contain administrative information, such as a list of acronyms and definitions related to this report. The appendixes also offer a summary of the Team's recommendations, detailed historical information, and metrics that indicate the scope of managing ADs throughout the U.S. commercial aviation industry.

# 2.0 BACKGROUND

## 2.1 AD Requirements

### *2.1.1 Definition of an AD*

Part 39 of Title 14, Code of Federal Regulations (14 CFR) provides that the FAA issue an AD for a product when it finds that an unsafe condition exists in the product and the condition is likely to exist or develop in other products of the same type design.[3] As a result, an AD amends and becomes a part of the airplane type design. The regulations further state that anyone who operates a product that does not meet the requirements of an applicable AD is in violation of § 39.7[4] each time it operates the airplane or uses the product. Compliance with an AD is the responsibility of the affected air carrier, and any violation of an AD subjects that air carrier to certificate action by the FAA.[5]

Each AD specifies a compliance period by which time the air carrier must accomplish the corrective action for the unsafe condition. The OEMs and the FAA establish these compliance periods based on risk management methods.

### *2.1.2 Alternative Method of Compliance*

The regulations also provide a process whereby air carriers can request FAA approval for an alternative method of compliance (AMOC) to an AD.[6] AMOCs are requested and granted to authorize deviation from the specifications of ADs, provided the FAA finds an acceptable level of safety is maintained. Examples include the following:

- Different parts, procedures, or service instructions;
- Procedures that negate errors in service instructions; and
- Extended compliance deadlines.

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[3] See appendix B to this report for the definition of type design.

[4] Section 39.7, What is the legal effect of failing to comply with an airworthiness directive?

[5] 14 CFR 13.19 states, in pertinent part, that the Administrator may reinspect any civil aircraft, aircraft engine, propeller, or appliance and suspend or revoke any Certificate of Aircraft Registration for any cause that renders that aircraft ineligible for registration. In addition, if the Administrator determines that the public interest and safety in air commerce requires it, he or she may issue an order amending, suspending, or revoking, all or part of any type certificate, production certificate, airworthiness certificate, or air carrier operating certificate.

[6] To request an AMOC, an air carrier submits a proposal to its aviation safety inspector (ASI). The ASI may make comments and then forwards the request to the designated official, typically the manager of the cognizant ACO. The air carrier also may send a copy of the proposal to the designated official and its ASI simultaneously. Requests to change the compliance period of an AD must show that the change would provide an acceptable level of safety. An air carrier may use an AMOC only after the FAA official designated in the AD finds that the proposal provides an acceptable level of safety and grants approval. The regulatory language of each AD identifies the individual who has authority to approve AMOCs to the AD; typically the manager of the ACO that issued the AD. An AD also may specify that an AMOC may be approved by an authorized representative (AR) of the manufacturer's Delegation Option Authorization organization who has been specifically authorized by the ACO manager to approve AMOCs. AR authorizations are limited to the requesting air carrier's airplanes. The FAA often designates ARs to approve AMOCs to ADs on airplane structures, but in practice, does not designate ARs for ADs on wiring and other systems. AD 2006–15–15 was not delegated and could only be approved by the manager of the Los Angeles Aircraft Certification Office (LAACO).

The AMOC, by regulation, typically must be requested and approved before the compliance deadline. An AMOC can be applicable to a single airplane or a fleet of airplanes for a single model (usually requested by an air carrier), or can be a global AMOC applicable to the entire fleet of that model (usually requested by the OEM). Although AMOCs are issued before the AD compliance date, the AMOC can be issued after the compliance date if the air carrier finds that they inadvertently deviated from the requirements of the AD. In such cases, that does not relieve the air carrier of its regulatory responsibility up to the time the AMOC is issued.

### *2.1.3 Incorporation by Reference of an SB*

The regulations state that an AD may incorporate by reference an OEM's SB. In these cases, the SB becomes part of the AD. In some cases, the specifications in the AD differ from those in the SB or those in the air carrier's standard maintenance practices. In either case, the specification of the AD must take precedence.

### *2.1.4 AD Management*

Air carriers, OEMs, and the FAA expend considerable effort to ensure the continuous airworthiness of airplanes through ADs and other processes. Appendix E lists metrics[7] that indicate the scope of managing ADs throughout the U.S. commercial aviation industry.

## 2.2 Improved Aviation Safety — Evolution of the Air Carrier and FAA Relationship

For many years the FAA's typical approach toward oversight included inspection for compliance and strict enforcement action for noncompliance. Limited structured collaboration and communication between the FAA and industry existed outside the realm of enforcement. Moreover, there was a lack of integrated safety agendas among the FAA, air carriers, and OEMs that created inefficiencies in addressing safety initiatives.[8]

In the late 1980s the FAA initiated the voluntary disclosure reporting program. This process created an environment whereby air carriers and the FAA collaborated with more transparency to achieve safety results without the fear of unnecessary punitive measures. The result was improved communication, information sharing, and ultimately improved safety in the skies.

In 1997 the National Civil Aviation Review Commission (NCARC) made further recommendations on collaboration to improve aviation safety, including the following:

- The need to implement self-audit and self-disclosure programs within aviation companies.
- The protection and sharing of safety information in nonpunitive ways.
- A willingness in Government and industry to invest in new ways of doing business.

[7] Over 95 percent of the metrics apply to commercial airplanes over 75,000 lb maximum takeoff weight.
[8] From the National Civil Aviation Review Commission chartered in 1996.

The NCARC recommended changes in the traditional regulatory relationship so that tools beyond the simple enforcement of rules would be available to improve safety. As a result of these recommendations, in 1997 representatives from nearly all entities in the commercial aviation business created the Commercial Aviation Safety Team (CAST). CAST set about establishing a framework of collaboration in matters of commercial aviation safety, with the expressed goal of reducing the commercial aviation fatal accident rate by 80 percent by 2007. The unofficial fatal accident rate in 2007 shows an approximate reduction of 65 percent from the 1997 level.

During that time, Government and industry were able to implement several significant safety and security initiatives. For example, a fleetwide introduction of terrain awareness and warning systems to prevent controlled flight into terrain accidents; and rapid design, certification, manufacture, and installation of reinforced cockpit doors for the entire U.S. commercial aviation fleet following the events of September 11, 2001. These initiatives demonstrate the critical importance and value of collaboration between Government and industry in improving safety.

In recent times ASIs typically have developed a constructive working relationship with their air carriers. As issues develop, that relationship is often used to diffuse contentious issues through very open and collaborative communications. That is not to say the ASI is without his or her normal enforcement tools, but that the better working relationship can often resolve issues through open communication before enforcement becomes necessary. Lack of communication is often at the root of disagreements, and close cooperation serves to mitigate that outcome.

In areas of AD compliance, ASIs have the authority, and have used it in accordance with their experience level, to ascertain whether compliance is evident. If it is not evident, they have appropriately worked with the ACO to make a compliance determination. This is not to suggest ASIs have any flexibility to allow air carriers to operate airplanes when noncompliance has been determined; they do not. The point is, until now, ASIs had worked closely in an open environment with their air carriers in reviewing compliance. In cases where compliance might not be obvious, ASIs and air carriers work together to seek a determination or an AMOC.

