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Final Report

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16. Abstract Corrosion Prevention and Control Programs (CPCPs) were issued as Airworthiness Directives (ADs). They were developed by type certificate holders with the assistance of aircraft operators and regulatory authorities. In 1993, the industry developed the Maintenance Steering Group (MSG)-3 Scheduled Maintenance Document Revision 2 to assess damage to airplane structure caused by corrosion. Since then, CPCPs have been incorporated into maintenance programs using MSG-3 guidance. Both the ADs and MSG-3 set the definitions for different levels of corrosion and established the corresponding inspection and maintenance tasks to maintain corrosion at an acceptable level. The definitions for different corrosion levels have changed over time, causing issues for air carriers with mixed fleets. In addition, manufacturers of Title 14 Code of Federal Regulations (CFR) 25 aircraft and Civil Aviation Authorities have different reporting requirements for the three corrosion levels. The FJ Leonelli Group (FJLG) was asked by the FAA to review these definitions and the CPCP reporting requirements. In addition, FJLG was asked to determine the potential impact to safety and the risks associated for air carriers that operate fleets with different makes/models of airplanes and to address the different definitions of corrosion levels in their manufacturer maintenance programs. Another issue addressed by this research is the use of common terminology in the industry to describe practices that relate to corrosion and how its effects are addressed. A related concern is the methods by which air carriers report corrosion findings. In this report, two alternative approaches for defining Level 1 corrosion are proposed. An update to FAA Order 8300.12 or the issuance of a new Advisory Circular to address corrosion definitions and the proper management of CPCPs is important because it would provide FAA aviation safety inspectors and the industry with recommendations and best practices regarding CPCPs used by operators. This report also recommends that the FAA work with international aviation authorities to further standardize CPCP issues. Finally, the FAA should consider a further revision to the 14 CFR 145 requirements.					
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LIST OF ACRONYMS

AASA	Aging Aircraft Safety Act
AASR	Aging Airplane Safety Rule
AATF	Airworthiness Assurance Task Force
AAWG	Airworthiness Assurance Working Group
AC	Advisory Circular
ACO	Aircraft Certification Office
AD	Airworthiness Directive
ALS	Airworthiness Limitation Section
AMC	Alternate Means of Compliance
AMM	Airplane maintenance manual
ANAC	Agência Nacional de Aviação Civil (Brazil)
ASI	Aviation safety inspector
ATA	Air Transport Association of America
CAA	Civil Aviation Authority
CAMP	Continuous airworthiness maintenance program
CFR	Code of Federal Regulations
CPCP	Corrosion Prevention and Control Program
CS	Certification Specification
DAH	Design approval holder
DGAC	Direction Générale de l'Aviation Civile
DT	Damage tolerance
DTE	Damage tolerance evaluation
EAAWG	European Ageing Aircraft Working Group
EASA	European Aviation Safety Agency
FJLG	FJ Leonelli Group
FSDO	Flight Standards District Office
FSIMS	Flight Standards Information Management System
ICA	Instructions for continued airworthiness
ICAO	International Civil Aviation Organization
IMRBPB	International Maintenance Review Board Policy Board
JAA	Joint Aviation Authorities
MPD	Maintenance Planning Document
MRB	Maintenance Review Board
MRBR	Maintenance Review Board Report
MSG	Maintenance Steering Group
NPA	Notice of Proposed Amendment
NPRM	Notice of Proposed Rulemaking
NTSB	National Transportation Safety Board
OEM	Original equipment manufacturer
SRM	Structural repair manual
SSIP	Supplemental Structural Inspection Program
TC	Type certificate
TCCA	Transport Canada Civil Aviation
TCH	Type certificate holder
TP	Transport Publication

EXECUTIVE SUMMARY

Corrosion Prevention and Control Programs (CPCPs) were developed in the early 1990s by type certificate holders (TCHs) with the assistance of aircraft operators and regulatory authorities and were issued as FAA Airworthiness Directives (ADs). In 1993, the industry developed a logical evaluation process identified in the former Air Transport Association of America Maintenance Steering Group (MSG)-3 Scheduled Maintenance Document Revision 2 to assess damage to aircraft structures caused by corrosion. Since then, CPCPs have been incorporated into maintenance programs using MSG-3 guidance.

Both the ADs and MSG-3 set the definitions for different levels of corrosion and established the corresponding inspection and maintenance tasks to maintain corrosion at an acceptable level. The definitions for different corrosion levels have changed over time, causing issues for air carriers with mixed fleets. In addition, manufacturers of Title 14 Code of Federal Regulations (CFR) 25 aircraft and Civil Aviation Authorities (CAA) have different reporting requirements for the three corrosion levels.

The FJ Leonelli Group (FJLG) was asked by the FAA to provide subject matter experts to review the corrosion level definitions and reporting requirements. This required a review of the definitions found in ADs, Maintenance Review Boards (MRBs), Maintenance Planning Documents (MPDs), and FAA Orders to conduct a gap analysis of definitions and reporting requirements as well as to recommend harmonized definitions. In addition, FJLG was asked to determine the potential impact to safety and the risks associated for air carriers that operate fleets with different makes/models of airplanes and to address the different corrosion level definitions in their manufacturer maintenance programs. FJLG developed this report to provide the FAA with information to build on the results of the research and to develop additional guidance material.

The primary focus of this research is the standardization of the definition of Level 1 corrosion. Over time, aircraft manufacturers and airworthiness authorities have adopted different definitions and reporting requirements for Level 1 corrosion. As a result, air carriers do not have a unified CPCP definition when operating mixed fleets. By contrast, Level 2 and Level 3 corrosion are mostly standardized in terms of their definitions and industry implementation.

The intent of a CPCP is to control corrosion to prevent it from exceeding Level 1 and to specify procedures if corrosion exceeds Level 1. A CPCP also requires a method to notify the FAA and the aircraft's manufacturer of findings and data associated with such damage. Over time, air carriers have adopted a more universal approach to defining levels of corrosion. Though these air carriers have deviated from the precise language of various definition documents such as MSG-3, MRB, and MPD, they have not deviated from the core definition of each level of corrosion. AD-mandated CPCPs cannot be changed by the operator, and most MSG-3 tasks are part of the Airworthiness Limitation Section; however, an operator can revise the task or interval to be more restrictive, but not less. Meanwhile, some local FAA Flight Standards District Offices do not permit any changes regarding these requirements in the manuals, even though 14 CFR 43 authorizes air carriers to write their own procedures as long as they are acceptable to the FAA.

Another issue addressed by this research is the use of common terminology used in the industry to describe practices that relate to corrosion and how its effects are addressed. A related concern is the methods by which air carriers report corrosion findings. For example, some FAA offices will not allow air carriers to report corrosion findings electronically to airplane manufacturers.

The CPCPs mandated by AD were reviewed for this report and materials (e.g., original equipment manufacturer [OEM] manuals) from OEMs and CAA were obtained for this research. Related practices of foreign regulatory authorities representing the state of manufacture of non-U.S. manufactured airplanes were also reviewed. In addition, International Maintenance Review Board Policy Board Issue Paper 119 was reviewed as a starting point to create a baseline that describes the issues and current industry practices.

Two alternative approaches to defining Level 1 corrosion were proposed as a result of this research. The first approach is for the FAA to specify minimum requirements for a Level 1 corrosion definition and explicitly state that variations in language are acceptable as long as the minimum criteria are present. The second approach is to establish a standard Level 1 corrosion definition, set a minimum definition, and specify that these definitions would be acceptable.

Under 14 CFR 43, the air carrier is responsible for performing maintenance using the methods, techniques, and practices prescribed in one of the following: the current manufacturers' maintenance manuals; in instructions for continued airworthiness prepared by the manufacturer; or other methods, techniques, and practices acceptable to the administrator. An air carrier accomplishes this task through its continuous airworthiness maintenance program (CAMP). The CAMP provides the actual technical instructions for the maintenance program, such as CPCP and removal of corrosion. In addition, CAMP controls the administration of the program, such as training and designation of required inspection items. It is this part of the program that ensures the reporting of corrosion to the TCH.

An update to FAA Order 8300.12 or the issuance of a new Advisory Circular to address Level 1 corrosion definitions and the proper management of CPCPs is important because it would provide FAA aviation safety inspectors and the industry with recommendations and best practices regarding CPCPs used by operators. With stronger and clearer guidance, it is possible that some of the misunderstandings and frustrations described by certain segments of the industry can be resolved. It is also important to work with other authorities and international aviation organizations to further standardize on CPCP issues because of the increasingly international nature of aviation manufacturing and the overall globalization of the industry. Finally, the FAA should consider further revision to the 14 CFR 145 requirements to clarify which definitions of corrosion levels and CPCP-related maintenance practices the FAA considers acceptable, because these facilities often perform work on many aircraft types of different manufacturers and operators.

1. INTRODUCTION

1.1 PURPOSE

The FJ Leonelli Group (FJLG) was asked to provide subject matter experts to review the definitions for the levels of corrosion damage and the reporting requirements used by manufacturers of Title 14 Code of Federal Regulations (CFR) 25 aircraft and Civil Aviation Authorities (CAAs). This required a review of the definitions found in Airworthiness Directives (ADs), Maintenance Review Boards (MRBs), Maintenance Planning Documents (MPDs), and FAA Orders to conduct a gap analysis of definitions and reporting requirements and to recommend harmonized definitions of corrosion levels and reporting requirements.

In addition, FJLG was asked to determine the potential impact to safety and the risks associated for air carriers that operate fleets with different makes/models of airplanes and to address the different corrosion level definitions in their manufacturer maintenance programs. FJLG was asked to prepare a written technical report (using International Maintenance Review Board Policy Board [IMRBPB] Issue Paper 119 as a baseline) after their review and analysis to provide recommendations to the FAA regarding the harmonization of definitions of corrosion levels and reporting requirements.

