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Research on Procedures and Guidance for Process/Repair Specifications

June 2009

Final Report

U.S. Department of Transportation
Federal Aviation Administration

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16. Abstract

A process specification is a detailed process requiring close control of certain parameters to produce a desired result. A process specification, as used in aircraft maintenance, may also be a subset of a repair procedure. Process specifications are used by manufacturers, airlines, and Federal Aviation Administration (FAA)-approved repair stations during the manufacturing process and in the performance of maintenance on U.S.-registered aircraft and products. However, there is little FAA guidance, particularly for repair stations, on how to develop process specifications for repairs and to obtain FAA approval for their use. This lack of guidance also affects the FAA inspectors responsible for coordinating approvals for these types of process specifications by adding them to repair stations' Operations Specifications.

This research revealed that there is some disagreement on how these process specification approvals should flow through the various FAA organizations and at what levels the specifications should be approved. However, this flow of information is not defined clearly in any FAA guidance and the personnel concerned have had to develop their own mechanisms to ensure new process specification approvals are routed and approved properly. The research team included recommendations on how process specification approvals should flow among FAA offices and directorates.

It should be noted that many issues presented in this study are opinions from the personnel who participated in the research. Some of these may be contrary to official FAA policy, but are useful and should be considered in efforts to improve the development and approval of process specifications.

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LIST OF ACRONYMS

AC	Advisory Circular
ACO	Aircraft Certification Office
AD	Airworthiness Directive
AEG	Aircraft Evaluation Group
AFS	Flight Standards Service (FAA)
AIR	Aircraft Certification Service (FAA)
AMO	Approved Maintenance Organization (JAA)
ASI	Aviation Safety Inspector (FAA Flight Standards)
ATA	Air Transport Association
AWS	American Welding Society
BASA	Bilateral Aviation Safety Agreement
CFR	Code of Federal Regulations
CMM	Component Maintenance Manual
DAR	Designated Airworthiness Representative
DER	Designated Engineering Representative
DoD	Department of Defense
EASA	European Aviation Safety Agency
FSDO	Flight Standards District Office
ICA	Instructions for Continued Airworthiness
IFO	International Field Office
IMA	Integrated Modular Avionics
JAA	Joint Aviation Authorities
MIP	Maintenance Implementation Procedures
MOE	Maintenance Organization Exposition
MOU	Memorandum of Understanding
NAA	National Aviation Authority
NDI	Nondestructive inspection
ODA	Organization Designation Authorization
OEM	Original Equipment Manufacturer
OPP	Owner-Produced Part
PAI	Principal Avionics Inspector
PMA	Parts Manufacturer Approval
PMI	Principal Maintenance Inspector
RDC	Repair Design Certificate (Canada)
RSM	Repair Station Manual
SAE	Society of Automotive Engineers
SFAR	Special Federal Aviation Regulation
SPARC	Standardized Procedures in Alterations Repairs and Certification
STC	Supplemental Type Certificate
SUP	Suspected Unapproved Part
TC	Transport Canada
TSO	Technical Standard Order

EXECUTIVE SUMMARY

F.J. Leonelli Group, Inc., under contract with the Federal Aviation Administration (FAA), performed this study to provide findings and recommendations related to procedures and guidance for process/repair specifications. A process specification is a detailed process requiring close control of certain parameters to produce a desired result. A process specification, as used in aircraft maintenance, may also be a subset of a repair procedure.

Process specifications are used by manufacturers, airlines, and FAA-approved repair stations during the manufacturing process and in the performance of maintenance on U.S.-registered aircraft and products. However, there is little FAA guidance, particularly for repair stations, on how to develop process specifications for repairs and to obtain FAA approval for their use. This lack of guidance also affects the FAA inspectors responsible for coordinating approvals for these types of process specifications by adding them to repair stations' Operations Specifications.

This research revealed that there is some disagreement on how these process specification approvals should flow through the various FAA organizations and at what levels the specifications should be approved. A significant problem is that newly developed process specifications are often quite technical and require a great degree of engineering expertise for a proper review. FAA inspectors generally are not engineers, and must obtain subject matter expertise from their counterparts in the Aircraft Certification Office, which is a separate FAA service organization. For this reason, some process specification approvals have been routed through the FAA regional offices to provide a higher coordination level for these efforts. However, this flow of information is not defined clearly in any FAA guidance and the personnel concerned have had to develop their own mechanisms to ensure new process specification approvals are routed and approved properly. It should be noted that many of the issues presented in this study are opinions from the personnel who participated in the research. Some of these may be contrary to official FAA policy, but are useful to properly address the perceptions that exist regarding process specifications.

The dearth of guidance material also affects repair stations and other users of process specifications. They are often confronted with the common problem of inadequate regulatory mechanisms in place, and sometimes have to expend considerable effort and resources to obtain process specification approvals through an untried and nonstandard system.

In response to these and other problems, the researchers have included recommendations on how process specification approvals should coordinate among FAA offices and directorates.

1. INTRODUCTION.

1.1 OBJECTIVE.

Process specifications are used by manufacturers, airlines, and Federal Aviation Administration (FAA)-approved repair stations during the manufacturing process and in the performance of maintenance on U.S.-registered aircraft and products. However, there is little FAA guidance, particularly for repair stations, on how to develop process specifications for repairs and to obtain FAA approval for their use.

The FAA enlisted the F.J. Leonelli Group, Inc. to study and recommend ways to improve the development and approval of process specifications. This report has been prepared to identify its findings and recommendations, which are specifically related to procedures and guidance for process and repair specifications.

1.2 BACKGROUND.

A process specification can be defined as a detailed and proven process requiring close control of certain process parameters to produce a desired result. They may involve physical, chemical, or metallurgical transformations that are not easily inspected, such as coating, heat-treatment, welding, and adhesive bonding.

A repair procedure is the step-by-step process used to define the accomplishment instructions for a repair. A process specification may be a subset of a repair procedure; however, generic specifications (such as those developed by the Society of Automotive Engineers and the American Welding Society) are not tied to a specific repair procedure.

Process specifications are documents approved by the FAA Administrator, via the FAA's inspection and certification personnel, containing information for performing specialized maintenance or, in some cases, alternate means of repair. Under Title 14 Code of Federal Regulations (CFR) Part 145.61(c), repair stations, which provide maintenance services to airlines and other operators of U.S.-registered (also called N-registered) aircraft with limited ratings, are sometimes required to include a process specification in their Operations Specifications, dependent on the maintenance to be performed. These Operations Specifications spell out the FAA's particular authorizations for each repair station facility.

Since a process specification contains details and instructions for inspection and repair processes, the document is normally given a title and number by the applicant and submitted to the repair station's FAA Certificate Holding District Office (CHDO) and its principal Aviation Safety Inspector (ASI) of the FAA Flight Standards Service (AFS). The principal inspector, in turn, coordinates the flow of the process specifications through the appropriate FAA Region for tracking purposes. The package is then sent to the FAA's Aircraft Certification Service (AIR), which provides the knowledge and capabilities to review and approve the data and the documents.

In general, the process specification must identify all the types of products to which the specification applies, including qualification test reports and outlines of the procedures repair

station personnel will use to implement the specification. A statement is also included stating that any change to the process specification is required to be submitted to the FAA for approval before implementation. The specification also contains an acceptable means for determining that the methods, techniques, and practices used in the procedure will continue to produce a product that meets the requirements of 14 CFR 43.13 (described in section 2), and that the work is accomplished in accordance with the FAA-approved process specification. The specification should also state that if there are any conflicting details between it and any current or future requirements of the CFR, the CFR requirements will take precedence.

After a process specification is approved by the FAA, it is required to be referenced in the repair station's Operations Specifications by title, number, and date of approval. One process specification format that is generally accepted by the FAA, and is easily understood by the regulating inspectors, is the Air Transport Association's (ATA) ATA-100 format; another is the MIL-STD format developed by the Department of Defense (DoD), or the Society of Automotive Engineers (SAE) format.

This general procedure has been in place since 1982, as cited in FAA Advisory Circular (AC) 145-4 (described in section 2.2) specifically for aircraft tires. Over the years, the aviation industry and the FAA have experienced difficulty when working with process specifications, such as the economic impact an organization can experience when one or more of its process specifications are deemed inadequate or inappropriate. Due to the increased internationalization of maintenance practices and regulatory authority cooperation, there are also issues between the FAA and other aviation authorities for the development of a standardized policy and an acceptable procedure associated with the approval of process specifications in a generic format.