There is no question within the FAA that ASIs possess the legal authority to exercise professional judgment in determining noncompliance. In fact, the Team consulted with the FAA Office of the Chief Counsel, and received specific concurrence on this point from the Acting Chief Counsel, with the express understanding that his concurrence would be noted in this report.

## 2.3 Special Emphasis Validation of AD Oversight

In early March 2008, events involving one air carrier's highly publicized noncompliance with a structural AD compelled the FAA to audit air carriers' compliance with ADs to verify that this was not a widespread issue. In addition, Congress[9] scheduled hearings for April 3, 2008, to investigate why the FAA allowed that air carrier to continue to fly airplanes that should have been grounded for maintenance and inspection.

On March 13, 2008, FAA's Director of the Flight Standards Service issued Notice N 8900.36, Special Emphasis Validation of Airworthiness Directives Oversight.[10] Phase I of the notice, which concluded March 28, 2008, instructed ASIs with oversight responsibility for air carriers to—

- Identify 10 ADs applicable to each fleet of airplanes, by model, used by each air carrier.
- Inspect the appropriate management records and work instructions to determine whether the air carrier had complied with the ADs.
- Examine the complete work package for at least one airplane for each of the ADs selected.

Under phase II of the notice, ASIs were instructed to complete a performance assessment of the air carrier using Air Transportation Oversight System (ATOS) Element Performance Inspection (EPI) 1.3.6, AD Management.[11] To complete this performance assessment, ASIs were instructed to review 10 percent of the ADs applicable to each fleet used by the air carrier. Those ADs already reviewed in phase I counted toward the total of 10 percent. The notice required that the phase II performance assessments be completed by June 30, 2008.

## 2.4 History of AD 2006–15–15

Several cases of arcing in the wheel well of MD–80 series airplanes in the 1980s prompted the initial SB that led to AD 2006–15–15. AD 2006–15–15 evolved from several SBs and SB revisions, a notice of proposed rulemaking (NPRM), and two SNPRMs over a 20-year period. (See appendix C to this report for a complete history of the development of the AD.)

[9] Specifically, the Transportation and Infrastructure Committee.
[10] The purpose of this notice was to direct an audit of part 121 air carrier compliance with ADs.
[11] A copy of ATOS EPI 1.3.6, AD Management, can be obtained at http://www.faa.gov/safety/programs_initiatives/oversight/atos/library/data_collection/sets/.

## 2.5 Environment During the Special AD Verification

The working environment that existed in the FAA and the air carrier industry before the start of the special AD verification was dramatically altered by the following events:

- A noncompliance with a structural AD by an air carrier;
- Statements from Congressional leaders and associated widespread media coverage of the structural AD noncompliance;
- Congressional hearings; and
- The subsequent discovery of actual and potential compliance problems related to AD 2006–15–15 at other air carriers.

These events resulted in a highly charged environment, with actual and perceived pressures from organizations and individuals within and outside the aviation community. Air carrier and FAA personnel who participated in this AD review expressed to the Team that they believed the collaborative approach of the FAA and the industry to resolve issues without jeopardizing safety while also minimizing the interruptions to air service was no longer an option. Instead, the "crisis" environment placed a very high level of pressure on FAA and air carrier personnel so that, in many cases, the well-established traditional authority of an ASI to use professional judgment to determine whether a noncompliance had occurred was supplanted with an overly conservative response.

The interference with the normal deliberative process typically used by the industry was created by often misleading and sometimes exaggerated treatment of the issues in the news media. There were numerous articles from one independent news service between March 26, 2008, and April 24, 2008, on the MD–80 series airplanes wiring problem. In some cases, there were several reports per day. That does not include the discussion of the problem on the 24-hour news channels, on network news, internet blogs, and in national newspapers. The charged environment created by an air carrier's noncompliance with a structural AD and those similar events that followed, and the subsequent media attention, fueled ASI and air carrier fears that imminent action was needed to verify AD compliance to the broader U.S. commercial aviation fleet.

The congressional hearings and intensity of media activities related to AD compliance were concentrated during a relatively short, but critical, period of time with respect to the special verification of AD 2006–15–15. It appears that the tempo of technical developments, in combination with the environmental pressures, exceeded the capabilities of established industry communications, coordination, and technical decisionmaking processes.

# 3.0 General Classes of ADs and Categories of Findings

## 3.1 General Classes of ADs

During its review, the Team determined that ADs broadly fall into two major classes, which the Team named and designated as class 1 and class 2 as follows:

- *Class 1*: This type of AD requires a configuration change that easily can be controlled by normal air carrier processes after implementation. This class includes the following:
  - Component modifications that an air carrier can control through its materials management and receiving inspection processes to prevent demodification.
  - Structural modifications that are controlled through structural repair manuals and the air carrier's engineering approval processes.
  - Configuration changes clearly identified in an illustrated parts catalog (IPC) or other manual.
- *Class 2*: This type of AD requires a configuration change that, after implementation, potentially has a higher opportunity than class 1 ADs for being undone through the air carrier's standard maintenance practices or operations. This class of ADs includes requirements for maintenance tasks that are either more specific than or different from those described in an air carrier's standard maintenance program. Unless otherwise directed, maintenance technicians working in the vicinity of these installations anytime after the AD is implemented would typically employ standard maintenance practices, which raises the risk of inadvertently taking the airplane out of compliance with elements of the AD.

Note: The Team categorized AD 2006–15–15 as a class 2 AD.

## 3.2 Categories of Findings

Team discussions with the air carriers revealed that during the special emphasis validation of AD management, there were various levels of confusion concerning the process of determining AD compliance. During the FAA's initial review process at the air carriers, the ASIs were investigating AD record compliance. However, as the special emphasis validation of AD 2006–15–15 progressed, some ASIs determined that if there were any deviations from the SB, the airplanes were deemed noncompliant; that determination did not include ACO consultation. The air carrier perceived there was no other option but to remove those airplanes from service. During task 2 (review of the AD development process), the Team will present an initial compliance decisionmaking flowchart as an example to assist ASIs during the compliance decisionmaking process.

To better assist the Team in making its findings and recommendations during this task, the Team created five scenarios[12] for which compliance was, or was not, satisfactorily demonstrated during the special AD validation. The following categories and their descriptions reflect findings from the special AD validation in general or of AD 2006–15–15 specifically.

***Category 1: Missed compliance.***
An air carrier did not comply with the instructions of the AD in any form within the schedule of the AD.

**Outcome—noncompliance**. The airplane is removed from revenue service and the air carrier must comply with the AD.

***Category 2: Unacceptable compliance demonstration.***
An air carrier attempted to comply with the AD, but the work was incomplete or unacceptable in satisfying the intent of the AD.