1.2 BACKGROUND

Corrosion Prevention and Control Programs (CPCPs) were developed in the early 1990s by type certificate holders (TCHs) with the assistance of aircraft operators and regulatory authorities; CPCPs were mandated by ADs. The initial ADs were based on early documents from The Boeing Company and later documents from McDonnell Douglas. In 1993, the industry developed a logical evaluation process identified in the former Air Transport Association of America (ATA) Maintenance Steering Group-3 (MSG-3) Scheduled Maintenance Document Revision 2 to assess damage to aircraft structure caused by corrosion.

The ADs and MSG-3 set the definitions for different levels of corrosion and established the corresponding inspection and maintenance tasks to maintain corrosion at an acceptable level. Though there may have been common definitions for the corrosion levels at that time, they have changed sufficiently to cause issues for air carriers with mixed fleets. In addition, differences in reporting requirements based on corrosion level can also cause issues.

The primary issue is with the multiple definitions of Level 1 corrosion; a harmonized definition is needed. By contrast, Level 2 and Level 3 corrosion definitions and implementation are mostly standardized. The intent of a CPCP is to control corrosion damage to not exceed Level 1 and to specify procedures to adjust the program, as necessary, if corrosion does exceed Level 1. A CPCP also requires a method to notify the FAA and the aircraft's manufacturer of findings and data associated with such damage. The first CPCPs were mandated by AD and addressed 11 specific airplane models. For newer model airplanes, CPCPs have been incorporated into maintenance programs using MSG-3 guidance.

Over time, aircraft manufacturers and airworthiness authorities have adopted different corrosion level definitions and reporting requirements. As a result, air carriers do not use a unified CPCP

definition when operating mixed fleets. Over time, air carriers have adopted a more universal approach to defining levels of corrosion. Though air carriers have deviated from the precise language in the various definition documents such as MSG-3, MRB, and MPD, they have not deviated from the original intent associated with the definition of each level of corrosion. AD-mandated CPCPs cannot be changed by the operator, and most MSG-3 tasks are part of the Airworthiness Limitation Section (ALS); they can be more restrictive but not less. Meanwhile, some local FAA Flight Standards District Offices (FSDOs) do not permit any changes regarding these requirements in the manuals they review, even though 14 CFR 43.13(c) authorizes air carriers to write their own procedures as long as they are acceptable to the FAA.

The differences between the original equipment manufacturer (OEM) Level 1 definitions have created confusion between the FAA and air carriers regarding regulatory requirements. This confusion has resulted in enforcement actions. One air carrier operating three different fleets of airplanes currently must train personnel to understand three separate Level 1 corrosion definitions and how to implement them in the maintenance programs. Another international air carrier has experienced similar issues and raised this concern at a recent Airworthiness Assurance Working Group (AAWG) meeting.

An analysis of the problem indicates that the definition issue is less of a technical or scientific issue and more of a legal and practical problem. Furthermore, beyond the issue of defining corrosion levels, there are other terms that are used in the industry, such as “remove for convenience,” that have varying interpretations and should be defined in a standardized manner. It appears from this research that the term “remove for convenience” is something that air carriers have developed; the term does not appear in the relevant ADs. The same is true of the term “to facilitate other maintenance,” which is used to justify the removal of aircraft skin and structure. In practice, these parts (e.g., stringers) go to the maintenance shops where they are repaired and often go back into the air carrier’s supply system to be reissued.

Another issue is that of “successive blending” (i.e., blending performed in a series versus multiple blends at different times) of corroded areas. For example, if a Level 1 area is blended a second time, it becomes Level 2. However, successive blends after the second blend (up to five in a row) may remain defined as Level 1. A related problem with this technique is that air carriers do not track successive blending very well or not at all. Therefore, this information may have to be built into maintenance program revisions. Operators would have to show they are recording these blending repairs if they wish to take advantage of successive blending allowances.

A related concern is the methods by which air carriers report corrosion findings. For example, some FAA offices will not allow air carriers to report corrosion findings electronically to the aircraft manufacturers.

All of these issues, and others that were identified as part of this research, support the need to develop harmonized definitions using standardized language for common problems. Though the Level 1 definition for corrosion was changed in MSG-3, any revised definitions may have to be submitted to the International MRB if they result in a change to MSG-3. This will most likely require the development of an issue paper by the FAA.

Another area that was examined as part of this research was the effect of these proposed changes on damage tolerance (DT) regulations such as 14 CFR 25.571. For example, with Level 1 repairs, the amount of material loss during the blending process does not affect the strength requirement; therefore, this would not require DT considerations. However, a Level 2 corrosion repair that would necessitate a major repair to restore the structural integrity and function of the structure may require a DT inspection or task.

1.3 METHODOLOGY

FJLG reviewed the ADs that triggered the CPCPs and used its contacts in the aviation industry and among CAAs to obtain materials necessary for this research, such as OEM manuals to gather the various corrosion definitions. FJLG also looked at what European Aviation Safety Agency (EASA), Agência Nacional de Aviação Civil (ANAC) of Brazil, and Transport Canada Civil Aviation (TCCA) have issued in terms of requirements in this area. These countries represent the state of manufacture for the majority of aircraft in air carrier service today. FJLG also reviewed the IMRBPB Issue Paper 119 as a starting point to create a baseline that describes the issues and current industry practices.

FJLG has developed this report to provide the FAA with sufficient information to build on the results of the research and develop additional guidance material. This report includes the following:

- The nature and extent of inconsistent application of CPCP policy and guidance.
- The differences in definitions and reporting requirements between manufacturers and CAAs.
- Recommendations for harmonized definitions and reporting requirements.
- Recommendations and best practices for the FAA to develop policy and guidance.

2. CPCPs

2.1 INTRODUCTION

The majority of experience with CPCPs has been in the U.S. airline industry, but it has spread to air carriers throughout the other parts of the world. CPCPs have also been incorporated into all aircraft whose maintenance programs have been developed using the MSG-3 methodology, including air carrier and corporate aircraft.

CPCPs came into sharp focus with the explosive decompression experienced by Aloha Airlines Flight 243 on April 28, 1988. The U.S. National Transportation Safety Board (NTSB) identified the cause of that decompression as metal fatigue exacerbated by crevice corrosion, in particular the disbonding and subsequent fatigue damage of a fuselage lap joint. During the investigation, the NTSB found that line maintenance personnel accepted the classic signs of ongoing corrosion damage as a normal operating condition. At that time, a program to control and prevent corrosion of the entire aircraft was not available. The corrective action for corrosion findings was often deferred with no record of the basis for deferral.

Prior to 1988, the industry lacked focus on preventing and controlling corrosion, and the FAA lacked compelling evidence that existing maintenance and inspection programs were not controlling corrosion at a safe level. Although many airplane manufacturers had provided maintenance programs for corrosion prevention and control, the FAA saw no reason to mandate such programs.

After the 1988 accident, the NTSB recommended that the FAA develop a model for a comprehensive CPCP that would be included in each operator's approved maintenance program. The aviation industry and CAAs formed the Airworthiness Assurance Task Force (AATF) to address issues related to aging aircraft. Among the issues addressed by the AATF was the need to develop baseline CPCPs. The AATF identified 11 specific airplane models (the Airbus A-300; British Aerospace BAC 1-11; Boeing 707/720, 727, 737, and 747; Fokker F-28; Lockheed L-1011; and McDonnell Douglas DC-8, DC-9, and DC-10) based on findings that the initiation and spreading of corrosion in the metallic structures of those airplanes created an "unsafe condition." As a result, the FAA issued ADs that mandated specific CPCPs for those 11 airplane models.

The AATF later was renamed the Airworthiness Assurance Working Group (AAWG) and was tasked by an FAA Aviation Rulemaking Advisory Committee to develop recommendations on whether new or revised requirements and compliance methods for CPCPs should be instituted and made mandatory [1]. The AAWG recommended in their report to the FAA that the CPCP task be considered closed. CPCPs were being proposed or adopted for all of the affected aircraft through the AD process, and the FAA was proposing a regulation for commercially operated air transport category aircraft that would require CPCPs to be approved and incorporated into each aircraft type's maintenance program. The AAWG endorsed this proposed rulemaking effort because it would provide the FAA with explicit regulatory authority to mandate comprehensive CPCPs.

The FAA did issue a Notice of Proposed Rulemaking (NPRM) in October 2002 [2] with a requirement to include FAA-approved CPCPs in operators' maintenance or inspection programs. However, the proposal was withdrawn in 2004 because the FAA's safety objectives were met through the incorporation of CPCPs in maintenance programs through the MSG-3 process for airplanes for which the FAA did not mandate CPCPs by AD; there was no need for further regulation.

2.2 CPCP ADs

A CPCP is a systematic approach to prevent and control corrosion in an aircraft's primary structure. The objective of a CPCP is to limit deterioration due to corrosion to a level necessary to maintain airworthiness and, when needed, to restore the corrosion protection schemes for the structure. CPCPs contain specific tasks, are part of an aircraft's maintenance program, and require a baseline zonal inspection program. The programs are self-correcting and are based on a set of industry-developed definitions that require certain maintenance actions to sustain the continued airworthiness of the airplane structure. CPCPs also contain specific reporting requirements.

A typical CPCP AD requires an operator to incorporate a baseline CPCP into its maintenance or inspection program. The baseline CPCP, developed by a manufacturer for all operators of a particular model of airplane, consists of corrosion prevention and control tasks; definitions of corrosion levels; compliance times (implementation thresholds and repeat intervals); and reporting requirements. After an operator has incorporated a baseline CPCP into its maintenance or inspection program, the ADs allow adjustment to the required repeat intervals of the CPCP, provided the maintenance program is maintaining corrosion at an acceptable level. The FAA has determined that corrosion damage occurring between successive inspections that is local and can be reworked or blended out within allowable limits (as defined by the manufacturer or the FAA) is an acceptable level of corrosion. In broad terms, these allowable limits of corrosion damage are defined as Level 1 corrosion.