1.3 METHODOLOGY.

The research team's approach to identify and report on the issues related to process specifications consists of three main areas: research, interviews, and personal experience. It should be noted that many of the issues presented in this study are the opinions of the personnel who participated in the research. Some of these may be contrary to official FAA policy, but are useful to properly address the perceptions that exist regarding process specifications.

1.3.1 Research.

The team conducted extensive research into the existing CFRs, guidance, and other published materials. The team also reviewed existing process specification approvals to identify some of the historically relevant issues. Researchers also used particular approvals for specific process specifications that they were involved in developing with the FAA Western Pacific Flight Standards Division and the FAA Aircraft Certification Office (ACO), located in Long Beach, California. The researchers also examined the procedural requirements cited by the ATA and DoD, as well as existing, but limited, FAA guidance in past policy files and advisory material. The team also researched information on process specifications available through the Internet.

1.3.2 Interviews.

The research team conducted interviews of various personnel at varying levels within the FAA, both at FAA headquarters and in the field, including the different offices with areas of responsibility for process specification development, coordination, and approval. Many of these individuals did not wish to be identified personally, nor by their office or position. Since the main purpose of this study was to determine the issues related to process specifications and where some of the areas of difficulty lie, the authors did not feel it is necessary or beneficial to identify those interviewed.

The researchers also interviewed representatives of various organizations to discover how the aviation industry views the use of process specifications, as well as how it views the FAA's policies and oversight regarding these specifications.

The organizations interviewed included:

- Aircraft Electronics Association
- Aviation Suppliers Association
- Aeronautical Repair Station Association
- National Air Transportation Association

Additionally, the researchers used their governmental contacts abroad to query the new European Aviation Safety Agency (EASA) as to how process specification issues will be handled in Europe because process specifications are specifically mentioned in FAA AC 145-7 (see section 2.2).

1.3.3 Personal Experience.

The research team consisted of individuals with significant experience within the FAA and other aviation organizations. Team members have encountered many of the issues related to process specifications that are described in this study as part of that experience. As a result, team members have drawn extensively from past experience in the preparation of this report. For example, the researchers recently assisted 14 CFR Part 145 foreign repair stations in the development and subsequent FAA approval of seven commercial process specifications.

2. PROCESS SPECIFICATION GUIDELINES.

2.1 REGULATORY FRAMEWORK.

The following sections describe the current regulatory framework surrounding the process specification issue.

2.1.1 Code of Federal Regulations.

14 CFR 27.605 titled Fabrication methods, states:

> "(a) The methods of fabrication used must produce consistently sound structures. If a fabrication process (such as gluing, spot welding, or heat treating) requires close control to reach this objective, the process must be performed according to an approved process specification.
>
> (b) Each new aircraft fabrication method must be substantiated by a test program."

14 CFR 29.605 titled Fabrication methods, states:

> "(a) The methods of fabrication used must produce consistently sound structures. If a fabrication process (such as gluing, spot welding, or heat treating) requires close control to reach this objective, the process must be performed according to an approved process specification.
>
> (b) Each new aircraft fabrication method must be substantiated by a test program."

14 CFR 43.13 titled Performance rules, states in pertinent part:

> "(a) Each person performing maintenance, alteration, or preventive maintenance on an aircraft, engine, propeller, or appliance shall use the methods, techniques, and practices prescribed in the current manufacturer's maintenance manual or Instructions for Continued Airworthiness prepared by its manufacturer, or other methods, techniques, and practices acceptable to the Administrator, except as noted in § 43.16. He shall use the tools, equipment, and test apparatus necessary to assure completion of the work in accordance with accepted industry practices. If special equipment or test apparatus is recommended by the manufacturer involved, he must use that equipment or apparatus or its equivalent acceptable to the Administrator…"
>
> "(b) Each person maintaining or altering, or performing preventive maintenance, shall do that work in such a manner and use materials of such a quality, that the condition of the aircraft, airframe, aircraft engine, propeller, or appliance worked on will be at least equal to its original or properly altered condition (with regard to aerodynamic function, structural strength, resistance to vibration and deterioration, and other qualities affecting airworthiness)."

14 CFR 145.61(c) states:

> "For a limited rating for specialized services, the Operations Specifications of the repair station must contain the specification used to perform the specialized service. The specification may be:
>
> (1) A civil or military specification currently used by industry and approved by the FAA, or
>
> (2) A specification developed by the applicant and approved by the FAA."

2.1.2 The FAA Technical Standard Orders.

An FAA Technical Standard Order (TSO) is a minimum performance standard issued by the FAA for specified materials, parts, processes, and appliances used on civil aircraft. Current TSOs are an approved FAA performance standard that applicants must use to receive a TSO authorization.

When issued by the FAA, a TSO permits articles to be eligible for use on U.S. type-certificated products. An important consideration of TSOs issued by the FAA is that the TSO authorization, or the letter of TSO Design Approval, does not convey installation approval by the FAA.

2.1.3 Type Certificates.

The FAA issues type certificates for all aircraft, engines, or propellers in use by civilian operators on U.S.-registered aircraft. The FAA maintains a list of Type Certificate Data Sheets (TCDS), which list limitations and information required for type certification of each aircraft, engine, and propeller, including items such as airspeed limits, weight limits, and thrust limitations.

A STC is a document issued by the FAA approving a product (aircraft, engine, or propeller) modification. The STC defines the product type design change, states how the modification affects the existing type design and serial numbers. It also identifies the certification basis, listing specific regulatory compliance for the design change. Information contained in the certification basis is helpful for applicants proposing subsequent product modifications and evaluating certification basis compatibility with other STC modifications.

It is important to note that possession of the STC document does not constitute rights to the design data or installation of the modification. The STC and its supporting data (drawings, instructions, specifications, etc.) are considered the property of the particular STC holder.

2.1.4 Flight Standards Service ASI Responsibilities.

There are two principal FAA lines of business relating to the issue of process specifications. Each directorate has very different and distinct sets of responsibilities coupled with varying viewpoints. The FAA AFS is tasked with the certification and oversight of operational types of organizations and people (i.e., airlines, repair stations, and airmen). FAA ASIs are part of AFS

and represent the direct link with organizations, such as airlines and repair stations, regarding approvals and surveillance of process specifications. ASIs normally work out of a Flight Standards District Office (FSDO), Certificate Management Office, or an International Field Office (IFO).

The Aircraft Evaluation Group (AEG) is also an AFS field element that helps support the certification and operational suitability determinations of new and modified type-certificated products. AEGs serve as the primary AFS liaison between the AFS organization and the appropriate AIR organization and the manufacturers. AEGs may be co-located with facilities of another FAA directorate, or one of their elements.

2.1.5 Certification ACO Responsibilities.

AIR, which is the sister organization to the AFS, provides design and certification approvals of new aircraft, engines, propellers, and related components and products. AIR's mission is to work with aviation authorities, manufacturers, and other stakeholders to successfully improve aviation safety by bringing their products to market. AIR provides a safety performance management system to ensure continued operational safety of aircraft; AIR also administers safety standards governing the design, production, and airworthiness of civil aeronautical products. Finally, AIR is tasked with overseeing design, production, and airworthiness certification programs to ensure industry compliance with prescribed safety standards.

AIR's engineering element is the Aircraft Certification Office (ACO). Each ACO administers and secures compliance with agency regulations, programs, standards, and procedures governing the type design of aircraft, aircraft engines, and propellers. The ACO also offers its certification expertise on investigating and reporting aircraft accidents, incidents, and service difficulties.

2.1.6 Instructions for Continuing Airworthiness.

As it relates to process specifications, the purpose of Instructions for Continuing Airworthiness (ICA) is to provide instructions on how to maintain altered aircraft and installed appliances in accordance with a process specification or a field-approved major alteration. The applicant creates and submits the ICA for the AFS ASIs' approval.

Prior to January 1998, the FAA did not require ICAs when additional appliances were installed on aircraft as a major alteration under the FAA field approval process. As a result, maintenance personnel did not have instructions on how to service, maintain, inspect, and replace those newly installed appliances or equipment. Without ICAs, a mechanic performing maintenance on items installed under a field-approved major alteration could be in violation of 14 CFR 43.13(a).

The reasons for an ICA are twofold. The first is to ensure that AFS's field approval policy is in line with 14 CFR 21.50, which requires ICAs for the holder of a type certificate or an STC applied for after January 1981. The second reason is to provide the certificated person performing an inspection or maintenance on the major alteration with instructions on how to maintain that change to the aircraft's type design, as required by 14 CFR 43.13(a) and 43.16.