**Outcome—noncompliance**. The airplane is removed from revenue service and the air carrier must comply with the AD.

***Category 3: Alternative method of compliance.***
An air carrier attempted to comply with the AD, but accomplished work that did not conform to the detailed specifications of the AD. The FAA subsequently found the work met the safety intent of the AD and issued an AMOC. An issue in this category may or may not have required revision of the work accomplished to comply with the AD. It is important to note that airplanes in this category did not operate in accordance with the AD from March 5, 2008, to the date the AMOC was received.

**Outcome—late compliance.** The airplane can operate after issuance of an AMOC and completion of any required rework; before that, the airplane is removed from revenue service.

***Category 4: Compliance demonstrated, but later undone.***
An air carrier complied with the AD and maintenance records showed AD compliance. However, through normal operation and/or maintenance action after compliance, a requirement of the AD was inadvertently undone, and the FAA found the airplane out of compliance.

**Outcome—noncompliance**. The airplane can operate after issuance of an AMOC and completion of any required rework; before that, the airplane is removed from revenue service.

[12] These scenarios have no official standing in the regulations or the FAA enforcement program. They were created by the Team only to facilitate a better understanding of the events involving AD 2006–15–15.

*Category 5: Compliance demonstrated, with or without trivial, minor discrepancies.*

An air carrier definitively complied with the AD but the ASI found trivial, minor, discrepancies or questioned compliance to the detailed specifications of the AD.

**Outcome—compliance**. No AMOC is required and the airplane can operate. However, if the ASI does not immediately and definitively determine compliance, the ASI must forward the decision to the appropriate FAA engineer, adding time for compliance determination.

**Categories of Findings**

| Category No. | Category Name | Description | Outcome |
|---|---|---|---|
| 1 | Missed Compliance | Air carrier missed the AD schedule. | Airplane grounded. |
| 2 | Unacceptable Compliance Demonstration | Air carrier intended compliance but demonstrated unacceptable work; if AMOC sought, it was denied. | Airplane grounded. |
| 3[13] | Alternative Method of Compliance | Work deviated from AD/SB; but found to meet safety intent. | AMOC issued; airplane can fly after completion of any required work. |
| 4 | Compliance Demonstrated but Later Undone | AD properly complied with; however, some aspects inadvertently undone later through normal operation or routine maintenance. | AMOC issued; airplane can fly after completion of any required work. |
| 5 | Compliance Demonstrated, With or Without Trivial, Minor Discrepancies | Compliance demonstrated with trivial, minor discrepancies discounted by inspector or engineer; no AMOC needed. | Airplane can fly. |

While air carriers brought category 3 airplanes into compliance after issuance of an AMOC, the Team reiterates that the AMOC process is intended to provide for the incorporation of an alternative method before the compliance deadline. All AMOCs issued during the special validation of AD 2006–15–15 were issued after the AD compliance deadline. Airplanes that fell into category 1, 2, or 3 were operating out of compliance between March 5, 2008, and the date the AMOC was issued, which subjects the air carrier to potential enforcement per established FAA procedures.

[13] It is acceptable to use an AMOC if accomplished by the compliance date; however, in this instance, AMOCs were received after the compliance date.

A summary of the special AD validation findings for AD 2006–15–15 indicates nearly two-thirds of all findings were category 5 findings, and nearly one-third were category 3 findings. There were only a few findings in categories 2 and 4, and none in category 1. Moreover, 70 percent of the issues treated as category 3 findings (that is, approved as part of an AMOC), under an environment free of the issues that surrounded the special AD validation (see above), would have easily been category 5 findings. The Team determined that the adverse environment directly contributed to some ASIs' aversion to making findings of compliance, deferring instead to require an AMOC for any variance.

# 4.0 DISCUSSION ITEMS

Based on the Team's review of the SB and AD, and interviews with air carriers, this section of the Team's report is organized into three distinct timeframes regarding AD 2006–15–15: development, implementation, and verification.

## 4.1 Development of AD 2006–15–15

### *4.1.1 Service Bulletin Development*

AD 2006–15–15 incorporated by reference Boeing SB MD80–29A070, revision 1. Accordingly, the SB specified detailed work instructions for accomplishing the AD. Before adoption of the AD, revision 1 was preceded by six other SBs or SB revisions[14] over a period of several years. These revisions provided earlier instructions for modifying the same wiring harness or certain components of it. Accomplishment of the earlier instructions was at the discretion of the air carrier.

The objective of SB MD80–29A070 is clear, and the accomplishment of its modifications is relatively straightforward compared to many SBs. However, the instructions provided in the SB are involved, detailed, and specific because they cover four different configurations of components in the wheel wells of several applicable MD–80 series airplanes.

Incorporation of some of the earlier SBs by some air carriers added to the challenge of completing SB MD80–29A070, revision 1, by requiring managers and maintenance technicians to coordinate the work with previous installations. Three of the four interviewed air carriers involved with the flight cancellations had incorporated the original SB MD80–29A070 into some airplanes before revision 1 was mandated by the AD. Revision 1 addressed certain instructions unique to one of the four airplane configurations. Revision 2 of the SB was issued on May 14, 2007, to provide certain engineering improvements and additional instructions unique to a certain configuration of a hydraulic sump, and was approved as an AMOC to the AD. At least two of the air carriers interviewed had installed revision 2 of the SB in applicable airplanes.

Boeing recently began annotating references in SBs with "given in," which specifies a required reference, and "refer to," which specifies an optional reference. However, existing practices for authoring SB accomplishment instructions do not provide for distinguishing between instructions that address the safety intent of an AD and instructions included to complete the overall work package.

The history and implementation of SBs culminating with SB MD80–29A070, revision 1, and the involved nature of its instructions contributed to confusion among ASIs and air carriers. This created a need for engineers, mechanics, and auditors to reassess whether work previously accomplished met the mandated requirements and to regain familiarity with accomplishment instructions and records.

[14] Boeing SB MD80–29A070, revision 1 was preceded by Boeing SB MD80–29–42; SB MD80–29–48; SB MD80–29–68; SB MD80–29–68, revision 1; SB MD80–29–68, revision 2; and SB MD80–29–070.

### *4.1.2 Lead Airline Process*

The Lead Airline Process is designed to assist in the development of the service instructions that may be incorporated by an AD to ensure air carriers have input to the instructions they may be responsible for implementing. As delineated in ATA Specification 111, Airworthiness Concern and Coordination Process, it is optimal for the coordination of a potential rulemaking to be initiated in time for industry to contribute to the development and approval of service instructions, such as an SB. This should take place before the FAA proposes the instructions for incorporation by reference in an NPRM. Ideally, this coordination among air carriers, the OEM, and the FAA would result in NPRMs with which air carriers concur; there would be no need to comment to the docket or pursue an AMOC. Once the FAA decides to publish an NPRM or final rule, coordination with the FAA is limited by the ex parté communication policy.

The Lead Airline Process should be implemented if the OEM determines through a preliminary assessment that a technical concern presents a potential safety-related problem. The process should be initiated at a point in time that will allow the lead airline and other air carriers to assist in developing new service instructions or revise existing instructions to address the problem.