The following examples show some of the compliance information issued by CAAs to mitigate unsafe corrosion in aircraft they have certified. CAAs of many nations that certify transport category aircraft have issued ADs related to CPCPs. Originally, CPCP ADs were issued when approved CPCPs did not exist or were not part of an operator's maintenance program. Today, in most cases, the implementation of the original ADs have succeeded in their goal of reducing corrosion and have also provided a means to integrate corrosion prevention practices into Maintenance Review Board Reports (MRBRs) and MPDs. Over the years, CPCP ADs have been modified as a result of safety information reported by operators to manufacturers, whereas other ADs have been revised by adopting terminating actions that were found to be effective.

The FAA issued CPCP AD 90-25-05, Amendment 39-6790 (55 FR 49268, November 27, 1990), which requires implementation of a CPCP contained in Boeing Document Number D6-35999, titled "Aging Airplane Service Bulletin Structural Modification Program –Model 747."

Another AD, 12-NM-008-AD, was issued by the Direction Générale de l'Aviation Civile (DGAC) of France, for Dassault Aviation Model Mystère-Falcon 50 airplanes. This AD was prompted by a manufacturer revision to the airplane maintenance manual (AMM) that introduced new/more restrictive maintenance requirements and airworthiness limitations. The AD is based on another DGAC-issued AD, which was AD F-2004-162 (EASA approval number 2004-10117). The AD required operators to comply with a new CPCP approach that was introduced in MF50 AMM chapter 5-40 at revision no. 21.

TCCA has also issued CPCP ADs for aircraft they have certified, including TCCA AD CF-2007-06, titled "Corrosion Prevention and Control Program," that applies to Bombardier Inc. DHC-8 aircraft, Models 101, 102, 103, 106, 201, 202, 301, 311, 314, 315, serial numbers 003 and subsequent. The purpose of that AD was to maintain corrosion to Level 1 or better and incorporate CPCP into each operator's approved maintenance schedule within 12 months of the effective date of the AD. According to the AD, Bombardier developed the CPCP in Part 1 of the aircraft's Maintenance Program Manual, PSM 1-8-7, 1-82-7, 1-83-7, which was accepted by TCCA on June 22, 2005.

ANAC issued AD No. 2006-10-01R2 (Amendment 39-1296) for Embraer models EMB-110 (FAB C-95), EMB-110C, EMB-110E, EMB-110F, EMB-110P, EMB-110B1, EMB-110S1, EMB-110P2, EMB- 110K1, EMB-110P1, and EMB-110 airplanes. The reason for issuing the

AD was that there had been cases of corrosion discovered in the wing-to-fuselage attachments, vertical stabilizer to fuselage attachments, Rib 1 half-wing, and passenger seat tracks of these model aircraft. The AD stated that such corrosion could lead to subsequent cracking of these parts, which would compromise the aircraft's structural integrity and, in turn, lead to structural failure/loss of certain control surfaces. The AD mandated that operators incorporate a modification to their approved maintenance plan to inspect for corrosion of the specified portions of the aircraft and, if applicable, remove the detected corrosion. This AD permitted previous accomplishment of Embraer Alert Service Bulletin No. 110-00- A007 original issue, or further revisions approved by ANAC, or the implementation of the tasks required by Section VI of Maintenance Planning Guide Transport Publication (TP) 110P2/145, PM 110/652 or PM 110/165, released by Embraer, as an acceptable means of compliance with the requirements of the AD.

2.3 CORROSION DEFINITIONS

Each CPCP, whether originally mandated by AD or later incorporated into the MPD for an aircraft, includes certain definitions to lay the groundwork and baselines for the programs. Corrosion is a progressive condition and generally becomes more serious as it moves deeper into the grain of the affected metal. Therefore, different levels of corrosion are defined: Level 1 being the least serious, Level 2 being increasingly problematic, and Level 3 being the highest. However, these definitions were never standardized, although they are largely well understood by CAAs, manufacturers, and the industry.

The lack of unified definitions has not been a problem for operators whose FAA Certificate Holding District Offices are flexible and allow some variations in the maintenance programs they have accepted. However, the operators that have less flexible certificate management have encountered problems. The variation in definitions is not significant, and several examples are presented in appendix A. Although most operators have migrated to the MSG-3 maintenance program and use the MSG-3 definitions, this research revealed that the lack of standardization is still a problem. Therefore, some alternate definitions are proposed in section 4 of this report.

2.4 FAA REGULATIONS

The FAA's Aging Airplane Program for transport category airplanes includes several regulatory initiatives related to structural fatigue, corrosion, aging systems, and wiring. Three major factors prompted the FAA's development of this program:

- Airplanes were being operated beyond original design service goals
- Original maintenance plans were not required to address potential age-related issues
- The 1988 Aloha accident

In 2005, the FAA finalized its Aging Airplane Safety Rule (AASR) [3]. The FAA issued this rule after a long period of development to comply with the statutory requirements placed on the FAA by Congress in the Aging Aircraft Safety Act (AASA) of 1991. Section 402 of the AASA requires the administrator to "initiate a rulemaking proceeding for the purpose of issuing a rule to assure the continuing airworthiness of aging aircraft." The AASR ensures the continued structural airworthiness of airplanes operating beyond their original design service goals.

In addition, the FAA found it necessary to initiate a consistent approach to preserve the continued airworthiness of airplane structures that are susceptible to fatigue cracking and could contribute to a catastrophic failure. Supplemental inspection requirements were added to 14 CFR 121, 129, and 135, requiring operators to use DT-based inspections and procedures to maintain the continued airworthiness of aircraft operated under those operating certificates.

During the rulemaking process for the AASR, the FAA reviewed its overall Aging Airplane Program and decided to withdraw the CPCP proposed rule [2]. The FAA's position was that the ADs that mandate CPCP programs combined with the revisions to maintenance programs by individual TCHs, the revisions to MSG-3, and the regulatory requirements for the operator to follow its maintenance program, provide sufficient guidance and input for operators to maintain the continued airworthiness of their aircraft. The final AASR removed language regarding reporting requirements in 14 CFR 121.368, 129.33, and 135.422 for operators to provide the current status of CPCPs as a separate item. Instead, the FAA specified that operators should provide this information as part of the required current inspection status of each airplane.

In 2007, the FAA issued 14 CFR 26, which requires design approval holders (DAHs) to make available to operators the DT data necessary for repairs and alterations to fatigue-critical airplane structures [4]. Known as the "DT rule," 14 CFR 26 supports operators' compliance with the AASR with respect to the requirement to incorporate into aircraft maintenance programs a method to address any adverse effects repairs and alterations might have on fatigue-critical structures. Though not directly related to this research, the 14 CFR 26 requirements are important because of their impact to the overall aging aircraft program with which operators have to comply.

2.5 FAA GUIDANCE

2.5.1 FAA Orders

FAA Internal Orders are directed primarily at its aviation safety inspector (ASI) workforce. Order 8900.1, the Flight Standards Information Management System (FSIMS) [5], is the FAA ASI's handbook and directs the oversight, certification, and other technical responsibilities of ASIs. However, it is always good practice for the industry to be aware of the contents of the Order and use it as a reference, even though they are not the intended audience of the handbook.

For example, Section 1 of Volume 3, Chapter 43, in FAA Order 8900.1, titled "Evaluate a Part 121 and Part 135 Continuous Airworthiness Maintenance Program," provides information, policy, and guidance for an ASI to evaluate an operator's continuous airworthiness maintenance program (CAMP) according to applicable 14 CFR regulations and FAA policy. Volume 6, Chapter 2, Section 28, of the Order, titled "Monitor Continuous Airworthiness Maintenance Program/Revision," provides guidance for ASIs to ensure that an operator's total CAMP includes the maintenance/inspection tasks necessary to maintain its aircraft in an airworthy condition. The Order lists the key areas of a maintenance program, including aircraft inspection requirements for structural inspection documents. The guidance instructs each responsible ASI to ensure that the operator they oversee incorporates the additional age-related structural inspections into its scheduled inspection program.

FAA Order 8300.12 [6] establishes the criteria and requirements for approval and surveillance of CPCPs as directed by ADs. The Order describes the interfaces and regulatory relationship between FAA Aircraft Certification Offices (ACOs), FSDOs, and the ASIs responsible for oversight of operators' maintenance programs. It also delves into the background of CPCPs and provides a good discussion of CPCP baseline programs and implementation. The Order stresses that an effective CPCP should consistently find corrosion no greater than Level 1 during repeat intervals. It also provides information to FAA personnel on how and when to adjust inspection intervals based on the level of corrosion found during an inspection task if it is greater than Level 1.

FAA Order 8300.12 establishes a definition for Level 1 corrosion that allows rework and blending within allowable limits and refers to the manufacturer's structural repair manual (SRM) and SBs. This is a more liberal approach and provides more information than MSG-3. It also provides the ASI with the understanding that rework and blending can be accomplished by the air carrier or by a repair station performing maintenance under the air carrier's program using methods, techniques, and practices prescribed in the current manufacturer's maintenance manual; instructions for continued airworthiness prepared by the manufacturer; or other methods, techniques, and practices in accordance with 14 CFR 43.13. Though these definitions may be helpful to FAA personnel, they are not found in a document that is intended for industry to follow.

2.5.2 FAA Advisory Circulars

There are relatively few FAA Advisory Circulars (ACs) specifically related to corrosion on aircraft and engines. For example, AC 91-56B [7] provides guidance material to DAHs and operators to use in the development of a DT-based Supplemental Structural Inspection Program (SSIP) for older airplanes. It also describes other elements of a continuing structural integrity program that support the safe operation of transport-category airplanes throughout their operational lives. Though AC 91-56B pertains to the operators and DAHs of transport category aircraft, it can also be used by other sectors of the industry, such as operators of normal-, acrobatic-, utility-, and commuter-category airplanes.

AC 91-56B also provides the background that led to the issuance of the first CPCP ADs. However, the primary purpose of the AC is to provide information to an operator/DAH to develop an FAA-approved SSIP that takes into account DT inspection requirements as a result of the AASR; the repair assessment program; CPCP; and repairs, alterations, and modifications.

AC 43-4A [8] was revised in 1991 and summarizes data regarding the identification and treatment of corrosion on aircraft structures and engines. It contains technical information on corrosion theory, the development of corrosion, and the definition of the different types of corrosion and how it attacks metal.