2.1.7 FAA Designee System.

The Federal Aviation Act of 1958 (Public Law 103-272, dated July 5, 1994) allowed the FAA to delegate activities, as the agency deemed necessary, to approve private persons to perform certain duties on the FAA's behalf. Although these designees are paid by their employers, or through fees they charge to customers, they act as surrogates for the FAA in examining various areas such as aircraft designs, production quality, and airworthiness. The FAA is responsible for overseeing the designees' activities and determining whether the work they perform meets the FAA's requirements for safety.

Private industry has been examining, testing, and inspecting aircraft as part of the FAA's regulatory system for aviation safety since at least 1927. Congress enacted legislation that specifically contemplated integration of the private sector into the certification process because "…the FAA was clearly in need of private sector expertise to keep pace with the growing aviation industry." 14 CFR Part 183 was created to implement this legislation, and the functional roles and responsibilities for designees were set forth in FAA Order 8110.37C for Designated Engineering Representatives (DER) and 8130.28A for Designated Airworthiness Representatives (DAR), as well as several other types of designees. In addition, FAA Order 8100.8B, "Designee Management Handbook," which is continually updated, is considered the primary source of FAA guidance for designees.

2.2 EXISTING GUIDANCE.

The following sections describe the existing FAA Orders, policy letters, handbook bulletins, and ACs relevant to the process specification issue.

2.2.1 The FAA Orders.

- FAA Order 8000.54, "Process Specifications for Retreading Tires and Inspection Procedures Manuals for Tire Retreaders"

  This order was issued by AFS-350 on November 2, 1982, and represents the oldest available FAA guidance on process specifications.

- FAA Order 8110.4B, "Type Certification"

  This order establishes procedures for accomplishing the evaluation and approval of aircraft type design data and changes to approved type design data.

  This order specifies items to consider for process specifications, such as

  (1) how to verify that there is a process specification for each special process.

  (2) how to verify if the process specification has been submitted for FAA engineering review and whether a check of processed articles indicates that the process will produce consistent parts during production in accordance with the type design.

(3) a determination of whether there is statistical evidence for this result.

(4) whether the process is being performed in accordance with the process specification and whether there are any deviations recorded.

The order also proposes the following outline as a guide for checking the content of a typical process specification:

1. Scope
2. Applicable documents
3. Quality requirements
4. Materials used in the process
5. Manufacturing; and
    a. Manufacturing operation
    b. Manufacturing controls
    c. Test specimen (construction)
    d. Tooling qualifications
    e. Tooling control
6. Inspection
    a. Process inspection
    b. Inspection records
    c. Inspection test
    d. Inspection controls

It also indicates that data submitted in any process for approval should not contain terms that are subject to interpretation such as "adequate," "as necessary," and "periodically," and that any tolerances required to control the process should be clearly defined.

- FAA Order 8110.37C, "Designated Engineering Representative (DER) Guidance Handbook"

  This order provides guidance, procedures, technical guidelines, and limitations of authority for DERs. The handbook contains guidance material for DERs and is designed to provide a better understanding of the FAA's DER management system for all personnel concerned.

- FAA Order 8110.42A, "Parts Manufacturer Approval Procedures"

  This order establishes procedures for the evaluation and approval of Parts Manufacturer Approvals (PMA) for replacement and modification parts. The procedures contained in the order apply to all engineering and manufacturing personnel.

- "Local" FAA Order NE CD 8110.1A, "Evaluation and Approval Responsibilities for Manufacturer's Material and/or Process Specifications Specified in the Type Design" (dated 5/28/86)

This order is specifically mentioned in AC 33-2B "Aircraft Engine Type Certification Handbook."

- FAA Order 8300.10 Airworthiness Inspector's Handbook, Vol. 2, Chapter 161, Repair Station Ratings, Section 13 "LIMITED SPECIALIZED SERVICE RATINGS, 145.61"

  This section of the Airworthiness Inspector's Handbook states that "all repair stations that have a limited specialized service rating use process specifications, in lieu of manufacturer's maintenance data, in the performance of maintenance or alterations." It also states that "just because a repair station uses a process specification does not mean the repair station needs a limited specialized service rating." According to the order, "it is inappropriate for an ASI to initiate action to alter a repair station's ratings and (Operations Specifications) based solely on the repair station's use of a process specification."

  The order states that limited specialized service ratings are "issued for a special maintenance function when the function is performed in accordance with a specification or data acceptable to the FAA. The (Operations Specifications) must include the specifications or data used by the repair station to perform that service in accordance with part 145."

  Furthermore, the order states that a process specification must involve a repair process or work scheme that is "novel, unique, or unusual in application, for which the manufacturer's data is not used for approving an article to its original condition and that specifies repair limits."

  Finally, the order states that "the process specification on the (Operations Specifications) would set forth the minimum standards for performing the generic process (specialized service)." As an example, the order describes that a "process specification would include an explanation of the housing, facilities, equipment, tools, trained personnel, and data necessary for the overall process."

2.2.2 Policy Letters.

- Policy Statement Number PS-ANM111-2002-01-04, "System Wiring Policy for Certification of Part 25 Airplanes"

  This policy statement provides guidance to FAA certification teams for the type design data needed. The policy serves to correct deficiencies associated with the submittal of design data and instructions for continued airworthiness involving airplane system wiring for type design, amended design, and supplemental design changes.

- Policy Statement Number PS-ACE 100-2002-006, "Material Qualification and Equivalency for Polymer Matrix Composite Material Systems"

This policy statement states that "…the ACO reviews the test plans and the updated material/process specifications prior to the initiation of testing. The review of the applicants' specifications should determine if they meet the application limitations." This is the same manner the ACO participates in any certification program.

- Policy Statement Number PS-ACE100-2004-10030, "Substantiation of Secondary Composite Structures"

  This policy statement aims to provide "general guidance on some technical issues to address when certifying secondary structures fabricated from composite materials" because "experience shows there are some inconsistencies between programs, particularly in dealing with issues such as material and process qualification/control, structural substantiation, flammability, and overall quality assurance."

- Policy Statement Number PS-ACE100-2001-006, "Static Strength Substantiation of Composite Airplane Structure"

  This policy statement addresses certification requirements, the static strength of composite airplane structures, and some commonly accepted engineering practices used for structural substantiation. The policy states that "it is usually in the applicant's best interest to establish this system and the appropriate process specifications as early in the type certification process as possible." It also states that "during development of the drawings and process specifications, when major changes are made to the type design it is often necessary to conform the test articles. The extent to which changes need to be re-conformed is left to the Aircraft Certification Office."

2.2.3 The FAA Handbook Bulletins.

- FSAW 97-17A, "Certificate and Operations Specifications Evaluation of Limited Specialized Services Rated Repair Stations"

  This bulletin establishes an FAA program to review repair stations with limited specialized service ratings, and the applicable Operations Specifications to standardize the issuance of certificates and Operations Specifications. It states that, on occasion, "applicants developed process specifications which were submitted for certification, but were not referred to the appropriate Aircraft Certification Office, and approval of the process specification was based on being referenced in the Operations Specifications. Subsequently, it was found that the developed document was not a process specification." It also recommends that "…any time an applicant's developed process specification is to be the governing document on the Operations Specifications, it should be submitted to the appropriate Aircraft Certification Office for their action, and the principal inspector should not include the specification in the applicant's Operations Specifications until this review has been performed."

2.2.4 The FAA Advisory Circulars.

Advisory Circulars establish an acceptable means to comply with a particular set of FAA requirements. They are issued and updated by individual FAA offices with expertise and responsibility for a particular area. It is important to note that ACs are not regulations and are not mandatory. However, FAA inspectors are required, in accordance with ACs, to accept documents, processes, and procedures that are generated as long as they are properly developed.

- AC 20-145, "Guidance for Integrated Modular Avionics (IMA) That Implement TSO-C153 Authorized Hardware Elements"

  This AC establishes an acceptable means to obtain FAA airworthiness approval for the installation of an IMA system that uses hardware elements authorized under TSO-C153, "Integrated Modular Avionics Hardware Elements." This AC provides guidance for applicants involved in the integration, installation, certification, and continued airworthiness of IMA systems into an aircraft or engine. The AC applies to the entire IMA system, not just the hardware elements. The AC is specific to installations of these systems on aircraft or engines approved under 14 CFR Parts 23, 25, 27, 29, 33, and 35.

- AC 21-20B, "Supplier Surveillance Procedures"

  This AC clarifies and revises methods acceptable to the Administrator for surveillance of suppliers by FAA Production Approval Holders. It applies to products, and parts thereof, submitted for airworthiness certification or approval after design approval (e.g., type certificate) and a production approval has been granted.