## 4.2 Implementation of AD 2006–15–15

### *4.2.1 Implementation at Each Air Carrier*

There is more flexibility in how an air carrier implements an SB than in how it implements the prescriptive requirements in an AD. When implementing an SB not associated with an AD, an air carrier can use a standard wiring practices manual (SWPM) to deviate from the SB reference material when required by the particular airplane configuration (for example, a structural repair in the area requires a bracket to be placed in a different location). However, using all the allowed, flexible tolerances in the SWPM to implement an SB that later becomes a prescriptive AD increases the risk of noncompliance.

This class 2 AD mandated a prescriptive subset of standard practices for tasks that normally are done using standard practices approved in the SWPM, which have more tolerances. During its discussions with the air carriers, the Team found that the air carriers incorporated the SB before it was an AD in some of their fleet's airplanes. In some instances, air carriers may have used the broader criteria in the SWPM rather than the prescriptive requirements of the AD.

In addition, after initial compliance with this AD, it was potentially easy to demodify the airplane by deviating from the prescriptive requirements of the AD wiring routing. Air carriers' normal maintenance processes conducted after the AD installation and compliance can sometimes inadvertently render an airplane nonconforming to its type design.

### *4.2.2 EAPAS Considerations*

Following the SwissAir 111 accident in 1998, wherein probable cause was a fire brought about by arcing electrical wires in the overhead panel on the flight deck, the FAA and industry began an extensive program to review the safety aspects associated with the design, certification, installation, maintenance, and inspection of wire systems in commercial airplanes. This program was called the Enhanced Airworthiness Program for Airplane Systems (EAPAS). In addition to very specific design and inspection requirements published in the fall of 2007, the EAPAS effort developed extensive training in the new lessons learned for the design, certification, installation, maintenance, and inspection of wire systems.

The intent of the Aging Transport Systems Regulatory Advisory Committee's[15] (ATSRAC) recommendation for community-wide safety training was to instill a cultural change in the way critical safety issues associated with airplane wire systems were handled. In a relative sense, safety of wire systems was not deemed critical before SwissAir 111, but the lessons learned in the accident investigation and the EAPAS work that followed highlighted the critical nature of potential failure modes of wire systems leading to unsafe conditions.

The training, although not a regulatory requirement, was recommended by the ATSRAC as essential training for all aviation personnel involved in wire systems.[16] The ATSRAC and the FAA developed materials to be used in conducting training throughout the safety community, especially those involved with airplane wire systems. Training records made available to the Team showed that typically anywhere from one to four representatives from a wide cross-section of the safety community attended some training. The relatively small number of individuals from any one company suggested the trainees would become "trainers" for the rest of the company's affected workforce. It is not clear, however, what level of training occurred within any company's workforce.

In addition, while some of the Team's findings clearly were inconsistent with electrical wiring interconnection systems (EWIS) installation guidelines, many configurations were within the guidelines of the EWIS-compliant SWPM but not the prescriptive requirements of the SB.

### *4.2.3 Workmanship Issues*

Workmanship issues relate to the lack of attention to detail in following the accomplishment instructions in the AD/SB. The workmanship issues identified during the audit stemmed from failures of maintenance technicians to follow the instructions in the air carrier engineering order, SB, or other applicable instructions; however, the technicians must recognize (or the air carrier must ensure the technician recognizes) when standard practices cannot be used because they are limited by other prescriptive requirements, such as those in an AD.

[15] The ATSRAC consisted of representatives from the FAA, airplane manufacturers, and the air carrier industry.
[16] The FAA published Advisory Circular (AC) 120–94, Aircraft Electrical Wiring Interconnection Systems Training Program, on November 20, 2007, providing guidelines for air carriers to develop EWIS training programs using the new materials developed by the ATSRAC.

## 4.3 Verification of AD 2006–15–15

During the interviews with affected air carriers, the Team learned that ASIs previously exercised judgment in determining compliance regarding spacing tolerance, split sleeving, or clamp installation (category 5 items). Typically, the ASI has verified the AD paperwork for compliance and might perform a visual inspection to assess general compliance with the intent of the AD. Air carriers usually do not request AMOCs for such items.

Also, many of the air carriers had accomplished the SB in some airplanes well in advance of it being issued as an AD, incorporating it into their scheduled maintenance. In some cases, air carriers may not revisit or redo an SB when an AD is issued to make the SB mandatory. They simply review their paperwork to ensure the SB was accomplished and then sign off the accomplishment of the AD.

Because of the environment during the FAA audit (see section 2.5), verification of compliance with the AD was not normal. Some ASIs continued to use their normal processes for verification and others instituted strict compliance, often using rulers to ensure tie spacing was exactly 1 inch, something they typically would not have done. Experience also played a role in the need to correct category 5 issues and highlighted that a more objective decisionmaking process for AD compliance needs to be developed that can be used in all situations. The Team will suggest a more objective decisionmaking process during task 2 of this project.

# 5.0 FINDINGS

## 5.1 Environment

As previously described in section 2.5 of this report, the environment was extraordinary and had a significant effect on the outcome of the special emphasis verification of AD 2006–15–15.

### Finding No. 1

The environment hindered timely communication of material fact, contributing to disorganized, ad hoc communications that resulted in apprehensive and reactionary responses at several levels of the FAA and industry.

## 5.2 Service Instructions

The involved nature of the SB's instructions and the number of revisions and superseding SBs over 21 years contributed to interpretation and workmanship issues, unnecessary requests for AMOCs, and discrepancies in SB kits. For example—

- Earlier SB illustrations depicted tape over sleeving at the connector, and the work instructions required sleeving over tape—contradictory;
- SB instructions relied on sketches[17] to provide installation instructions without text to provide clarification—inconsistent;
- Several dimensions were preceded by "approximately"—ambiguous; and
- SB kits contained the incorrect number and size of certain piece-part hardware; for example, SB instructions specified a size 8 nut to be fastened to a size 10 screw—incorrect.

In addition, the SB was overly prescriptive[18] and inconsistent in areas that were not crucial to the safety intent of the AD/SB. An example of an overly prescriptive requirement is contained in AD 2006–15–15; it addresses the requirement to have single continuous sleeving. This AD specifies the length of the sleeving and the amount of tape to be installed. (None of these requirements are specified in any manual covering the affected area and consequently could be "undone" by using standard practices/SWPM practices.)

The SB on sleeving specifies limited material type options, whereas the SWPM allows the use of alternative sleeving materials that are not included in the SB. Post-compliance use of the materials specified in the SWPM could result in undoing the AD/SB installation. Conversely, the one-inch tape spacing is consistent with the SWPM and is a standard practice, therefore, it is not considered overly prescriptive.

[17] SB instructions require the use of three washers, each for attaching one clamp to the hydraulic service panel and another clamp to the wheel well structure, while the illustration shows only one washer for the service panel clamp and none for the other.
[18] See appendix B to this report for a definition of overly prescriptive.

### Finding No. 2

In the current method of writing SBs, the accomplishment instructions of an SB do not distinguish between instructions that satisfy the safety intent of the AD and instructions that merely serve to complete the overall work package. This contributed to unnecessary questions of compliance and requests for AMOCs.