Though the reviewed FAA guidance provides good information to the FAA workforce, manufacturers, and operators, the information is scattered and does not address the current industry practices discussed in this report. Furthermore, these guidance documents do not address or consider other definitions of corrosion levels put forth by various manufacturers and other CAAs.

2.6 INTERNATIONAL CIVIL AVIATION ORGANIZATION REQUIREMENTS

2.6.1 General

The International Civil Aviation Organization (ICAO) minimum airworthiness standards for airworthiness certificates are contained in Annex 8 Airworthiness of Aircraft [9], titled “Type Design or Manufacture of Aircraft,” which provides the basis for the development of national airworthiness regulations and rules that specify the scope and detail necessary for individual states to follow for the certification and continuing airworthiness of individual aircraft. As specified in Annex 8, national airworthiness regulations and rules must specify that the State of Registry is the sole authority responsible for ensuring that every aircraft on its registry conforms in all essential respects with its certificated type design. Furthermore, the State of Registry is responsible for ensuring that every aircraft on its registry is maintained in an airworthy condition throughout its service life.

ICAO refers to the conditions and limitations of the approved type design as specified in the CAA-approved type certificate (TC) data sheet. This information is part of the TC and is mandatory for the safe operation and continued airworthiness of the aircraft.

Annex 8 requires the following information to be documented in a form and manner prescribed by the CAA, and subsequently made available to operators of aircraft:

- a) Limitations and procedures necessary for a safe flight operation because of design, operating, or handling characteristics, including those necessary to maintain compliance with the approved noise limits, if applicable. This information is usually provided in the aircraft flight manual, mass and balance manual, and master minimum equipment list;
- b) Limitations and procedures necessary for a safe ground operation and maintenance such as:
 - 1) Mandatory replacement times for structural parts, structural inspection intervals, and related structural inspection procedures (usually identified in an airworthiness limitations document);
 - 2) Mandatory maintenance tasks to be performed at predetermined intervals, as established during the type certification process (usually identified as certification maintenance requirements); and
 - 3) Instructions for continued airworthiness of the aircraft, engine and propeller (usually contained in maintenance review board report), descriptive data and accomplishment instructions for the maintenance, servicing, inspection and repair (usually contained in the aircraft/engine/propeller maintenance manuals, engine installation manual, and structural repair manual).

- c) A continuing structural integrity program, including specific information concerning corrosion prevention and control, necessary for the continued airworthiness of airplanes with more than 5,700 kg maximum certificated takeoff mass (as required in ICAO Annex 8, Part II) [9].

ICAO requires a structural integrity program that includes information concerning corrosion prevention and control from the type design organization for the owner/operator to ensure that an airplane's structural integrity will be maintained over the operational life of the airplane.

Depending on the structural design criteria for the airplane, the continuing structural integrity program should include:

1. Supplemental inspections
2. Corrosion prevention and control
3. Structural modifications and associated inspections
4. Repair assessment methodology
5. Widespread fatigue damage review

According to ICAO, the CPCP should be initiated as early as possible in the service life of an airplane and should preferably be available when the airplane is introduced into service.

2.6.2 ICAO Aircraft Structural Inspection Program Requirements

For structures with reported cracking, corrosion, or wear, the threshold and recurrent inspection interval (i.e., initial inspection and periodicity for repeat inspections) should be determined by analysis of the service data and available test data for each individual case, as appropriate.

For corrosion inspection and control, the threshold is established on the basis of worldwide fleet experience and expressed in calendar time. The CPCP should contain recommendations for the definition of corrosion levels, inspection techniques, re-application of protective treatments, and recording and reporting of findings. The definitions for corrosion levels specified by ICAO can be found in appendix A of this report.

2.7 EASA REQUIREMENTS

Historically, there has always been Joint Aviation Authorities (JAA) membership, as well as European operators and industry representatives, participating in the AAWG. However, recommendations for action focused on FAA operational rules, which are not applicable in Europe. Therefore, EASA decided to establish the European Ageing Aircraft Working Group (EAAWG) to implement aging aircraft activities into the JAA regulatory system. This resulted in amendments to Joint Aviation Requirement OPS Subpart-M and then to Part-M. The current Alternate Means of Compliance (AMC) document 20-20 [10] is based on EAAWG's work with subsequent revisions to accommodate developments in the philosophy of aging aircraft.

Just like the FAA and other CAAs, EASA continually works to maintain the structural integrity of older aircraft on an international basis. Senior EASA policy makers participate in the IMRBPB, aircraft MRBs, and rulemaking activities regarding aging aircraft. These workgroups

allow for an exchange of in-service information that often results in subsequent changes to inspection programs for European manufactured aircraft.

EASA is currently involved in the rulemaking process with Notice of Proposed Amendment (NPA) 2013-07 [11] regarding aging aircraft structures. NPA 2013-07 addresses safety issues related to aging aircraft structures for large airplanes. It proposes amendments to EASA Part 21, Part 26, Certification Specification (CS) 26, CS 25, AMC 20-20, and the AMC to Part-M to ensure that the safety risks associated with the aging aircraft issues are mitigated appropriately.

The EASA proposal is different from the FAA's AASR in that it requires all TCHs/applicants for a TC to create an ALS, perform a fatigue and damage tolerance evaluation (DTE) of the airplane structure, and include the DTE in the ALS. FAA 14 CFR 26 does not require the DTEs to be part of the ALS. The EASA proposal also requires each TC holder to establish a baseline CPCP that requires the identification of fatigue-critical structure and ensures unsafe levels of fatigue cracking will be precluded in service.

Proposed language for EASA Part 26 establishes a definition for a CPCP program, which states that the CPCP prevents and controls corrosion in an aircraft's primary structure. The CPCP consists of a basic corrosion inspection task, task areas, defined corrosion levels, and compliance times (implementation thresholds and repeat intervals). EASA's proposed Part 26 also requires the revision of an owner/operator's maintenance program to include applicable inspections or maintenance procedures issued by the TCH and a CPCP that takes into account the baseline CPCP issued by the TCH in compliance with EASA Part 26. The CSs, which are guidance material issued by EASA to provide explanations on compliance demonstration, were developed for the corresponding Part 26 paragraphs and follows the principles proposed in NPA 2012-13.

With respect to CPCPs, CS 25 provides a definition of Level 1 corrosion and a requirement that the ALS must include a statement that requires operators to include a CPCP in their maintenance program that will ensure corrosion is controlled to Level 1 or better. Compliance with the proposed rule can be achieved through a baseline program established according to AMC 20-20.

Today, EASA's AMC 20-20 provides an alternate means of compliance for the establishment of a CPCP program. It provides guidance to the TCH on the development of an inspection program that includes the frequency and extent of inspections necessary to provide for the continued airworthiness of aircraft. AMC 20-20 also gives operators a choice to adopt the baseline program provided by the TCH, or they can choose to develop their own CPCP. In developing their own CPCP, an operator may join with other operators and develop a baseline program similar to a TCH-developed baseline program for use by all operators in the group. Appendix 4 in AMC 20-20 also provides guidance to operators and DAHs that are developing and implementing a CPCP for airplanes maintained in accordance with a maintenance program developed in compliance with the continued airworthiness requirements found in Part M.A.302 that governs the requirement for an approved maintenance program.

A short review of EASA AD 2012-0036 [12] concerning CPCP for Jetstream series 3100 and 3200 aircraft was completed for this report. The purpose of this review was to compare the way EASA and FAA issue ADs. This specific AD resulted in finding considerable corrosion

problems in the rudder upper hinge brackets on the aircraft. The problem appeared to be related to drain holes being clogged. However, the purpose of the AD by EASA was the same as the FAA's concerns for detecting corrosion.

2.8 CANADIAN REQUIREMENTS

TCCA provides several documents to industry for use in the development of maintenance programs. The "Maintenance Schedule Approval Policy and Procedures Manual" [13] and TP 13850 [14] were reviewed for this report.

TP 13850 provides acceptable procedures and guidelines for developing scheduled maintenance instructions as part of the process for showing compliance with the ICA requirements of aircrafts that are type-certified or intended to be type-certified in Canada. It requires that the scheduled maintenance instructions be developed in accordance with an MRB process, a Maintenance Type Board process, or a manufacturer's internal process, and be published as either an MRBR or as manufacturers' recommendations and included within an aircraft's ICA.

TP 13850 is not a regulatory document; it is included by reference as part of Canadian Aviation Regulation Standard 625 [15]. This document is different than FAA or EASA documents in that it does not provide details about CPCP or definitions. Its basis is the development of the MRBR through the use of the MSG-3 process. It could be inferred that the definitions in MSG-3 are the same as those used in the development of the MRBR TCCA type-certified aircraft.

The TP 13850 document provides guidance to TCCA and industry personnel in the development and approval of aircraft maintenance schedules. This document differs in that it is a policy and procedure manual on how to obtain approval of a maintenance schedule. TP 13850 only mentions CPCP as part of what is required for the contents of the maintenance schedule.

2.9 BRAZILIAN REQUIREMENTS

The following documents issued by the ANAC of Brazil were reviewed for this report:

- Various Brazilian ADs (Diretriz de Aeronavegabilidade)
- Various Brazilian ACs (Instrução Suplementar)
- Brazilian inspector guidance (Manual do Inspetor: Manual de Procedimentos)
- Brazilian regulations (Regulamento Brasileiro da Aviação Civil)

Because they are all published in Portuguese, the documents were scanned to look for words related to corrosion, such as "CPCP" and "corrosão" (corrosion in Portuguese), with help from a native speaker (who is not an aviation maintenance expert) to determine their applicability.

There was little relevant information available on ANAC websites related to corrosion and CPCPs. However, what is interesting about the Brazilian regulations is that the authority there has incorporated some regulations found in 14 CFR; the incorporated regulations were not translated into Portuguese, which could have changed some of the meaning. For example, U.S. 14 CFR 25 has been incorporated in English as Brazilian RBAC 25 and is a verbatim copy of the U.S. regulation. In fact, the English text, as amended by the FAA, is considered the primary and

guiding reference rather than the Portuguese translation. Therefore, for all intents and purposes, Brazilian certification requirements for large transport aircraft are identical to those of the United States. It would then be logical to conclude that Brazilian corrosion program requirements are also similar to those of the United States.