- AC 21-26, "Quality Control for the Manufacture of Composite Structures"

  This AC provides information and guidance to demonstrate compliance with the requirements of 14 CFR Part 21, Certification Procedures for Products and Parts, regarding quality control systems for the manufacture of composite structures involving fiber-reinforced materials, e.g., carbon (graphite), boron, aramid (Kevlar), and glass-reinforced polymeric materials. It also provides guidance regarding the essential features of quality control systems for composites.

- AC 21-31, "Quality Control for the Manufacture of Non-Metallic Compartment Interior Components"

  This AC provides information and guidance concerning compliance with the requirements of 14 CFR Part 21.

- AC 21-40, "Application Guide for Obtaining a Supplemental Type Certificate"

  This AC serves as a certification guide and checklist for obtaining an STC. The AC states that 14 CFR and FAA directives (Orders and Notices) are the final authority and take precedence over this AC.

- AC 23-15A, “Small Airplane Certification Compliance Program”

  This AC provides a compilation of historically acceptable means of compliance to specifically selected sections of 14 CFR Part 23 that may be burdensome for small, low-performance airplanes.

- AC 23-20, “Acceptance Guidance on Material Procurement and Process Specifications for Polymer Matrix Composite Systems”

  This AC provides information and guidance concerning an acceptable means of compliance with 14 CFR Part 23. It is applicable to the material and process specifications, or other documents, used to ensure sufficient control of composite prepreg materials in normal, utility, acrobatic, and commuter category airplanes.

  The AC states that “material and process specifications used to produce composite structures must contain sufficient information to ensure that critical parameters in the fabrication process are controlled in production.”

- AC 33-6, “Weld Repair of Aluminum Crankcases and Cylinders of Piston Engines”

  This AC provides information and guidance concerning acceptable means for the development of process specifications for weld repairs on piston engine crankcases and cylinders.

- AC 43-FAB, “Fabrication of Aircraft Parts by Maintenance Personnel” (Not yet published)

  This proposed AC provides a means of compliance with 14 CFR 43.13 requirements for the fabrication of parts by maintenance personnel.

- AC 43-16A, “Aviation Maintenance Alerts”

  This AC describes Aviation Maintenance Alerts, which are issued monthly and are based on information from operators and maintenance personnel of civil aeronautical products. The alerts provide a uniform means through which safety and service experience may be interchanged. This publication’s intent is to improve safety and service reliability of aeronautical products.

- AC 145-4, “ Inspection, Retread, Repair, and Alterations of Aircraft Tires”

  This AC provides guidance for the development, qualification, and approval of aircraft tire repair and retread process specifications, and the use of special nondestructive inspection (NDI) techniques. The information provides an acceptable means of developing a process specification for approval. The AC also describes requirements that may form the basis for FAA approval of a process specification as set forth under 14 CFR Part 145.

The AC defines process specifications as "documents approved by the Administrator containing information for performing specialized maintenance, such as retreading of tires." It also states that repair stations with limited ratings are required to include a process specification on their Operations Specifications. Air carriers or commercial operators having a continuous airworthiness maintenance program under 14 CFR Parts 121, 127, or 135 are required to include a process specification for retreading their tires in their program. A few 14 CFR Part 125 operators have inspection programs that require each operator to include a process specification in its manual for retreading its tires.

- AC 145-6, "Repair Stations for Composite and Bonded Aircraft Structure"

  This AC provides information and guidance concerning an acceptable means compliance with the requirements of 14 CFR Parts 21, 43, 121, 125, 127, 135, and 145, regarding procedures and facilities for repairs and alterations of structures consisting of metal-bonded and fiber-reinforced materials (e.g., carbon, boron, aramid, and glass-reinforced polymeric materials).

- AC 145-7A, "Issuance of Repair Station Certificates to Foreign Approved Maintenance Organizations under the Maintenance Implementation Procedures of a Bilateral Aviation Safety Agreement"

  This AC provides information and guidance concerning an acceptable means that may be used by a European Joint Aviation Authorities (JAA) Approved Maintenance Organization (AMO) to obtain, renew, or amend a 14 CFR Part 145 repair station certificate under the provisions of Maintenance Implementation Procedures (MIP) concluded pursuant to a Bilateral Aviation Safety Agreement (BASA).

  The AC states that "an AMO granted a specialized service rating must ensure all work performed under the provisions of a specialized service rating is done in accordance with FAA-approved data; therefore, FAA issuance of a specialized services rating requires FAA-approved process specifications. FAA approval of process specifications will be recorded on the organization's Operations Specifications. During National Aviation Authority (NAA) audits, the NAA will ensure that only FAA-approved process specifications are being used on U.S.-registered aircraft or aeronautical-products intended for installation on U.S.-registered aircraft."

  Note: The FAA is currently in the process of revising this AC.

- AC 145-8A, "Acceptance of Repair Stations by the JAA and JAA-Member NAAs under the MIP of a Bilateral Aviation Safety Agreement"

  This AC provides information that can be used by repair station certificate holders in the U.S. to obtain JAA and foreign NAA acceptance under the provisions of MIP concluded pursuant to a BASA.

  Note: The FAA is currently in the process of revising this AC.

- Draft AC Turbine Engine Repairs and Alterations–Approval of Technical and Substantiation Data

  This draft AC provides guidance to obtain FAA approval of technical data for turbine engine repairs and alterations in compliance with 14 CFR Part 33. The purpose of the AC is to ensure that, when developing technical and substantiation data, independent entities and type certificate holders apply uniform standards.

  The concern that prompted the drafting of the AC is that the FAA has observed a significant increase in the number of gas turbine repairs that are:

  1. Not in the manufacturer's maintenance manual
  2. Are developed by a non-type-certificate holder of an engine

2.3 PROCESS SPECIFICATION DEVELOPMENT, USAGE, AND FORMAT.

The following sections describe the basis and types for process specification development from the U.S. government and industry entities for aviation applications. These process specifications are sometimes called "special processes" to distinguish them from repair-related process specifications. The format and guidelines for several process specification development standards from the Air Transportation Association of America, the Department of Defense, and the FAA are also presented.

2.3.1 Process Specifications (Special Processes).

The professional and industrial organizations in the U.S. leading the development of standards and specifications include ASTM International, the Society of Automotive Engineers (SAE), the American Iron and Steel Institution, the American Welding Society (AWS), and the American Society of Mechanical Engineers, among others. Many standards and specifications have also been developed by U.S. government agencies, such as the DoD. However, the U.S. government is downscaling its specification efforts and many military specifications are being converted to specifications controlled by industry groups. For example, MIL-I-25135 has historically been the controlling document for both military and civilian penetrant material uses. The recent change in military specification management has led to the requirement of the military specification being incorporated into standards, such as SAEs; industry is transitioning toward the use of these newer specifications.

Generally, the desired tendency is for a given standard to become more uniformly used and accepted. One method of increasing standardization is for a large agency to adopt a standard developed by a smaller one. In the U.S., thousands of standard specifications are recognized by the American National Standards Institute, which is a national, yet private, coordinating agency.

In addition to standards and specifications developed by government entities and standards associations, aeronautical manufacturers have also established their own. For example, Boeing has developed a series of specifications referenced in its manuals for a variety of processes.

Table 1 shows more examples of standards and specifications used in aviation.

Table 1. Examples of Standards and Specifications for Aviation Applications

AGMA 911	Design Guidelines for Aerospace Gearing
AGMA 925	Effects of Lubrication on Gear Surface Distress
API STD 1529	Aviation Fueling Hose
API/IP SPEC 1581	Specifications and Qualification Procedures for Aviation Jet Fuel Filter/Separators
API/IP SPEC 1583	Specifications and Laboratory Tests for Aviation Fuel Filter Monitors with Absorbent Type Elements
API/IP STD 1542	Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage, and Mobile Fuelling Equipment
ARINC 429 P1	Mark 33 Digital Information Transfer System (DITS); Part 1: Functional Description, Electrical Interface, Label Assignments and Word Formats
ARINC 600	Air Transport Avionics Equipment Interfaces
ASTM D 1655	Standard Specification for Aviation Turbine Fuels
ASTM D 471	Standard Test Method for Rubber Property-Effect of Liquids
ASTM E 1742	Standard Practice for Radiographic Examination
ASTM E 399	Standard Test Method for Linear-Elastic Plane-Strain Fracture Toughness KIC of Metallic Materials
AWS D17.1	Specification for Fusion Welding for Aerospace Applications
BS EN 2282	Characteristics of Aircraft Electrical Supplies
BS EN 2424	Marking of Aerospace Products
MIL-STD-704	Aircraft, Electric Power Characteristics
NAS 1149	Washer, Flat
NAS 410	NAS Certification and Qualification of Nondestructive Test Personnel
NASM21209	Insert, Screw Thread, Coarse and Fine, Screw Locking, Helical Coil, CRES
NASM33537	Insert, Screw Thread, Helical Coil, Inch Series, Coarse and Fine Thread, Standard Assembly Dimensions for
NEMA WC 27500	Standard for Aerospace and Industrial Electrical Cable
RTCA DO160	Environmental Conditions and Test Procedures for Airborne Equipment
RTCA DO178	Software Considerations in Airborne Systems and Equipment Certification
RTCA DO254	Design Assurance Guidance For Airborne Electronic Hardware

Table 1. Examples of Standards and Specifications for Aviation Applications (Continued)

SAE AMS 2175	Castings, Classification and Inspection of
SAE AMS 2644	Inspection Material, Penetrant
SAE AMS-H-6875	Heat Treatment of Steel, Process for
SAE AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
SAE AS 478	Identification Marking Methods
SAE AS 9100	Quality Management Systems - Aerospace - Requirements
SAE AS 9102	Aerospace First Article Inspection Requirement Technically Equivalent to AECMA PREN 9102

2.3.2 Guidelines and Format for Process Specification Development.

This section describes several guidelines, structures, and formats used to develop process specification for aviation applications.