AD 2006–15–15 (a class 2 AD as defined in this report) specifies wire bundle routing and modifications that were very prescriptive subsets of SWPM practices. As a result, it is possible that in subsequent maintenance, an air carrier or repair station maintenance technician could demodify some or all of the installation and render it noncompliant with the AD through the use of the standard practices defined in the SWPM, if he or she were unaware the wiring was an AD-required installation.

The Lead Airline Process contributed to the development of both SB revisions proposed in the rulemaking process culminating with AD 2006–15–15. However, the level of specificity of SB instructions addressed in that process did not in all cases match the level of detail that arose during the audit. In addition, not all of the differences in the configurations of the applicable airplanes were addressed during the Lead Airline Process. Consequently, the SB instructions did not prevent questions of compliance or installations that were noncompliant.

Several air carriers implemented the SB before the AD was issued in some airplanes. At least one air carrier interviewed did not recognize the importance of the prescriptive criteria in the AD and did not revisit and reevaluate their earlier work for compliance with the prescriptive requirements in the AD.

## 5.3 Process of Determining Compliance Versus Noncompliance

The aviation regulations allow the FAA to accept alternatives to compliance with airworthiness requirements through a determination of equivalency. In the case of an AD, part 39 allows the FAA to accept alternatives to AD compliance through the AMOC process. These critical safety decisions are made at levels above the ASI. However, at the ASI level there is no process for ASIs to disposition discrepancies in conformity. Although the Team acknowledges that there is a difference in the magnitude of a wrong decision at each level, the Team determined that a process for allowing the ASIs to make these determinations would benefit the FAA and should be developed.

A number of the special AD verification audits of AD 2006–15–15 resulted in the removal of airplanes from service where the work accomplished appeared to meet the safety intent of the AD, but ASIs deemed minor variations in the installation to be noncompliant. This approach to compliance led to a strictly literal verification of compliance. During this period, air carriers filed applications for AMOCs with Boeing and the FAA for approximately 70 technical issues. The Team noted that the AMOC process provides alternative methods of compliance; however, AMOCs must be requested before the compliance date of the AD. After-the-fact requests for AMOCs were made by the air carriers to keep their airplanes in service; however, because the requests were after the AD compliance date, the air carriers are subject to FAA enforcement.

The Team also noted that some ASIs and air carriers reacted to environmental pressures to ensure all actions were documented, rather than to rational technical resolutions of questions of potential noncompliance because—

- ASIs felt they had no latitude to allow minor deviation from specified configurations and, for example, resorted to measuring the spacing of the lacing and clamp direction, rather than ensuring clearance from chafing; and
- Air carrier personnel felt they had no option but to remove airplanes from revenue service.

As noted above, there were numerous examples of compliance with the intent of the AD, yet there were minor deviations from the SB resulting in flight cancellations (many were category 5 findings). However, none of the air carriers interviewed, the OEM, nor the FAA believed the airplanes removed from service presented immediate safety-of-flight issues.

There was a lack of understanding of the purpose of the AD, which was to create clearance for wire bundles. The events that precipitated the special emphasis AD verification were a known overflight of a structural AD and subsequent congressional hearings, while the cases related to AD 2006–15–15 involved inadvertent or unknown noncompliances and minor discrepancies. The methods of clamping and tie backs created a focus on some issues that could have been resolved without the air carriers cancelling so many flights.

### Finding No. 3

No formal process, training, or education exists to support ASIs exercising normal, technical judgment to allow the safe and orderly verification of compliance in a manner that would avoid unnecessary flight cancellations and service interruption.

## 5.4 Workmanship

The majority of air carrier findings in category 3 reflected workmanship issues, such as the appropriate length of sleeving, clamp orientation, and wire bundle routing and lacing issues, rather than paperwork issues. The category 3 findings at the air carriers the Team interviewed were generally of the same nature. All the category 3 findings demonstrated an acceptable level of safety because the air carriers eventually received an AMOC. However, some of these AMOCs required the air carriers to rework elements of the installation per the AMOC.

The air carrier maintenance facilities modified most of the airplanes; contract maintenance facilities modified the rest. Although not a specific area of concern, the Team noted that there was no apparent difference in the type, number, or severity of installation issues attributed to and between work performed by contractors and work performed by air carrier personnel.

The FAA audits of AD 2006–15–15 indicate that maintenance technicians were not following the prescriptive requirements of the AD and did not seek the air carrier's approval for deviations from the SB. Furthermore, with some installations, it is evident that the lessons learned from EAPAS had not penetrated to the air carriers' maintenance technicians

to emphasize the content of, importance of, and reasons for new specific wiring repair and installation practices. A high level of variance from the AD's prescriptive installation directions—contrary to the best practices for wiring installations developed from EAPAS—and the other poor workmanship, leads the Team to believe the need to explicitly follow engineering instructions, comply with the intent of EAPAS, and understand the critical safety nature of wire systems needs to be reinforced in the aviation community.

### Finding No. 4

Most air carriers interviewed incorporated the SB before the AD was issued in some airplanes but did not apply a level of workmanship consistent with the prescriptive AD requirements. This contributed to unnecessary questions of compliance, requests for AMOCs, and noncompliant modifications.

## 5.5 Communication

### *5.5.1 General*

The political and media environment discussed in this report caused a breakdown in communication protocols within the industry during the audits of AD 2006–15–15. Industry informally communicated issues outside normal processes and regular channels. Air carriers, the OEM, and regulatory personnel often first learned of significant developments through the media. Once the flight cancellations began in mid-April, there was insufficient time for air carriers to collectively establish material facts and coordinate resolutions before new developments captured attention and resources. The Team found this breakdown in communication protocols caused unnecessary requests for corrective action, uncertainty about the condition of some airplanes, and a variety of other issues that led to many of the flight cancellations.

Technical communications were effectively generated to allow contact between ACO, CMO, OEM, and air carrier technical personnel in an effort to resolve technical issues. The advantages of these technical communications were mitigated by informal communications taking place at other levels. However, ASIs with concerns about compliance determination were reluctant to make decisions concerning minor variations in the work accomplished absent guidance from more senior managers. Guidance for the ASIs was not forthcoming as FAA managers at all levels sought to avoid the appearance of dictating to the field or coordinating too closely with the air carriers. The air carriers resorted to submitting AMOCs in an effort to force compliance decisions. The AMOC process was never intended to grant compliance after the required compliance date.

In requesting AMOCs, the air carriers retained their normal access to the ACO on an individual basis, and, as compliance questions surfaced at several air carriers, air carrier and Boeing engineers established a separate communication link that provided for group communication and coordination, and ACO participation was specifically sought and gained.[19] It was noted that there were exemplary communications between air carrier and

[19] The FAA established a 24/7 hotline to the ACO, however, access to that hotline was limited to CMO personnel.