3. INDUSTRY ISSUES RELATED TO CPCPs

3.1 AIR CARRIERS

Interviews conducted with personnel of air carriers with different fleets revealed inconsistencies in the manner in which CPCPs are managed. However, most air carriers use similar methods to address Level 1 corrosion. In such cases, the mechanic assigned to the aircraft identifies corroded components and marks the area that will need blending. Some air carriers use corrosion preventive compounds; prime and paint corroded areas; and then return the aircraft to service, making appropriate notations in their CAMP. One air carrier uses a similar technique but adds a specific color dye to the blended area to help identify the area in the future. Typically, Level 1 corrosion is not reported to the air carrier's FAA Certificate Management Office (CMO). However, the manufacturer is normally provided a report on the location where the corrosion was found.

In discussions with one air carrier's Director of Maintenance concerning CPCP programs, he described some of the issues his air carrier had experienced with differences in Level 1 corrosion definitions among manufacturers. Many of the issues were related to the FAA's oversight of the corrosion programs. He stated that there appears to be a disconnect between the FAA and some operators at the air carrier level. The typical 14 CFR 121 CAMP requires an operator to report Level 2 and Level 3 corrosion to the manufacturer. However, Level 1 corrosion is addressed using an aircraft's ICA for return to service. This action is documented in the aircraft's logbook and captured under its reliability program, which is typically shared with the manufacturer. The difficulty is that some ASIs do not fully understand why the programs are set up in this manner. Level 1 corrosion can be addressed by the air carrier in all cases without any safety concerns by following the ICA provided by the manufacturer. This level of corrosion should trigger no changes to manufacturer corrosion programs. The Director also stated that Level 2 corrosion can also be addressed by following the manufacturer ICA in most cases; however, these must be reported to the manufacturer so that it can analyze the data and assess the findings for impact to airworthiness. This analysis may lead to inspection interval changes or revision of the ICA. Level 3 corrosion is different and must be reported to the manufacturer; in most cases, the Level 3 corrosion will require specific instructions from the manufacturer or an FAA Designated Engineering Representative, who often works for the manufacturer, to generate the approved data for the repair and return to service. In most cases, Level 3 corrosion will trigger a revision to the aircraft's inspection program.

Air carrier personnel explained that a common misconception is that most corrosion is found in aircraft cabin areas, specifically in the seat tracks of passenger aircraft as a result of spilled liquids and other debris. However, the majority of the corrosion is found in aircraft galleys; the passenger cabin is the next area of concern. One air carrier, noticing an increase in corrosion findings, contacted the manufacturer to review the issue. The problem was alleviated by the manufacturer attaching a carbon film to the floor structure, which helped to improve the CPCP.

One operator indicated that there are no consistent methods of dealing with Level 1 corrosion processing. When dealing with an inspection process for a specific area of the aircraft, it is common to find corrosion in an area not specifically identified on the maintenance job cards. This process adds another maintenance task to accomplish.

There is no consistent method for identifying an area of the aircraft that has been subject to Level 1 corrosion blending. For example, one airline uses purple dye to identify an area where blending has been previously accomplished in case future blending is required. The Manager of Technical Services for this airline indicated that different airlines use different methods for highlighting a blended area. The absence of a standardized method for indicating blended areas could cause issues when aircraft are sold or leased to different parties.

The subject of MSG-3 and how it pertains to CPCPs was also discussed. One manager of Technical Services believes that both MSG-3 and CPCP are good programs. However, they reported that one issue that has been identified is the repeated blending of an area, which could cause a major repair over time, and how it is addressed.

Another airline's Director of Maintenance who was contacted provided this information, in part [17]:

With light corrosion, that can be addressed in accordance with the SRM. This would involve light blending, treating the area of corrosion [with] preventive compounds, prime, and paint. This scenario does not involve removal of a lot of material so it is considered minor in nature, and most carriers would not mark this area and simply make the required documentation under their CAMP.

There is no standardization in the identification or marking of areas considered Level 1 corrosion. Though each of the airlines contacted follow the SRM requirements for documentation concerning the blending of the corrosion area, the process beyond the corrosion repair is subject to interpretation by each airline.

The Director of Maintenance for one airline indicated that corrosion above Level 1 involves greater corrective action, including the removal of material, causing a change in the strength of the affected area. This can include removal and replacement of skin/stringers in severe cases. The corrective actions for such cases would be considered major repairs and would have to be documented and reported on the air carrier's major repair list. Not all air carriers mark the blended areas, but they are required to accurately document and report the repairs.

This operator's position is supported by 14 CFR 121.380, which requires anyone selling or leasing an aircraft to deliver the aircraft with all major repairs identified. The advanced computer recordkeeping systems that most airlines use today make finding corrosion repairs relatively easy. Furthermore, receiving airlines must accomplish due diligence before accepting any aircraft.

With respect to Level 1 corrosion and the early detection and remedy process, manufacturers continue to have similar approaches to the blending and return-to-service process. One airline

manager explained that their approach to Level 1 blending is “the use of the SRM, which generally prescribes removal of the corrosion through mechanical means (sandpaper, scotch bright, etc.) then treat the area with a corrosion preventive compound, primer and paint.” He also stated that “the material removed is very minimal and has no effect on skin, primary structural element, or fastener strength.” He also confirmed that the data used to develop the original MSG-3 maintenance program established limits for Level 1 corrosion and that revised ICA are not required for maintenance and inspections [17].

3.2 CORPORATE OPERATORS

A number of corporate aviation CPCPs were reviewed for this study to determine how they compare with those in the scheduled air carrier environment. The corporate aviation CPCPs provide focus on specific areas of the CPCP and categorize a higher level of concern for various areas of an aircraft such as avionics compartments, battery compartments, landing gear, and other areas that are more susceptible to corrosion. The importance of inspecting for corrosion in internal areas that are not easily accessible is clearly identified within CPCP documents as a concern for both the manufacturer and operators.

To increase safety, some commercial operators have reduced the inspection cycle time as a result of their operational environment. Level 1 corrosion identification and resolution appears to follow the current manufacturer’s maintenance manuals. For those operators outside of the 14 CFR 121 environment and operating under 14 CFR 91, there is a focused inspection process into areas that their operational environment dictates.

3.3 U.S. DEPARTMENT OF DEFENSE

To have an understanding of the CPCP process and how other aviation sectors handle the issue of corrosion, U.S. military documents that address corrosion control were reviewed for this study. Some military CPCP initiatives revealed that the military alone sees costs related to corrosion damage to be between \$10 and \$20 billion annually. The monetary value is cumulative for equipment damage to both aircraft and other vehicles within the inventory. The U.S. Department of Defense directive 5000.1 [16] requires that the acquisition process include provisions for CPCP mitigation and lifecycle determination. However, directive 5000.1 does not specifically address different corrosion levels.

3.4 ORIGINAL EQUIPMENT MANUFACTURERS

A review of Airbus and Boeing documents revealed that they have different instructions concerning Level 1 corrosion. Furthermore, some manufacturers (such as Embraer) expand their SRM guidance on Level 1 corrosion to include a specific material, the type of corrosion that would be most common on that material, and what the appearance of corrosion would look like on that type of material.

For example, the Embraer ERJ 145 SRM provides a fairly detailed explanation of the types of corrosion and the characteristic appearance of corroded surfaces (see table 1).

Table 1. Types of corrosion

Material	Type of Corrosion	Appearance of Corrosion
Aluminum alloy	Pitting, intergranular, exfoliation, stress corrosion, fatigue cracking, and fretting corrosion	White-to-gray powder
Titanium alloy	Halogen solution (chloride, principally) contact may result in degradation of mechanical properties	Colored surface oxides develop above 370°C (700°F)
Low alloy steel	Surface oxidation; crevice and pitting corrosion; and stress corrosion cracking	Reddish-brown oxide (rust)
Stainless steel	Crevice corrosion, intergranular cracking, surface corrosion, and some pitting in marine environments	Rough surface, brown stain
Cadmium plating on alloy steel	Surface oxidation and hydrogen cracking embrittlement	White powder and cracks

Other SRMs of regional aircraft do not have the same level of identification. Based on the documents reviewed for this report, there is some variation in the level of information available to air carriers by the manufacturers.

Furthermore, when comparing the manuals of different aircraft, such as Bombardier CRJ and Embraer Regional Jet, some differences in the Level 1 corrosion program requirements can be found. For example, the CRJ SRM and the Embraer Corrosion Prevention Manual were compared. Each manual approaches the subject of Level 1 corrosion in a similar but slightly different method. One manual defined the process as being reworked or blended out within allowable limits as defined by the manufacturer, and does not require structural reinforcement or replacement. The other manual identifies Level 1 as damage occurring between successive inspections that is localized or widespread, and can be reworked or blended out within the allowable limits as defined in the SRM for the component.

3.5 REGULATORS

Various regulators also define corrosion differently. For example, the EASA 20-20 manual mirrors FAA Order 8300.12 in the initial Level 1 description, but provides additional guidance for an event that is not typical of an operator's use of aircraft in the same fleet.

Discussions with air carrier personnel revealed that there are different approaches and requirements by the various OEMs to address Level 1 corrosion. This highlights the predicament

that is placed on the FAA ASI when dealing with multiple models in an operator's fleet of aircraft. Standard practice is for the inspector to determine the most stringent requirements among the different models and require the operator or operators to maintain all of the models to the inspection requirement contained within that document. The lack of consistency could require an operator to adopt multiple programs or create one program using the most stringent requirement for the various models of aircraft.

Another major issue is the lack of a standardized process of identification used by the airlines for the marking of blended areas. One airline that was contacted uses one paint color to mark the blended areas but indicated that the airline may use whatever color they deem appropriate for the affected area. Perhaps a standardized approach to the identification of blended areas would be appropriate.