2.3.2.1 Air Transport Association of America.

Air Transport Association Specification 100 for Manufacturer's Technical Data (known as ATA 100) is a standard developed by the association to create a common structure and layout for aircraft service- and maintenance-related documentation. The ATA issued the specifications for Manufacturers Technical Data on June 1, 1956, to establish "a standard for the presentation of technical data, by an aircraft, aircraft accessory, or component manufacturer required for their respective products." Furthermore, ATA stated that "to standardize the treatment of subject matter and to simplify the user's problem in locating instructions, a uniform method of arranging material in all publications has been developed."

The ATA 100 divides aircraft into systems. Numbering in each major system provides an arrangement for breaking the system down into several subsystems. The ATA 100 also defines the document production and use environment by imposing a very strict way of structuring text in terms of topical organization and practical document production. For example, all maintenance documents must be divided into tasks and subtasks. Each maintenance task description should include a definition of the task, and a description of any task to be performed should be described in a successive order of subtasks. Each task and subtask has a precise denomination that is represented by document titles.

ATA continually updates its specifications; the most current version, at this writing, is the ATA Specification 2200 (iSpec 2200), "Information Standards for Aviation Maintenance."

2.3.2.2 Military Standard 961E.

The military standard (MIL-STD) 961E covers the format and content requirements for developing defense specifications. It defines a process specification as "a type of program-unique specification that describes the procedures for fabricating or treating materials and items."

The standard describes a checklist for elements and topics to be considered when developing a specification, which is listed below:

- Section 1: Scope
- Section 2: Applicable Documents
- Section 3: Requirements
- Section 4: Verification
- Section 5: Packaging
- Section 6: Notes
- Appendices
- Index
- Concluding Material

Each section also has a variety of detailed subsections. Although MIL-STDs are gradually falling out of favor and industry organization standards are superceding the DoD's own requirements (e.g., many MIL-STDs are being canceled), MIL-STD-961E serves as a good starting point for repair stations wishing to develop process specification documents.

2.3.2.3 Other Formats.

In addition to the MIL-STDs, other formats exist for the development of a process specification. One example is produced by the SAE, which issues a variety of process specifications for automotive and aerospace applications.

For example, the FAA Office of Aviation Research commissioned a study to propose guidelines for process specifications development, specifically for a particular class of composites. That study, DOT/FAA/AR-02/110, "Guidelines for the Development of Process Specifications, Instructions, and Controls for the Fabrication of Fiber-Reinforced Polymer Composites," published in March 2003, described the following sample process specification (based on MIL-STD-961).

1.0 Scope
2.0 Applicable Documents
3.0 Requirements
    3.1 Personnel
    3.2 Required Materials
    3.3 Required Equipment
    3.4 Facilities
    3.5 Tooling
    3.6 Required Procedures
4.0 Quality Assurance
    4.1 Responsibility for Inspection
    4.2 Inspection
    4.3 Documentation
    4.4 Test Methods
5.0 Notes

2.4 SOURCES OF DATA.

2.4.1 Designated Engineering Representatives.

DERs are one source of FAA-approved technical data that repair stations can use to develop process specifications for approval. In its guidance (FAA Order 8110.37C), the FAA instructs DERs to advise repair stations that they are responsible for coordinating approvals for process specifications with their FSDOs. Normally, the repair station's assigned principal ASIs will review packages generated by DERs for process specification approval.

The FAA cautions DERs not to approve generic process specifications for a repair station. These are process specifications that are not tied to a specific repair procedure.

2.4.2 Original Equipment Manufacturer's Requirements.

A common source of technical data used by repair stations to generate process specifications are the original equipment manufacturer's (OEM) own manuals, procedures, and specifications. Generally, OEMs are not eager for repair stations or other entities to modify their repair procedures or process specifications. There have been cases in which the OEM may no longer support a product or may fail to provide a repair scheme for a product and prefers to mandate its replacement, and a third party, such as a repair station, finds a market for the repair of these products. Some repair stations have been able to effectively develop process specifications for such repairs and obtain the necessary FAA approvals.

2.4.3 Special Federal Aviation Regulation No. 36-8 Organization.

Special Federal Aviation Regulation No. 36-8 (SFAR 36) authorizations cover the development of major repair data. According to SFAR 36, the holder of an air carrier certificate or operating certificate, who operates large aircraft and has been issued Operations Specifications for operations under 14 CFR Parts 121 or 135, may perform a major repair on a product using technical data that have not been approved by the Administrator, and if authorized in accordance with SFAR 36, approve that product for return to service.

To accomplish these repairs, the air carrier

- must have a procedures manual that complies with SFAR 36 with technical data that has been developed in accordance with the procedures contained in the manual.
- must develop the technical data specifically for the product or article being repaired.
- must accomplish the repair in accordance with the procedures contained in the manual and the procedures approved by the Administrator for the certificate.

According to FAA Order 8000.42, "Authorization to Develop and Use Major Repair Data Not Specifically Approved by the Administrator," AIR and AFS personnel issue these authorizations to holders of air carrier, commercial operator, or repair station certificates after concurrence. The certificate holder applies first to the FSDO with certificate responsibility. The ACO in the

appropriate FSDO's geographic area then evaluates the qualifications, ability, and authority of the applicant's engineering staff. The FSDO is responsible for coordinating with the applicant and initiating the letter of authorization. After review and concurrence, the ACO and the FSDO jointly sign the applicant's procedures manual and letter of authorization.

2.5 PARTS AND RAW MATERIALS CONTROL.

The control of parts and raw materials at the repair station applying for approval is a prime consideration in the FAA's review of a process specification. FAA guidance states that a Repair Station Manual (RSM) should describe generally how material is ordered, stocked, and requisitioned for maintenance or alteration purposes. A general description of how the stock room operates with respect to handling and storage should also be included, which may include the method for handling, storing, and using shelf-life items and materials.

Any repair station should also have adequate procedures that include visual inspection of shipping containers and their contents for damage in transit, proper packing, and complete paperwork. RSMs should include procedures that are sufficiently detailed for receiving personnel to perform their work. These personnel should be able to determine whether an article is in satisfactory condition, or if it was damaged when it was received. Procedures should specifically describe how receiving personnel are supposed to document or record damage.

A parts sampling program requires the repair station to pull a certain percentage of parts for quality control inspection. The inspection process could include visual, NDI, and nondestructive or destructive testing to ensure that the product meets repair quality standards.

Occasionally customers request that repair stations fabricate replacement parts for maintenance on their aircraft, engines, or components. Several issues have resulted from this because these OPPs could be considered Suspected Unapproved Parts (SUP) if not done correctly.

2.6 HUMAN FACTORS.

The term "human factors" represents the principles that apply to aeronautical design, certification, training, operations, and maintenance to achieve a safe interface between the human element and other systems components by proper consideration of human performance.

"Human performance" represents human capabilities and limitations, which have an impact on the safety and efficiency of aeronautical operations. Another concept, "ergonomics," is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance.

Human factors considerations form an important part in the development and review and approval of process specifications and should be considered during any process specification changes.

2.7 QUALITY ASSURANCE AND INSPECTION REQUIREMENTS.

The quality assurance and inspection requirements at a repair station are important parts of the development and approval process for repair stations. If a repair station has a quality department and elects to develop a new process or repair, the quality assurance department (or its equivalent) could develop the necessary inspection methods and procedures. This could include sampling parts to ensure that their quality meets the repair station's standards.