OEM engineers, and the Los Angeles Aircraft Certification Office (LAACO). The air carriers had 24 hours a day, 7 days a week telephone access to the experts at Boeing and to the FAA engineers at LAACO. Air carrier, CMO, OEM, and LAACO personnel communicated through several multiparty teleconferences.

### *5.5.2 AMOCs*

The normal AMOC approval process was revised during the April flight cancellations. Several multiparty teleconferences occurred among air carrier, CMO, OEM, and LAACO personnel during the April flight cancellations. However, FAA AEG personnel were not included in these discussions. LAACO informed Boeing that no further AMOCs could be granted without approval from the FAA legal counsel, and any AMOCs would need to be forwarded from that air carrier's CMO with recommended approval. Later, the LAACO informed Boeing that all AMOCs would need to be processed through FAA Headquarters. In addition, during the period of flight cancellations, decisionmaking authority on the necessity of an AMOC was in dispute. In some instances, ASIs required an AMOC even after the proper authority (the ACO) stated that an AMOC was unnecessary.

In several cases, Boeing requested and was granted fleet-wide AMOCs to consolidate AMOCs offered to individual air carriers. However, this was discouraged during the April flight cancellations, which prevented one air carrier from benefitting from AMOCs issued to another air carrier. In addition, there was general confusion over who was making the AMOC decisions.

The lack of a timely process for communicating the availability of AMOCs to all affected air carriers caused many duplicate requests for AMOCs. In addition, several air carriers requested that they not be advised of the AMOCs being requested by other air carriers, fearing that these would be used as "hit lists" to rapidly surface questions of noncompliance at their air carrier. Such lists evidently were used to audit at least one of the interviewed air carriers.

#### Finding No. 5

There was miscommunication, improper communication, and a failure in formal communication throughout the industry.

There was confusion and miscommunication over who had authority to approve AMOCs, who could request an AMOC, and who was responsible for coordinating the AMOC process within the various departments in the FAA.

Boeing did not issue any All Operator Communications during the period of flight cancellations. This led to confusion in the industry and further reliance on media reports.

# 6.0 RECOMMENDATIONS

Based on the findings in section 5.0 of this report, the Team developed the following recommendations, which it categorized by process areas. Because a number of the recommendations cover multiple findings, the Team is presenting its findings separately. See appendix D for a cross-reference of the recommendations to the specific findings in this report. The Team will investigate a number of the recommendations during task 2.

## Recommendation No. 1—Compliance Versus Noncompliance Decisionmaking Process

The FAA should—

- Develop a more objective, deliberative decisionmaking process for determining compliance versus noncompliance that can be used in any situation.
- Reemphasize to ASIs that they have the authority to use professional judgment to determine whether noncompliance exists.
- Develop a decision tool for use by ASIs to assist in using professional judgment when making compliance determinations.
- Streamline and improve the process for making compliance determinations and make it impervious to external influence.
- Eliminate single-person decisionmaking.
- Clarify the roles and responsibilities of the Flight Standards Service, Aircraft Certification Service, OEM, and air carrier in the compliance decisionmaking process.
- Review the AMOC process for enhancements and to ensure AEG personnel are included in the process.
- Develop a process to raise ASI concerns on compliance determinations to a higher level.
- Define and strengthen the communication process flow and make it impervious to external influence.

### Recommendation No. 2—Service Bulletin Process

The OEM and the Air Transport Association of America, Inc. (ATA), as appropriate, should—

- Revise the way SBs are written to avoid mandating things that are not required to meet the safety intent of the SB. This would include ensuring air carriers have appropriate guidance and controls when authoring air carrier AD accomplishment documents.
- Avoid drafting class 2 SBs.
- Revise ATA Specification 111 for improvements to the Lead Airline Process.

### Recommendation No. 3—Air Carrier AD Control Process

Each air carrier should develop processes and procedures to—

- Prototype ADs before accomplishment.
- Prevent class 2 ADs from being undone during normal maintenance actions.
- Ensure AD configurations are maintained.
- Ensure that when incorporating an SB anticipated to become an AD that the physical condition of prior work is reviewed when the AD is issued.

### Recommendation No. 4—Industry Training Process

Each air carrier, OEM, and repair facility should—

- Implement training on the AD process and AD implementation.
- Implement training to reinforce best wiring practices (for example, EAPAS).

## 7.0 CONCLUSION

Upon completion of its review of AD 2006–15–15, the Team determined that the cancellation of many flights might not have taken place in the normal air carrier operational environment. The highly publicized compliance issue with a structural AD unrelated to AD 2006–15–15, followed by a congressional inquiry, numerous statements from congressional representatives, and extensive media reporting created a charged environment in which the aviation community overreacted and the FAA deviated from its normal decisionmaking processes and avoided granting normal technical remedies. This environment, coupled with an overly prescriptive AD and SB without option for minor deviations, precluded the FAA and air carrier personnel from employing traditional, proven, and safe technical action to ensure safety and minimize disruption of service to the traveling public. Minor deviations that do not constitute noncompliance have traditionally been guided by sound technical judgment.

A positive outcome of this extensive review of AD 2006–15–15 and its associated SBs is that it uncovered and highlighted areas where the air carriers, OEMs, and FAA, as appropriate, should make improvements. Improvements are needed in the following areas:

- Workmanship;
- EWIS training;
- Clarity of SB material, air carrier work instructions, and industry standard practices;
- The Lead Airline Process;
- Prevention of airplane demodifications; and
- Guidance for FAA personnel that will not only lead them through decisionmaking during crisis events but protect their decisions from being influenced by outside events.

# APPENDIX A — ACRONYMS

| | |
|---|---|
| **14 CFR** | Title 14, Code of Federal Regulations |
| **AC** | advisory circular |
| **ACO** | aircraft certification office |
| **AD** | airworthiness directive |
| **AEG** | Aircraft Evaluation Group |
| **AMOC** | alternative method of compliance |
| **AR** | authorized representative |
| **ASI** | aviation safety inspector |
| **ATA** | Air Transport Association of America, Inc. |
| **ATOS** | Air Transportation Oversight System |
| **ATSRAC** | Aging Transport Systems Regulatory Advisory Committee |
| **CAST** | Commercial Aviation Safety Team |
| **CMO** | certificate management office |
| **EAPAS** | Enhanced Airworthiness Program for Airplane Systems |
| **EPI** | element performance inspection |
| **EWIS** | electrical wiring interconnection systems |
| **FAA** | Federal Aviation Administration |
| **IPC** | illustrated parts catalog |
| **LAACO** | Los Angeles Aircraft Certification Office |
| **NCARC** | National Civil Aviation Review Commission |
| **NPRM** | notice of proposed rulemaking |
| **OEM** | original equipment manufacturer |
| **SB** | service bulletin |
| **SFAR** | Special Federal Aviation Regulation |
| **SNPRM** | supplemental notice of proposed rulemaking |
| **SWPM** | standard wiring practices manual |

# APPENDIX B — DEFINITIONS

**Airworthy** — The airplane conforms to its type design and is in a condition for safe operation.

**Alternative method of compliance (AMOC)** — An AMOC is a different way, other than the one specified in an AD, to address the unsafe condition on an airplane or with an airplane engine, propeller, or appliance. An AMOC must ensure the unsafe condition is corrected by providing an acceptable level of safety.