4. DEVELOPMENT OF NEW DEFINITIONS

4.1 ANALYSIS

The FAA originally proposed in NPRM 67 FR 62142 to mandate the approval of CPCPs by the FAA. This would have constituted an approved FAA maintenance program that would cover CPCP for all manufacturers and operators of 14 CFR 121 aircraft. The purpose of the NPRM was to expand the requirement for CPCPs to older airplane models that were not covered in previous ADs. In October 2004, the FAA withdrew the NPRM. The reason indicated by the withdrawal of the NPRM was that operators were incorporating the MSG-3 process to develop schedules for CPCPs. Therefore, the tasks are part of the operators' program accepted by the FAA.

The definitions in FAA Order 8300.12 neither align with the definitions found in EASA AMC 20-20, nor do they match the definitions that were listed in the FAA's NPRM 67 FR 62142 that was withdrawn. They also do not closely resemble the definitions that are used by Boeing in the MRB documents reviewed for this report.

4.2 DIFFERENCES IN LEVEL 1 CORROSION

When reviewing the differences in the definition of Level 1 corrosion, the baseline review began with the MSG-3, which was then compared with EASA AMC 20-20 and FAA Order 8300.12 to determine what areas were compatible with each other. Each attempts to provide a generalized definition for use by the operator and the regulatory authority.

In a document prepared by the IMRBPB Issue Paper on May 26, 2012 [17], Mr. Joel Maisonnobe from Dassault Aviation provided this analysis of the problems with definitions provided by MSG-3, EASA AMC 20-20, and FAA NPRM: "For an unidentified reason, the definition of Level 1 corrosion in the MSG-3 is more restrictive than the one adopted by the EASA in AMC 20-20 (Continuing Structural Integrity Programme) or the one that was originally proposed by the FAA in the NPRM 02-16 (67 FR 62142)." Mr. Maisonnobe went on to point out that the FAA NPRM in which the FAA proposed definitions was later cancelled because the FAA considered that the existing transport-category airplane CPCP programs developed through the MSG-3 were compliant with the intent of the NPRM.

The issue of lack of standardization, which can lead to different interpretations by the maintenance personnel assigned to do the work and the regulatory authority conducting a review, is clearly defined in this IMRBPB document. In addition, there are a large number of different agencies (military, civilian, manufacturer, etc.) with guidance filling the CPCP manuals identified in this review.

It is suggested in this IMRBPB and other articles that the MSG-3 definition is the most restrictive of the many definitions that have been reviewed for this report. The MSG-3 guidance concerning Level 1 corrosion, defines Level 1 corrosion as:

Corrosion damage that does not require structural reinforcement or replacement; or corrosion occurring between successive inspections exceeds allowable limit but is local and can be attributed to an event not typical of operator usage of other aircraft in the same fleet (e.g. mercury spill); or light corrosion occurring repeatedly between inspections that eventually leads to rework or blend-out that exceeds allowable limits [18].

Though this appears straightforward, it could present problems between the regulator and the airline if the airline developed a process of replacement rather than blending/repair of the associated part. Though the majority of the airlines' process of correction is the blending of the part and then return to service, some elect to remove and replace the part to expedite the process. The "remove and replace" approach on the part of the airline could create a problem with a regulator's strict interpretation of the MSG-3 definition.

The EASA definition provides three parts of corrosion repair explanations. The first part of the EASA Level 1 definition is similar to MSG-3 in meaning but not in context. The first definition states that corrosion can be worked out by blending and that the aircraft can be returned to service. The second part of the EASA Level 1 definition provides for corrosion damage that exceeds the allowable limit but can be attributed to an event not typical of the operators' use of aircraft in the same fleet. The third part of the EASA Level 1 definition focuses on the operator's experience, the result of which may be partially attributable to the air carrier's maintenance practices and the effectiveness of its maintenance program. EASA also establishes definitions for Level 2 and 3 corrosions.

A review of the Airbus 2007 MRB [19] for the A-318/319/320/321 series aircraft shows that the first part of the definition is comparable with the first part of the MSG-3 Level 1 definition. Airbus goes further than the MSG-3 language to define Level 2 using similar language found in the third part of the MSG-3 definition. The Level 3 definition is a policy statement that enables the operator to engage its maintenance program in determining what action to take.

As an additional baseline reference, FAA Order 8300.12 [6] has its own definition of Level 1. It states, "Level 1: Corrosion is damage occurring between successive inspections as defined by the manufacturer in a structural repair manual (SRM, service bulletin, etc)." In addition, the "Foreword" section of the document states, "This order establishes the criteria and requirements for approval and surveillance of Corrosion Prevention and Control Programs (CPCP), as directed by Airworthiness Directives (AD)." This provided a different approach to the way an operator or

the regulatory authority can interpret the intent of FAA Order 8300.12. This would require the operator to determine the intent of the instructions within that manual and if any of the SRMs address how to deal with corrosion. For regulatory authorities, Order 8300.12 is to be used for approval and surveillance of CPCP programs. This definition of Level 1 shows that there are multiple choices for the operator and the regulatory authority and that those choices are not in sync with each other.

The military review of Level 1 corrosion found that there are similar approaches to the way Level 1 is defined in the document, “Aging of US Air Force Aircraft” [20], published in 1997. The document contained references to maintain the corrosion level that would only require blending. The 1997 document further recommended that all commercial derivative aircraft be maintained in accordance with the OEM maintenance program, which would incorporate the Level 1, Level 2, and Level 3 corrosion programs. This recommendation was presented to the Secretary of the Air Force. In December 1998, Air Force Policy Directive 62-4 was published by order of the Secretary of the Air Force to establish the maintenance programs of the OEM in all Commercial Derivative Aircraft.

AD 90-25-01 [21] references the proposed definition per ATA MSG-3. Much of the first part of the definition comes from the wording contained in the third part of Boeing’s definition of Level 1 corrosion. The second part of the definition comes directly from the Airbus definition, which “exceeds allowable limit but is local and can be attributed to an event not typical of operator usage of other aircraft in the same fleet” [19]. The wording of the third portion of the definition is a single event not found in the other documents that were reviewed during this research period.

TCCA produced AC 521-009 [22] for Service Difficulty Reporting to provide instruction on Level 1 corrosion. This document is similar to the definition found in the Boeing Level 1 corrosion document and provides for reworked or blended within limits by the manufacturer.

There are multiple documents that are similar in the approach to Level 1 corrosion. Each of these documents has their own merit, but the definitions lack consistency. Simple word changes and incomplete instructions in the reference documents have made it difficult for airlines to apply a single corrective measure for Level 1 corrosion. This process has forced airlines to defend their interpretation of the definitions as opposed to the regulatory agencies providing oversight. Creating a single source of reference for Level 1 corrosion, even if it has two or three conditions in the definition, would reduce the friction between the operator and the regulatory authority.

4.3 PROPOSALS FOR HARMONIZED DEFINITIONS

The review of CPCP-related documents identified multiple definitions of Level 1 corrosion. Originally, the MSG-3, EASA, and ICAO definitions were most likely to provide the standard for U.S. and international maintenance programs. However, this has proven to not be the case. Some countries use MSG-3 as the basic definition and then add scenarios to expand, and in some cases clarify, the operational use of the corrosion program. Manufacturers follow the same basic framework for using the MSG-3/EASA 20-20 documents as their reference. However, because MSG-3 has a restrictive field of use for Level 1 corrosion, manufacturers have made minor expansions to the wording to meet the individual needs and scope of operations by including those additional Level 1 references in some of their SRM documents.

The research and analysis conducted for this report confirms that corrosion definitions are similar across the various documents related to governmental regulators and manufacturer programs, but they are not identical. This is a problem because air carriers and other operators are confronted with issues related to mixed fleets and, at times, a lack of knowledge on behalf of individual inspectors overseeing their operations. The individual inspectors are not necessarily to be blamed for their lack of flexibility in accepting harmonized corrosion definitions developed by operators, particularly those with mixed fleets. If some maintenance program instructions are vague, and the safety issues are real (after all, the Aloha accident was what precipitated the development of CPCP ADs), it is natural for inspectors to wish to err on the side of caution.

However, the FAA can recommend a standardized definition of at least Level 1 corrosion (the least concrete of the 3 levels and the one that is most open to variation and interpretation) through the ongoing MSG and MRB processes, so that a standard definition will be distilled from this process and established across manufacturers and authorities over time. This process might take some time, and some of it is outside of the FAA's control. In the meantime, a parallel approach could involve issuing guidance in the form of an AC (for example) that would present the issues related to CPCPs from the perspective of the manufacturer, operator, and the FAA, as the regulator. Because a significant part of the issue is one of education regarding the purpose and scope of CPCPs and the corrosion level definitions, establishing the most significant aspects of these programs (particularly for 14 CFR 25 transport category aircraft) could help serve as an effective reference to ensure that the regulator and certificate holders are clear with respect to the fundamentals of CPCP requirements.

Under this approach, the FAA could define the minimum requirements for a Level 1 corrosion and explicitly state that variations in language are acceptable as long as the minimum criteria are present. In this manner, existing inconsistencies in definitions could be accommodated until a harmonized definition is developed. Furthermore, additional language and requirements of Level 1 definitions would also be acceptable as long as they were more stringent. This also would accommodate certificate holders with mixed fleets who wished to settle on a single Level 1 definition, but not necessarily choose the simplest or most basic one because of variation in fleet composition (with a majority of aircraft under one CPCP and a few smaller subfleets under another).

Using the Level 1 definitions listed in appendix A of this report, such a standard definition would look as follows:

When individual areas of corrosion are discovered, they can meet any one of the following characteristics to be considered Level 1:

1. Corrosion damage occurring between successive inspections that is local and can be reworked/blended out within allowable limits. These limits need to be those defined by the manufacturer in its maintenance program or SRM, or those modified with FAA approval.
2. Corrosion damage is localized, but it exceeds allowable limits (as defined by the manufacturer in its maintenance program or SRM, or those modified with FAA approval) and can be attributed to an event that is not typical of the operator's usage of other airplanes in the same fleet. An example would be the spill of a corrosive agent that can be considered a one-time and isolated event.
3. Corrosion damage is similar to that which the particular operator has experienced over several years, but that the operator has demonstrated to be only light corrosion between successive inspections prior to this particular case. However, this latest inspection shows that cumulative blend-outs now exceed allowable limits (as defined by the manufacturer in its maintenance program, or those modified with FAA approval).