The design and implementation of an organization's quality management system is influenced by varying needs, particular objectives, the products provided, the processes employed, and the size and structure of the organization. To enhance customer satisfaction, an organization should adopt a process approach when developing, implementing, and improving the effectiveness of a quality management system. For an organization to function effectively, it has to identify and manage numerous linked activities. An activity using resources, and managed to enable the transformation of inputs into outputs, can be considered a process. The application of a system of processes within an organization, together with the identification and interactions of these processes and their management, can be referred to as the "process approach." An advantage of this approach is the ongoing control that it provides over the linkage between the individual processes within the system, as well as over their combination and interaction. When used within a quality management system, such an approach emphasizes the need to

- understand and meet requirements.
- consider processes in terms of added value.
- obtain results of process performance and effectiveness.
- continually improve processes based on objective measurement.

Quality assurance and inspection systems at repair stations are essential if they are to properly implement and accomplish surveillance over the process specifications they have in place.

2.8 PROCESS SPECIFICATION (REPAIR PROCEDURE) APPROVAL PROCESS.

2.8.1 Process Specification Guidelines.

Process specifications contain in-depth instructions on methods and processes for inspection, repair, and testing, and are usually given a title and number by the applicant. They are documents approved by the FAA and should include the specification on the repair station's Operations Specifications along with the title, number, and date approved. Process specifications identify all the types of parts or components to which the process specifications apply and should include the qualification test reports that were used to develop the process specification to ensure the requirements of 14 CFR 43.13 will be met. Process specifications should include outlines of procedures for repair station personnel to use and should include a statement that any change to the process specification must be submitted to the FAA before it can be implemented.

Process specification documents should also state that if there are any conflicting details between the specifications and any current or future requirements in 14 CFR, then the CFR will take precedence.

2.8.2 Existing Approval Process.

The existing approval process steps for preparing a process specification (repair procedure) are as follows:

1. The applicant (repair station) prepares a process specification document for FAA approval following FAA guidance. The applicant also includes any technical manual revisions necessary to incorporate the new process specifications. The applicant ensures that all the data in the process specification have been approved by the FAA Administrator, typically via a DER.

2. The applicant submits the proposed process specification to the principal FAA ASI assigned to the applicant's certificate according to FAA guidance.

3. The principal ASI reviews the process specification document and ensures that all proper materials and supporting documentation have been submitted. Any outstanding issues are discussed and resolved between the principal inspector and the applicant to refine the application.

4. The applicant's principal ASI submits the process specification application to the FAA ACO directly responsible for certification of the part, appliance, or process in question. (Note: Not all FAA regions have a formal application for this step. The FAA Western Region requires such coordination through their AFS maintenance offices for tracking purposes.) Any outstanding issues are discussed and resolved between the ACO and the principal inspector, who remains the main point of contact with the applicant.

5. After reviewing the application, the ACO issues a written technical concurrence indicating that the process specification application (in whatever form it may be), as submitted, will permit the applicant to meet 14 CFR 43.13 using the particular process specification.

6. In some cases, a higher official, such as an FAA Regional Flight Standards Division Manager, issues a letter approving the process specification to the office manager of the principal ASI assigned to the applicant.

7. The principal ASI approves the process specification and adds it to the applicant's Operations Specifications and then submits the revised Operations Specifications to the applicant. The principal ASI also approves the applicant's revised manual procedures to enable proper implementation of the new process specifications by the applicant.

8. Through surveillance, the principal ASI verifies that the applicant is capable of consistently producing articles in conformance with the article's type design requirements. The principal ASI also verifies that the applicant is processing the articles in accordance with the newly approved process specifications, and that the materials, tools, and equipment called for in the process specifications are being used.

9. The applicant must be able to satisfy the principal ASI that any NDI used as part of the process specification has the capability to detect allowable defects, including their size and location specified by the process specifications.

Figure 1 shows the flowchart of the existing approval process.

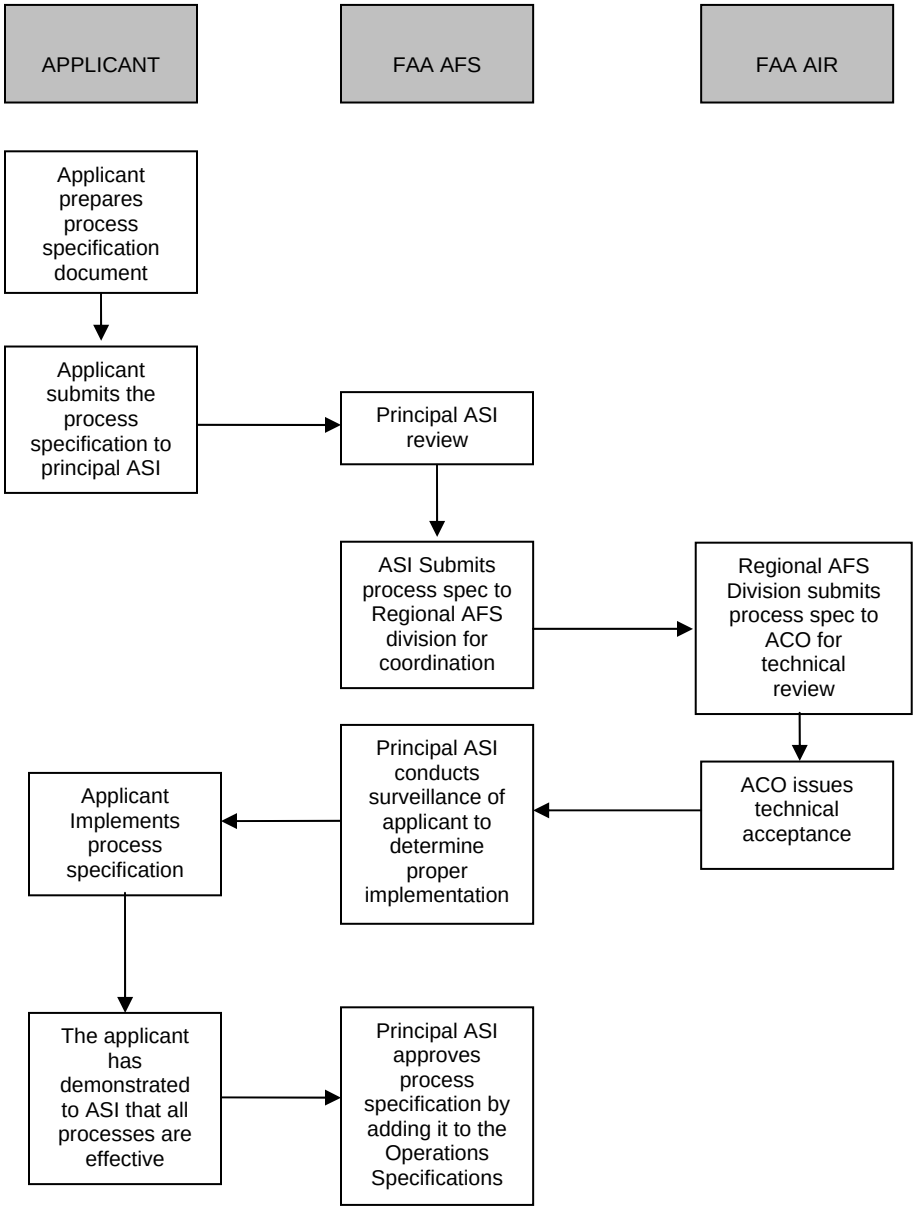

Figure 1. Flowchart of the Existing Approval Process for Process Specifications

2.8.3 Revision Process.

A revision process is established to ensure that all work flows, process flow, and documentation are current and available to all company personnel. The revision process should be described in the repair station's RSM and should incorporate information such as:

- The personnel responsible for keeping manuals up to date
- The sources the repair station will use to obtain updated information
- The coordination process for updates within the repair station
- The approval and acceptance process for updates with the FAA

All company management personnel must be trained to understand what is required by the RSM, whether it relates to processes or documentation. In addition, there should be provisions to update the process specifications as a result of a change in OEM manuals, the issuance of an Airworthiness Directive (AD) or any other change that could impact the elements on which the process specification was based.

3. FINDINGS.

3.1 DIFFICULTIES IN THE APPROVAL PROCESS.

A number of requirements that should be considered during the development of a process specification are outside the OEM's standards. The affected standards range between items such as solvents to piece-part components or surface treatments.

The FAA does not allow for any deviation from such standards without an engineering approval from a DER or the ACO. A component that is made up of numerous parts could involve a number of different standards; any change to a repair process for a single part or component could constitute a change to a standard.