**Class 2 AD** — This type of AD requires a configuration change, that after implementation, potentially has a higher vulnerability to be undone through the air carrier's standard maintenance practices or operations.

**Compliance** — A state or act of adhering to a specification or policy, standard, or law that has been clearly defined. Conforming to the requirements specified in the applicable regulations of Title 14, Code of Federal Regulations (14 CFR).

**Conform to the type design** — To be in a state that represents every aspect, detail, and attribute of the approved type design.

**Grounded** — The airplane is no longer allowed to operate in commercial operations. However, the airplane can be operated on ferry flights and maintenance test flights.

**Noncompliance** — A state or act of not adhering to a specification or policy, standard, or law that has been clearly defined. Not conforming to the requirements specified in the applicable regulations of 14 CFR.

**Overly prescriptive** — With respect to this report, use of procedures that are over and above procedures typically used for routine maintenance and specified in standard manuals, such as airplane maintenance manuals and standard wiring practices manuals. Overly prescriptive requirements according to this definition are at risk of being "undone" during routine maintenance after the AD or SB is initially complied with and particularly for those not requiring repetitive inspection under the AD.

**Type design** — The engineering definition of a particular product. The type design consists of the following (see 14 CFR 21.31):

- Drawings and specifications;
- Dimensions, materials, and processes;
- Airworthiness limitations;
- For primary category airplanes, if desired, a special inspection and preventive maintenance program designed to be accomplished by an appropriately rated and trained pilot-owner; and

- Other data to describe the product design, and to determine the airworthiness, noise characteristics, fuel venting, and exhaust emissions (where applicable).

**Unsafe condition** — There is no written definition in any FAA regulation or FAA order of what constitutes an "unsafe condition." Therefore, for the purposes of this report, an unsafe condition is one that, after careful assessment by FAA aviation safety engineers, is determined not to provide an acceptable level of risk to the public. The unsafe condition can be one that jeopardizes the continued safe operation of a product, endangers an occupant, or poses an injury threat to persons on the ground.

**Workmanship** — Within the context of this report, workmanship means work performed that adheres to instructions or, where applicable, to standard practices.

# APPENDIX C — DETAILED HISTORY OF AD 2006–15–15

In 1986 Boeing received two in-service reports of arcing in the back of the electrical connector to the auxiliary hydraulic pump from air carriers operating MD–80 series airplanes. Boeing issued an SB[1] in August 1987 to install a straight backshell with a wire comb on the auxiliary hydraulic pump connector.

Boeing received two more reports of arcing at the backshell after the issuance of the SB. The root cause was determined to be pulling stress on the connector pins. Boeing issued another SB[2] in December 1990, to replace a section of the textile overbraid on the auxiliary pump wire harness with more flexible sleeving[3]. This SB superseded, but did not cancel, the previous SB, retaining some of the former's provisions.

Subsequently, three air carriers reported three instances of shorted wires in the right wheel well and evidence of arcing on the power cables at the auxiliary hydraulic pump.[4] Boeing issued a new SB[5] in May 2001, recommending that air carriers visually inspect the auxiliary hydraulic pump wire harness, replace the existing connector backshell with a 90-degree backshell, install a new clamp, and install protective sleeving. This new SB superseded and canceled the two previous SBs. Boeing then issued two revisions to the SB because air carriers reported variations in actual airplane wiring configurations, which the SB needed to address clearly.[6]

On June 2, 2003, the FAA published a notice of proposed rulemaking (NPRM)[7] proposing a mandatory inspection and follow-on actions, in accordance with revision 2 of the SB.[8] The FAA received comments to the NPRM that identified significant technical issues with this SB, and Boeing decided to create a new SB[9] instead of revising the existing one.

On May 2, 2005, the FAA published a supplemental NPRM (SNPRM) proposing inspection and follow-on actions in accordance with the latest SB.[10] The FAA received comments to the SNPRM, which, based on the lead airline's incorporation of the SB in "several" airplanes, identified relatively minor technical issues. Commenters also requested that any AD specifically identify the applicable provisions of the SB.

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[1] Boeing SB MD80–29–42.
[2] Boeing SB MD80–29–048.
[3] The more flexible sleeving was intended to reduce the pulling force on the pins in the connector.
[4] One incident resulted in a fire in the wheel well. Investigation revealed the connector was damaged from sharp bending of the wires that mate to the straight connector at the pump motor and chafed wires in the wheel well area.
[5] Boeing SB MD80–29A068.
[6] Boeing issued SB MD80–29A068, revision 1, on February 21, 2002, and SB MD80–29A068, revision 2, on November 19, 2002.
[7] Docket No. 2001–NM–387–AD.
[8] Boeing SB MD80–29A068.
[9] Boeing SB MD80–29A070. Boeing added in the background section of this SB the following statement, which had not been included in any of the previous SBs: This SB is the result of the safety assessments conducted by Boeing under Special Federal Aviation Regulation (SFAR) 88, Fuel Tank System Fault Tolerance Evaluation Requirements.
[10] Boeing MD80–29A070.