The emphasis in these three examples is on concepts rather than wording. As long as the three concepts are captured, variations in wording would be acceptable. It may seem curious to use more language than the original definitions to arrive at a standard definition of Level 1 corrosion. However, clearer and more specific language in these examples help to expand on the original concepts in a more understandable fashion.

Any advisory material associated with the expanded definition of Level 1 corrosion also could include several of the definitions listed in appendix A side-by-side with the expanded language and show point-by-point how each one of them meets the intent of the general definition within the AC.

Another approach to establishing a standard Level 1 corrosion definition would be to set a minimum definition and for the FAA to specify how definitions that included at least this language would be acceptable. For example, Level 1 corrosion could be defined as any one of the following, for a particular operator under its FAA-accepted maintenance program:

1. Corrosion damage on primary structure (as defined in the applicable SRM) that does not require structural reinforcement or replacement.

Note: This condition is still valid when replacement is not required but is chosen by the operator for convenience or economic reasons.

2. Corrosion that occurs on primary structures (as defined in the applicable SRM) between successive inspections exceeding allowable limits, but is local and can be attributed to an event that is atypical in other aircraft of the same fleet.
3. Light corrosion occurring on primary structures (as defined in the applicable SRM) repeatedly between inspections, eventually leading to rework or blend-out that exceeds allowable limits.

The concepts embodied in either of these Level 1 corrosion definitions would have to be incorporated into guidance for the FAA inspector workforce in the form of an Order or as part of Order 8900.1 (FSIMS). The FAA would also need to incorporate this expanded Level 1 corrosion concept into the training materials for all new airworthiness inspectors when they join the FAA workforce.

4.4 REPORTING REQUIREMENTS

An issue that dovetails with the definition of Level 1 corrosion (and that of other Levels) that was identified as part of this research is the use of certain terms that are commonly used in the industry to describe practices that relate to corrosion and how its effects are addressed.

For example, air carrier personnel expressed concerns about the removal of components that are “in the way” when a maintenance technician has to work their way back to the area of corrosion.

Another aspect of air carrier CPCPs is that when addressing Level 1 corrosion, some air carriers prefer to expedite the process and simply change out the affected part and replace it with a similar part. Then, the corroded part is sent back to the shops and blended, primed, inspected, and returned to the supply of available parts.

One practice that is also quite common is “remove for convenience,” which is when a panel or structural element is removed to accomplish a repair because of corrosion that is found during an inspection.

The reason to remove such corroded parts is critical with respect to the CPCP and its reporting requirements because it can result in changes to a maintenance program and an increase in the level of FAA scrutiny. Based on industry interviews presented in section 3 of this report, most of the time when parts with corrosion damage are removed for convenience, the reason is the practical expediency of sending the affected parts to a specialized shop where the work can be conducted in better lighting conditions with effective means to collect any waste material that is removed in the process and to facilitate access to certain areas of the part. The same work would be more difficult if the part was still on the aircraft; some areas of damage are more difficult to reach with the proper tools and materials. It is in the interest of safety for maintenance to be accomplished in the most ideal conditions possible, taking human and environmental factors into account, and avoiding shortcuts or incomplete repair work.

Problems can arise when parts are removed because of corrosion damage, because the act of removing the part could result in an interpretation that the corrosion automatically falls into a Level 2 classification. A Level 2 classification results in a mandatory report to the FAA and

elevates the issue beyond what may be necessary if the reason for the removal was a practical one rather than because of a higher level of corrosion damage. Without a proper definition of “remove for convenience,” some operators may be driven to repair some corrosion damage in situ, when it would be more advantageous to remove the part and accomplish the work in a shop to avoid the complication. At the same time, the FAA needs to be mindful of ensuring that the “remove for convenience” tag is not being misused either.

Another issue identified in this report is the ability of operators to report items, such as corrosion, electronically. In recent years, the FAA has permitted in other areas of maintenance the distribution of manuals and other maintenance data, as well as the storage and retrieval of maintenance records, up to and including the ability of operators and repair stations to record electronic signatures on maintenance records (see AC 120-78 [23]). Electronic data and records are much more flexible and lend themselves to further analysis, as necessary. The FAA should encourage electronic reporting of corrosion and possibly issue guidance to that respect either in the same AC regarding CPCPs for 14 CFR 25 aircraft, or as separate guidance to its inspectors via an FAA Order, for example.

Though FAA Order 8300.12 includes plenty of useful information for the FAA inspector workforce regarding the approval of CPCPs, there needs to be additional guidance for operators to assist them in the development, implementation, and updating of such programs along with further explanations and definitions in a document that is applicable to both certificate holders and inspectors. ACs provide an acceptable means to meet FAA regulatory requirements, and by presenting some of the FAA’s interpretation of issues related to CPCPs, some of which are presented in this report, misinterpretations and misunderstandings may be avoided. Both the certificate holder and the regulator want to achieve the same goals: a safe operation with an effective means to address corrosion both during maintenance and through feedback to the manufacturer to make further design refinements to existing or future aircraft. By creating more common ground, common language, and common understanding, these goals can come within closer reach.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

There are a number of differences among the many air carriers and manufacturers within the global network of airline Corrosion Prevention and Control Programs (CPCPs). Each has its merits, but there is little consistency or standardization of the process used by airlines or in the oversight by their state of registry.

Within the U.S. airline operations, it has been demonstrated that there are issues of interpretation with the different CPCP programs. As identified in this report, the methods used by each individual air carrier to provide maintenance continuity with the manufacturers’ programs, along with the requirements of Maintenance Steering Group-3 (MSG-3), Advisory Circular (AC) 8300.12, and other advisory documents, present a significant challenge for the operator maintenance programs and the FAA’s oversight.

Though the CPCP definition problem is not serious in terms of its impact on safety, it does decrease efficiency, which consumes resources that could better be used in other areas. In some cases, current CPCPs allow interpretation of the definition for Level 1 corrosion to the individual reader. In other cases, the FAA chooses the strictest reference for CPCP (even at an air carrier with multiple fleet types) and holds the operator to the single standard. Other aircraft manufacturer CPCPs are set aside while the FAA requires the operator to perform to the highest of the standards within the operator's maintenance program.

5.2 RECOMMENDATIONS

As a result of this study of CPCPs, a series of recommendations have been made to the FAA and are listed below:

1. The FAA should establish a set of definitions that are standard regardless of fleet type that will allow each air carrier to continue to perform maintenance and administer their own continuous airworthiness maintenance program (CAMP.) For corrosion, manufacturers and regulatory authorities should consider finding a common ground for identification, understanding, and remedial action for Level 1 corrosion. As described in section 4.2, the definition of Level 1 varies between aviation authorities and industry documents. The safety intent is not lost in these variances; however, a standard or common Level 1 definition would provide industry a common reference point. In addition to the common reference point, there should be a standard established for recurring issues with corrosion within a specific section of an aircraft.
2. The FAA should develop policy and advisory material that provides the flexibility for the air carrier to comply with the Maintenance Review Board Report (MRBR), acknowledging that each air carrier has its own maintenance program and is responsible for performing maintenance using the methods, techniques, and practices prescribed in the current manufacturer's maintenance manual or instructions for continued airworthiness prepared by the manufacturer; or other methods, techniques, and practices acceptable to the administrator. The air carrier accomplishes this task through its CAMP, which provides the actual technical instructions for the maintenance program, such as CPCP and removal of corrosion. CAMP also controls the administration of the program, such as training and designation of required inspection items. It is this part of the program that ensures the reporting of corrosion to the type certificate holder.

For this report, feedback was obtained about the lack of standardization in maintenance practices regarding the identification and mapping of corrosion, and of repairs made to address corrosion. However, air carrier personnel also understand their own unique programs and how they fit their operations, and would not welcome "too much" standardization (i.e., changes to their current way of addressing corrosion).

3. The FAA should consider reviewing the training programs for air carrier airworthiness aviation safety inspectors (ASIs) to ensure that they understand the purpose of CPCPs and how they integrate the MRBR and the air carriers' CAMPs. Training should include an allowance for intervals to be optimized and adjusted if corrosion is found during regular maintenance. The subjects of aging aircraft, CPCPs, and damage tolerance have

been around for some time now; however, the FAA ASI workforce has seen significant turnover and could benefit in a training course that integrates aging aircraft maintenance programs, MSG-3, and the Maintenance Review Board (MRB) process. Most importantly, the ASIs would benefit from a training course about their role in review and oversight of these programs.

4. The FAA should work with industry and other Civil Aviation Authorities to develop a standardized approach on how to address Level 1 corrosion findings. This could be accomplished through the International Maintenance Review Board Policy Board process. Developing a document that would “level the playing field” and is easily understandable would increase aircraft maintenance efficiencies and address safety problems. A standardized approach and document would address the terms and practices associated with CPCPs that have been identified as part of this research.
5. The FAA should review the requirements for reporting and take into account the industry practice of removing components “for convenience,” which is to allow for the corroded areas to be accessed more easily. This practice is in the interest of safety and should not be discouraged through overly strict reporting requirements. The purpose of reporting requirements to manufacturers and the FAA is to improve the CPCPs as more in-service experience is gained and to account for variations in the conditions experienced by different operators in different climates and operating conditions.

In other circumstances, components are removed to save time when accomplishing repairs, which sometimes involves the wholesale replacement of these components to avoid delaying the return to service of the aircraft. If the corrosion damage to the component is within the Level 1 scope, then there is no reason to report the removal of the component, because there would be no change to the CPCP resulting from such a report.