A complex avionics component could involve OEM repair requirements in which the subcomponents relate to a number of TSOs, including components that were produced under multiple PMAs. A change to a process specification for a subcomponent could involve a number of different engineering approvals. Those changes could impact areas that are spread across different ACO offices and complicate the coordination and approval process. As a result, extensive testing, along with a comprehensive risk analysis, should be completed prior to any approval.

Currently, any repair or process change that affects airworthiness or major repairs will likely be approved by DERs. The designees are authorized to approve engineering changes in line with their particular expertise. They are required to process their data packages through their local ACO prior to approval and processing to their customers. Problems can occur when the DER physically lives in a different area or region than the ACO engineers who have the background and experience to review the particular engineering changes. For example, the FAA Transport Airplane Directorate is located in both Seattle and Los Angeles. A DER that lives in Chicago would report to, and send their engineering data to, the FAA Central Region (Chicago). The ACO engineering group in the FAA Central Region may not have the expertise to review and

approve the data in question. If there were any mistakes in the approval process, it is likely that they would be overlooked under such a scenario.

Currently, the AEG uses charts and checklists to determine all the requirements for continuous airworthiness or maintenance program standards during the development of aircraft, engines, and STCs. ICAs are an important element to ensure that a product is airworthy throughout its life cycle. Currently, there are no requirements for ICA development or for coordination with DER data review through the AEG offices during coordination of major repairs or alterations. For example, the DER Handbook and FAA Order 8110.37C indicate that DERs are not specifically required to provide or consider ICA documentation.

An FAA review of a number of major repair documents (prepared with DER data) revealed no additional requirements specifying changes in the relevant inspection programs. A repair of a part or change in a process specification may require a change to the maintenance program and should be addressed in the DER's data.

3.2 SAFETY ISSUES IDENTIFIED FOR PROCESS SPECIFICATION APPROVALS.

A number of issues could negatively affect safety during the development process of a process specification by a certificated repair station, or by a repair station that is a part of a bilateral agreement.

3.2.1 Inspector Expertise.

In normal circumstances, packages flow through the FAA Principal Maintenance Inspector (PMI) or the Principal Avionics Inspector (PAI) for approval and addition to a repair station's Operations Specifications. This allows the repair station to return to service all products that use the new process. If the PMI or PAI does not have the expertise or training on the product or process, he or she may be unable to detect significant flaws in those specifications and could be approving specifications that may affect continuing airworthiness for that product.

3.2.2 Bilateral Aviation Safety Agreements MIP Repair Station Issues.

The European JAA currently does not address process specification procedures in their Joint Aviation Requirements (JAR). It may well be that the JAA is waiting for the FAA to develop this formal process so it can be harmonized, or that the transition to the new EASA has stalled this effort. In the meantime, FAA-certificated repair stations have been awaiting a decision regarding JAA listings for over 2 years because of a void in this area.

The specific problem is that AC 145-7A requires that

> "an AMO is granted a specialized services rating, it must ensure that all work performed under the provisions of a specialized services rating is done in accordance with FAA-approved data. Therefore, FAA issuance of a specialized services rating requires FAA-approved process specifications. FAA approval of process specifications will be recorded on the organization's OpSpecs in addition to the NAA limitations/scope of approval. During NAA audits, the NAA will

> ensure that only FAA-approved process specifications are being used on U.S.-registered aircraft or aeronautical products intended for installation on U.S.-registered aircraft."

BASA agreements between the FAA and various NAAs provide the oversight responsibility to the NAA offices in Europe via the BASA MIP. Through this special agreement, the NAAs conduct inspections (audits) under the parameters of the BASA MIP and provide control over the FAA-certificated 14 CFR Part 145 repair stations' processes and procedures per 14 CFR and the BASA MIP. Checks and balances are necessary for a product that is repaired by repair stations, particularly foreign ones. This is because assigned IFO principal inspectors seldom conduct inspections of repair stations that fall under the authority of an NAA compared to how often ASIs inspect the domestic repair stations they are assigned to.

In this study, which is based on information from the authors' FAA and industry experience, as well as interviews conducted, some European companies have indicated that no approval process existed for process specifications or repair processes for N-registered products by the NAA. In one example, a foreign repair station was erroneously using a foreign air carrier's maintenance repair processes and procedures to repair N-registered products rather than the OEM's per 14 CFR 129.14. At present, there are no mechanisms in place for bilateral agencies to consider the acceptance of another's approval of repair processes and process specifications without being specifically reviewed by an FAA ACO.

During the interview process, researchers learned that the repair station capability list is maintained and controlled by the NAA office in its local country. Currently, it is very difficult for a PMI outside the repair station's IFO to request and receive a copy of this list from the NAA for a given country. The PMI has to send a request to the local IFO, whose personnel must then request a copy from the particular NAA.

As described in AC 145-7A, using a capability list is an effective way of identifying all articles that an AMO has established as their repair capability. It establishes procedures for conducting self audits in its facility and lists capabilities that are approved and accepted by the AMO's NAA on the FAA's behalf. However, the fact that AC 145-7A has not been updated to reflect the changes in the new regulations, particularly the new 14 CFR Part 145, is an emerging issue. This raises the question of whether local authorities are working under the old guidelines or the new regulations. This AC is being revised and is in the final stages of that process at this writing. Final draft guidance is being issued to NAA-affected countries in the meantime. Once complete, AC 145-7A will be suspended.

3.2.3 Language Difficulties.

Foreign repair stations that fall under a bilateral agreement are allowed to write their repair station manuals in their native language. A different interpretation from English to the local language could result in a loss of specifications or a misinterpretation of a requirement, which could affect airworthiness. While this is an operator's responsibility, under such a scenario, no system of checks and balances currently exists to ensure products are repaired in accordance with the OEM's specifications.

The current BASA II MIPs require repair stations to use their EASA-approved Maintenance Organization Exposition (MOE) with an FAA special condition supplement in lieu of an RSM. The FAA supplement must be written in English, and any parts of the MOE referenced in the supplement must be in English. While the MOE is the legal requirement, it is difficult for a responsible ASI to know if a particular process has been translated or interpreted correctly.

3.2.4 Parts Issues.

Owner-Produced Parts (OPP), produced by foreign repair stations per an air carrier's requirements, could also be affected by the issues described for repair stations under a BASA MIP. For example, the local NAA could approve a process that may be contrary to U.S. standards because 14 CFR 145.7(a) allows a foreign repair station to send its capability list directly to its NAA. Since some OPPs are consumed during repair work, a DAR reviewing records for components or aircraft may not find such a change in the product during the review process. Under such a scenario, the particular product might not meet U.S. standards or requirements.

SUPs present another parts-related issue. In 2003, an SUP case involving a process specification issue raised some concerns, and the FAA realized its policy's inconsistencies toward process specifications. A particular problem arose when process specifications were FAA-approved, but further analysis revealed that the process specifications were inadequate. In spite of this, until these inconsistencies were resolved, the FAA considered these parts approved, according to a memo dated April 28, 2003. The memo stated that

> "…lacking any safety concerns, as no reports of any type of related failure have been made, the production of the (items) may be considered tacitly approved. After considerable discussion it was agreed by the participants, that a National Action Plan was needed and would be initiated by AFS-300, to recall, for re-evaluation, the process specifications currently used to substantiate major component repair and parts fabrication. As part of the plan, a checklist for inspector(s) would be provided to assist in the first phases of the evaluation process and to guide the repair stations in needed corrections to their existing process specifications."

Therefore, as long as the FAA had knowledge of the process specification and was consistent, a part cannot be considered to be unapproved when using that process specification.

In spite of this, the FAA still gets SUP reports related to process specifications. Many are submitted by companies to report that other companies are lacking the proper process specification approvals, which could be considered an unfair advantage.

Another issue relates to the OEM's liability. OEMs are concerned that if they do not agree with a particular repair scheme, they may still be liable for a "process specification" part. In response, the OEMs have filed a number of legal actions to stop the use of certain process specifications.

3.3 LIABILITY CONCERNS FOR FAA PERSONNEL.

FAA personnel that were interviewed for this study also raised the issue of liability in process specifications approval. A PMI or PAI reviews any number of documents on a day-to-day basis. Process specification changes are an important part of the repair and production process. Even when lacking expertise in the area of the proposed changes, a principal inspector still may be accountable for ensuring the airworthiness of the products that are returned to service if they fail during the life of the product and result in an incident or accident.

3.4 CONSIDERATION OF AD REQUIREMENTS DURING DEVELOPMENT AND IMPLEMENTATION OF PROCESS SPECIFICATIONS.

Each repair station requesting a change to repair processes or specifications should have a system in place that provides for data and process information gathering during the development of their application package. The applicant should also have procedures in their RSM that requires them to develop a system equivalent to an OEM's AD requirements for that product during and after the product development process, and a notification system to ensure that customers are informed of any airworthiness concerns that arise regarding their product.