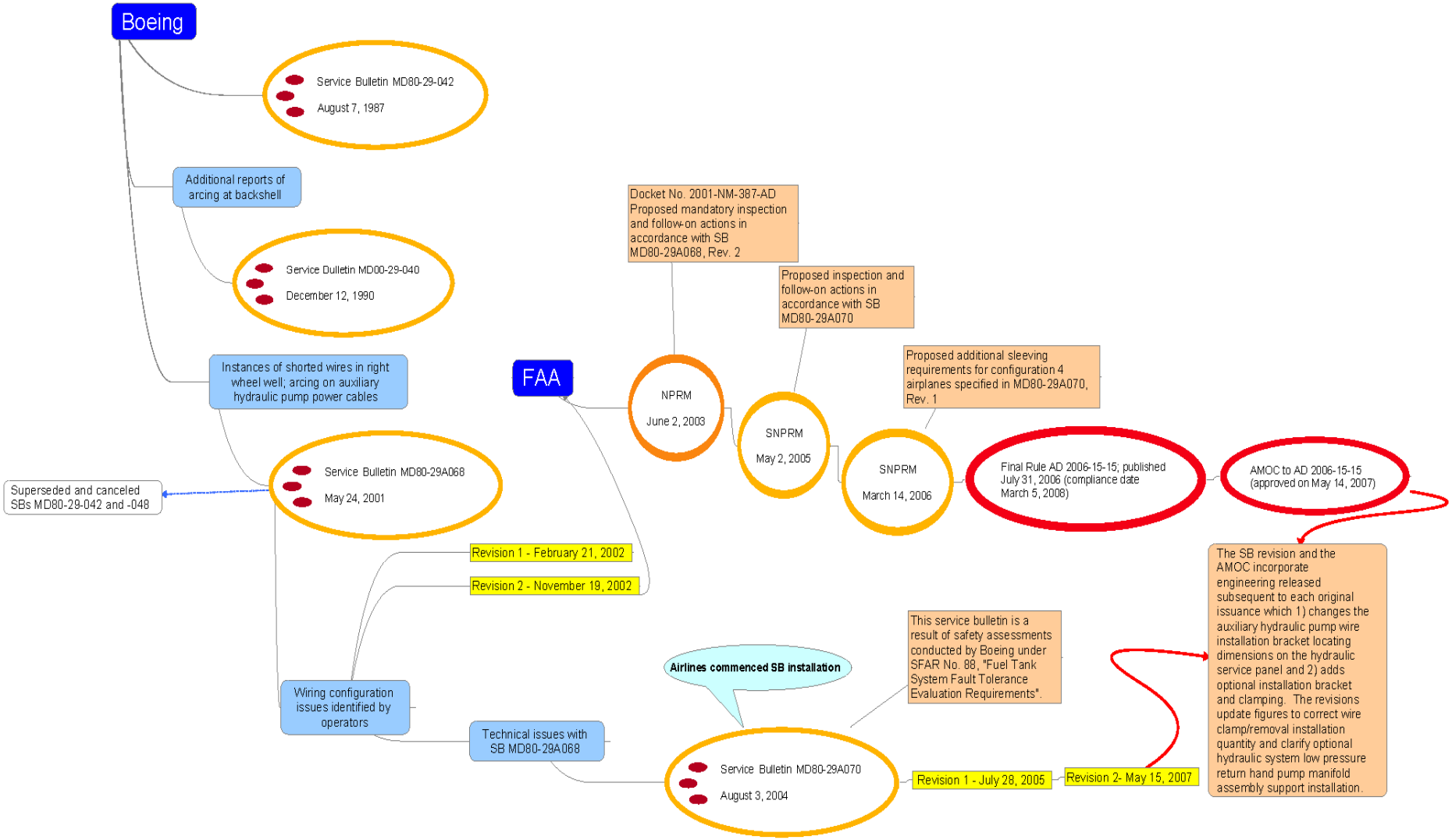
On March 14, 2006, the FAA published a second SNPRM to address additional actions in revision 1 of the SB.[11] On July 31, 2006, the FAA published the final rule on AD 2006–15–15, with an effective date of September 5, 2006. The AD incorporated by reference Boeing Alert SB MD80–29A070, revision 1, and set a compliance deadline of March 5, 2008.

On May 14, 2007, the Los Angeles Aircraft Certification Office approved revision 2[12] of the current SB as an AMOC to AD 2006–15–15.

[11] Boeing Alert SB MD80–29A070, revision 1, dated July 28, 2005. Revision 1 added instructions for a fourth airplane configuration not addressed in earlier SBs, specifying certain sleeving requirements for these airplanes. Based on OEM comments, this NPRM was identified as stemming from SFAR No. 88 design reviews.

[12] Boeing Alert SB MD80–29A070, revision 2, dated May 15, 2007. Revision 2 was issued to incorporate engineering released subsequent to the prior issue of this SB, which changed the auxiliary hydraulic pump wire installation bracket locating dimensions on the hydraulic service panel and added optional installation bracket and clamping. Figures were updated to correct wire clamp removal/installation quantity and to clarify the optional hydraulic system low pressure return hand pump manifold assembly support installation.

# Map of the History of AD 2006–15–15



## APPENDIX D — CROSS-REFERENCE OF RECOMMENDATIONS AND FINDINGS

| Recommendation No. 1—Compliance Versus Noncompliance Decisionmaking Process | Finding Nos. |
|---|---|
| The FAA should—<br>• Develop a more objective, deliberative decisionmaking process for determining compliance versus noncompliance that can be used in any situation.<br>• Reemphasize to ASIs that they have the authority to use professional judgment to determine whether noncompliance exists.<br>• Develop a decision tool for use by ASIs to assist in using professional judgment when making compliance determinations.<br>• Streamline and improve the process for making compliance determinations and make it impervious to external influence.<br>• Eliminate single-person decisionmaking.<br>• Clarify the roles and responsibilities of the Flight Standards Service, Aircraft Certification Service, OEM, and air carrier in the compliance decisionmaking process.<br>• Review the AMOC process for enhancements and to ensure AEG personnel are included in the process.<br>• Develop a process to raise ASI concerns on compliance determinations to a higher level.<br>• Define and strengthen the communication process flow and make it impervious to external influence. | 1, 3, and 5 |

| Recommendation No. 2—Service Bulletin Process | Finding Nos. |
|---|---|
| The OEM and ATA, as appropriate, should—<br>• Revise the way SBs are written to avoid mandating things that are not required to meet the safety intent of the SB. This would include ensuring air carriers have appropriate guidance and controls when authoring air carrier AD accomplishment documents.<br>• Avoid drafting class 2 SBs.<br>• Revise ATA Specification 111 for improvements to the Lead Airline Process. | 2 |
| **Recommendation No. 3— Air Carrier AD Control Process** | **Finding Nos.** |
| Each air carrier should develop processes and procedures to—<br>• Prototype ADs before accomplishment.<br>• Prevent class 2 ADs from being undone during normal maintenance actions.<br>• Ensure AD configurations are maintained.<br>• Ensure that when incorporating a SB anticipated to become an AD that the physical condition of prior work is reviewed when the AD is issued. | 2 |
| **Recommendation No. 4—Industry Training Process** | **Finding Nos.** |
| Each air carrier, OEM, and repair facility should—<br>• Implement training on the AD process and AD implementation.<br>• Implement training to reinforce best wiring practices (for example, EAPAS). | 4 |

# APPENDIX E — METRICS ON U.S AIR CARRIER AIRWORTHINESS DIRECTIVES

The volume of ADs in today's modern fleet poses a significant logistical challenge for air carriers, original equipment manufacturers, and the FAA. The instances of compliance and noncompliance found during the AD audit program should be viewed in the context of the overall number of ADs in effect and applicable to the U.S. fleet. The air carrier must—

- Implement applicable ADs on time.
- Ensure AD modifications are documented, logistically supported, and maintained.
- Ensure any recurring AD requirement is supported and accomplished on time.

Metrics and examples indicating the scope of AD management are as follows:

- There are typically 250 ADs issued every year. Aggregated over many years, there could be thousands of ADs in effect at any given time.
- There are over 1 million maintenance line items tracked in the AD management systems of a typical large air carrier.
- Major air carriers can each process up to 300 maintenance actions related to ADs each day.
- Some ADs may require 1,000 pages of air carrier engineering order instructions and supporting documentation.
- A large U.S. air carrier operating 500 airplanes may have over 3,000 ADs that must be managed.
- The AD management programs of all involved parties must accommodate AD revisions or superseded ADs, including those that occur multiple times and those adopted before the superseded AD has been completed.

While the complexity of managing the compliance of ADs is quite apparent, each of the 117 U.S. air carriers nonetheless has an unqualified requirement to comply with all applicable ADs at all times. Noncompliance to any AD for any period of time subjects the air carrier to the FAA's enforcement program.