6. The FAA should issue additional policy and guidance to provide FAA ASIs and the industry with recommendations and best practices regarding CPCPs. The controversy and difficulty resides primarily in interpretation and imprecise language. Some of this is because corrosion itself is progressive and not as easy to quantify because it is happening at a molecular level. Identifying corrosion is dependent on the skill and knowledge of inspectors and mechanics; it can occur and propagate in unusual ways based on the behavior of the corroding agent and the material it is attacking. Though manufacturers should have latitude in implementing innovative designs, there are advantages to standardizing language and maintenance practices related to corrosion to simplify maintenance and make it more efficient, all in the interest of safety.
7. This might involve updating FAA Order 8300.12 or the issuance of a new AC to address the issues of the Level 1 corrosion definition, what the FAA considers important in the management of CPCPs, and what is less important. With stronger and clearer guidance, some of the misunderstandings and frustrations described by certain segments of the industry can be resolved. This could involve establishing an AC work group to review and make changes to the existing ACs that address corrosion and CPCPs.

8. The FAA should review the areas that impact air carrier CPCPs and develop a best practices document. This document can be the advisory material referenced in recommendation 6 or a standalone document that is developed by an industry that the FAA supports. Air carriers do not necessarily make decisions regarding the CPCPs and other facets of their maintenance programs based on purely regulatory factors. There are economic decisions that may drive them to repair or discard certain aircraft structural elements during maintenance.

A best practice document would also address issues such as corrosion found and addressed during scheduled heavy maintenance that may not tie in with the CPCP for the aircraft, resulting in the same area to be looked at again under the CPCP even if the area was already repaired. An analysis of the interviews completed for this report also shows that it is unclear whether corrosion remaining in an area that cannot be replaced and has to be repaired is still under the CPCP.

Air carrier personnel typically issue a non-routine task card in those cases. What is unclear is how that ties into the CPCP, which occurs at set time intervals. Air carriers should be able to adjust their intervals, and if they perform a repair in a particular area they should not have to look at it immediately thereafter, even if the CPCP lists the same area. Doing so would be redundant.

Allowances for this are consistent between the FAA, European Aviation Safety Agency (EASA), and the International Civil Aviation Organization, which allow for intervals to be optimized and adjusted if corrosion is found during regular maintenance, despite what a CPCP requires. However, there is no document that captures this practice. The FAA and industry should review scenarios such as these and consider providing relief while maintaining the required standard of safety.

9. The FAA should review certain terms such as “remove for convenience” and “to facilitate other maintenance,” which are not clearly defined or may not have associated policy to dictate when they can be applied. In some cases, it may be tied to MRB documents because they are not described in any AD that was reviewed for this report. There also may not be a definition of this sort within EASA programs, which would make it unclear how they are being used; the terms could have different meanings for different air carriers. This is another area for which it may be important to harmonize with the Europeans. One concern is that it will be important not to void any agreements for facilities that may hold different certificates from different national aviation authorities.

An effort of this type among authorities and industry to harmonize definitions would be beneficial to the 14 CFR 145 repair stations performing contract maintenance for air carriers. Because these repair stations must follow the applicable air carrier maintenance programs, and many repair stations have more than one air carrier customer, harmonized CPCP definitions would reduce the possibility of errors by repair station personnel applying incorrect maintenance procedures. Just as air carriers must manage the different maintenance requirements among fleet types, repair stations also must manage the

differences between the various programs of their air carrier customers. Any simplification and standardization in this area could benefit safety.

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APPENDIX A—CORROSION DEFINITIONS

Table A-1. Corrosion definitions

ISSUER	LEVEL 1	LEVEL 2	LEVEL 3
<p>Maintenance Steering Group-3 (MSG-3) Rev 3</p>	<p>Corrosion damage that does not require structural reinforcement or replacement;</p> <p>Or</p> <p>Corrosion occurring between successive inspections exceeds allowable limit but is local and can be attributed to an event not typical of operator usage of other aircraft in the same fleet (e.g., mercury spill);</p> <p>Or</p> <p>Light corrosion occurring repeatedly between inspections that eventually leads to rework or blend-out that exceeds allowable limits.</p> <p>NOTE: The MSG-3 definition is more restrictive than the definitions adopted by the European Aviation Safety Agency (EASA) in Alternate Means of Compliance (AMC) 20-20 and more restrictive than the definitions proposed by the FAA in Notice of Proposed Rulemaking (NPRM) 02-16 (67 FR 62142)</p>	<p>N/A</p>	<p>N/A</p>

Table A-1. Corrosion definitions (continued)

ISSUER	LEVEL 1	LEVEL 2	LEVEL 3
EASA AMC 20-20	<p>Corrosion occurring between successive inspection tasks that is local, and can be reworked or blended out with allowable limits;</p> <p>Or</p> <p>Corrosion damage that is local and exceeds the allowable limit but can be attributed to an event not typical of operator’s usage of other aircraft in the same fleet (e.g., mercury spill);</p> <p>Or</p> <p>Operator experience has demonstrated only light corrosion between each successive corrosion inspection task, and the latest corrosion inspection task results in rework or blend-out that exceeds the allowable limit.</p>	<p>Corrosion occurring between any two successive corrosion inspection tasks that requires a single rework or blend-out that exceeds the allowable limit;</p> <p>Or</p> <p>Corrosion occurring between successive inspections that is widespread and requires a single blend-out approaching allowable rework limits. (i.e., it is not light corrosion as provided for in the Level 1 definition).</p> <p>NOTE: A finding of Level 2 corrosion requires repair, reinforcement, or complete or partial replacement of the applicable structure.</p>	<p>Corrosion occurring during the first or subsequent accomplishments of a corrosion inspection task that the operator determines to be an urgent airworthiness concern.</p> <p>NOTE: If Level 3 corrosion is determined at the implementation threshold or any repeat inspection, then it should be reported. Any corrosion that is more than the maximum acceptable to the design approval holder (DAH) or the Agency must be reported in accordance with current regulations. This determination should be conducted jointly with the DAH.</p>

Table A-1. Corrosion definitions (continued)

ISSUER	LEVEL 1	LEVEL 2	LEVEL 3
<p>Title 14, Code of Federal Regulations Parts 121, 129, and 135 (Docket No. FAA-2002-13458; Notice No. 02-16) RIN 2120-AE92 “Corrosion Prevention and Control Program”</p>	<p>Corrosion damage occurring between successive inspections that is local and can be reworked or blended out within allowable limits as defined by the manufacturer or the FAA;</p> <p>Or</p> <p>Corrosion damage that is local but exceeds allowable limits and can be attributed to an event not typical of the operator's usage of other airplanes in the same fleet;</p> <p>Or</p> <p>Corrosion damage that an operator has experienced over several years has demonstrated to be only light corrosion between successive prior inspections but that the latest inspection shows that cumulative blend-outs now exceed allowable limits as defined by the manufacturer or as approved by the FAA.</p> <p>NOTE: The FAA NPRM only defined Level 1 and anticipated defining Levels 2 and 3 in an Advisory Circular.</p> <p>The FAA later withdrew the NPRM, which left the U.S. industry without a regulation-based definition.</p>	<p>N/A</p>	<p>N/A</p>

Table A-1. Corrosion definitions (continued)

ISSUER	LEVEL 1	LEVEL 2	LEVEL 3
FAA Order 8300.12	Corrosion is damage occurring between successive inspections that is local and can be reworked or blended out within allowable limits as defined by the manufacturer in a structural repair manual (SRM), service bulletin (SB), etc.	Corrosion is damage occurring between successive inspections that requires rework or blend-out. The Airworthiness Directive (AD), in general, requires Corrosion Prevention and Control Program (CPCP) adjustments for corrosion exceeding Level 1. Level 3 corrosion is especially severe and requires other expeditious actions as specified in the AD.	Corrosion is damage found during the first or subsequent inspection(s), which is determined by the operator to be a potential airworthiness concern requiring expeditious action.

Table A-1. Corrosion definitions (continued)

ISSUER	LEVEL 1	LEVEL 2	LEVEL 3
CRJ700/900 SRM	<p>Corrosion occurring between successive inspections that can be reworked or blended out within allowable limits as defined by Bombardier Aerospace Regional Aircraft and does not require structural reinforcement or replacement;</p> <p>Or</p> <p>Corrosion damage that exceeds allowable limits and could require structural reinforcement but can be attributed to an event not typical of the operator's usage of other aircraft in the same fleet (e.g., mercury spill, chemical spill) and is not of critical airworthiness concern;</p> <p>Or</p> <p>Operator experience has demonstrated only light corrosion between successive inspections, but the latest inspection and cumulative blend-out now exceeds the allowable limits and could require structural reinforcement or replacement.</p>	N/A	N/A

Table A-1. Corrosion definitions (continued)

ISSUER	LEVEL 1	LEVEL 2	LEVEL 3
EMB145 Corrosion Prevention Manual	<p>It is the corrosion damage occurring between successive inspections that is localized or widespread and can be reworked or blended out within the allowable limits as defined in the SRM Allowable Damage section for the component;</p> <p>Or</p> <p>It is the corrosion damage that is local but exceeds allowable limits and can be attributed to an event not typical of the operator's usage of other airplanes in the same fleet;</p> <p>Or</p> <p>Operator experience over several years has demonstrated only light corrosion between successive inspections, but latest inspection and cumulative blend-out now exceed the allowable limit.</p>	N/A	N/A
Transport Canada (AC 521-009)	Corrosion damage occurring between successive inspections that is local and can be reworked or blended out within allowable limits defined by the manufacturer.	N/A	N/A

Table A-1. Corrosion definitions (continued)

ISSUER	LEVEL 1	LEVEL 2	LEVEL 3
Boeing	<p>Corrosion damage occurring between successive inspections that is local and can be reworked or blended out within allowable limits as defined by the manufacturer (e.g. SRM, SB, etc);</p> <p>Or</p> <p>Corrosion damage occurring between successive inspections that is widespread and can be reworked or blended out well below allowable limits as defined by the manufacturer;</p> <p>Or</p> <p>Corrosion damage that exceeds allowable limits and can be attributed to an event not typical of the operator's usage of other airplanes in the same fleet.</p>		
Airbus	NOTE: Same as that of MSG-3	N/A	N/A

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