All airlines that maintain products for N-registered aircraft, whether U.S. or foreign, have an approved maintenance program or Continuing Analysis and Surveillance System (often, they also have a reliability program) that requires them to review all AD documents on a regular basis to ensure the airworthiness of all their products is current. This is the basis for the maintenance reliability program for their products. Each airline is also responsible to ensure that any repairs made on their products are performed to their approved standards and requirements. Their manuals should identify how the AD review and compliance will be performed and who is responsible for these AD requirements.

3.5 COORDINATION AND COMMUNICATION BETWEEN ASI/ACO/AEG.

If a repair station has discovered damage that is outside the OEM manual, it can then request repair data from the owner or air carrier. If the owner or air carrier is not qualified under SFAR 36, then a repair request is sent to a DER for disposition. The repair data, in most cases, is reviewed and approved by the ACO prior to release to the repair station because, as described in FAA Order 8110.37C, Appendix 1, 2.a.(3), the FAA reserves for itself the approval of materials and fastener allowables, which includes fatigue allowables. In most cases, the data concerning these items are considered during airframe and powerplant major repairs. There is no current requirement for AEG coordination during the review process to ensure that ICA requirements are met. While the AEG is part of the coordination loop during the development of new products or STCs, it is not included during changes to a repair process or specification.

3.6 THE OEM INTERFACE.

During the interviews, it was noted that foreign repair stations that do not have OEM support have made changes to their inspection or repair processes using data approved by a DER. In such situations, there is no mechanism for feedback to the OEM concerning changes in the inspection or repair processes that affect their products.

In one example, a review of a repair station overhaul package indicated that a repair station changed an NDI inspection process from a dye penetrant inspection to a simple visual inspection. When representatives of the repair station were asked why they changed the process, they explained that they found 50 percent more actual cracks with the visual inspection than with the dye penetrant inspection called for in the OEM manuals. However, these representatives indicated that the OEM was not aware of these findings and that they had not reported them to the OEM. A concern in this particular case was that the inspection involved the hub bolts that hold the C1 disk on the fan shaft of an engine—a critical item for the safe operation of the engine. In this case, the FAA Engine Directorate and the OEM had no idea that a potential for failure existed in these engine disks.

3.7 REPAIR STATION CONSIDERATIONS.

A particular challenge for the managers of 14 CFR Part 145 repair stations is the replacement or relocation of a PMI or PAI. Each FAA inspector may have a different view than his/her predecessor regarding how the implementation of a process specification should be conducted under its Operations Specifications. It is important that an ASI establishes familiarity with the repair station's capabilities and repair processes.

It may be difficult for an ASI to approve a submitted package if the repairs were complex and outside of his or her experience level. This leaves FAA inspectors in a very awkward position, and FAA official policy guidance is largely silent on this topic. Presently, the decision to approve the submittal is left to the discretion of each individual principal inspector to handle to the best of his/her ability.

3.8 INDUSTRY VIEWPOINT.

Industry representatives interviewed for this study stated that process specifications are essentially maintenance manuals developed by, and for, a repair station. They are "mini" component maintenance manuals (CMM), and the data supporting them has to be approved under 14 CFR Part 21, while their application is under 14 CFR Part 145. Specifically, the limited specialized service ratings in 14 CFR 145.61(c) mandate process specifications. However, there is some confusion regarding process specifications within the industry; industry representatives argue that the process specifications described in the regulations only pertain to those of a civil or military specification or "one developed by an applicant," rather than those for a repair or general maintenance. For example, plasma spraying may have six different specifications (such as those issued by The Boeing Company or General Electric).

14 CFR 43.13(c) allows airlines to develop their own engineering orders, which is why they do not need process specifications. Also, 14 CFR Part 121 subpart L does not have ratings, and an airline can decide its own actions. The current trend is to have in-house or external DERs generate approved data (or alternatively, use data generated under SFAR 36).

According to some expert opinions, 10 percent of the industry is using process specifications, which are most commonly used for accessories. They work as a "safety valve" for the industry because maintenance manuals cannot contain everything. This is the same reason the FAA has implemented the major/minor repair heuristic process. Industry representatives also note that no

good definition exists to describe the differences between major repairs and major alterations to a part and that the FAA should address these issues.

Process specifications have been used as a way for ASIs to help repair stations work efficiently. They range from supplemental information added to a maintenance manual to a completely new type of repair. Process specifications are like workarounds and are very prevalent because they allow many repair stations to stand out in today's competitive environment. They are also generally written for smaller facilities. However, due to inadequate guidance, the information on their usefulness is mainly spread by word of mouth among industry members.

Process specifications have become an issue in cases when a repair station has an established practice and a new principal ASI questions their procedures. "Rogue" process specifications present a concern that they are written too broadly and could be misused. A review system for process specifications, in which the FAA could revise them or revoke them, would be an improvement.

Many manufacturers in the maintenance business do not want to help their competitors. Because manufacturers have more expertise in manufacturing than repairing, repair stations sometimes may be the better choice when it comes to repairs. OEMs often pursue legal action regarding process specifications for profit rather than for safety-related motives. Some OEMs are actively removing repair procedures from their manuals to capture additional repair work. This forces operators to send equipment to the OEMs if the components fall within certain parameters, or the operators have to dispose of the components. Liability concerns for the OEMs have also contributed to this trend.

In many cases, industry representatives have recommended process specification issuance to their members, but this recommendation is dependent on the cooperation of the repair station's principal ASI. Usually, process specifications can solve a specific problem. If the principal ASI agrees, the problem can often be resolved quickly when both parties agree what was done in the past was safe, but did not fit within the repair station's ratings. This often occurs when a new principal ASI does not agree with his/her predecessor's assessments.

Industry representatives argue that a process specification gives the FAA principal ASI more control because he or she does not have to issue an entire limited rating, but instead, can approve a set of process specifications. In doing so, the ASI only adds the functions that a repair station can actually accomplish to the operations specification. The process specifications also serve as a procedural authorization when there are no rules for a specific case, without overriding substantive rules and authorizations.

In one example of a use for process specifications, an industry representative described how a repair station performed heat treatment on a part, at a lower temperature and for a longer time than the OEM specified. This resulted in a significant decrease in hydrogen embrittlement of the part. In another case, a process specification was used to disassemble a bonded structure and determine whether it needed a major or minor repair. The repair station had a limited airframe rating that only let it accomplish the work that was in its process specification. The process specification was more detailed than AC 43.13-1B "Acceptable Methods, Techniques, and

Practices—Aircraft Inspection and Repair," and replaced the repair station's old limited specialized service rating.

Industry representatives argue that process specifications are the only tool that repair stations have to modify their maintenance programs. They are normally used in four circumstances:

1. To maintain legacy equipment that is no longer supported
2. To maintain equipment produced without any overhaul manual
3. To replace a repair procedure with a better one
4. To substitute a field approval for multiple component installations

Because it is not possible to get an STC for a TSO part, repair stations can use a process specification to modify TSO parts. However, some process specifications have been used by repair stations to modify type-certificated products. It is unclear why the FAA permitted this practice. In normal practice, these TSO components would receive new labels after being repaired and/or modified through a process specification. Industry representatives caution that when process specifications are used, recordkeeping practices need to reflect exactly what work was performed, because the repair station is no longer following the OEM's instructions.

Some repair stations have taken DER-generated data for installation of an item and, in accordance with their contract with the DER, turned that data into a process specification for future installations. The repair stations then add these process specifications into their Operations Specifications. This results in a very cost-effective way of performing repetitive work that is not included in an OEM manual.

According to industry representatives, process specifications represent the procedural aspect and separate regulations governing the end product (the substantive standards). Approvals for process specifications need to be made from an engineering perspective and FAA ASIs may not qualify to make these determinations. A DER should put the process specification packages together for approval because the qualification of data is an FAA AIR function, as AIR is responsible for technical data and AFS is responsible for maintenance data. 14 CFR Parts 21 and 43 have the same requirements for data. Therefore, a DER should be able to develop a process specification and should be involved in the approval process of respective repairs.

Process specifications should be procedural and should be used when ratings fail to cover something in a repair station's Operations Specifications. An actual approval of data should not be included in a process specification because this can be accomplished by a DER with an FAA 8110-3 Form. Some industry representatives note that the FAA is moving the industry towards Organization Designation Authorizations (ODA) rather than the use of DERs.

Industry representatives caution that process specifications applicants must ensure that hired DERs are within their authority to approve the necessary data since there are various DER specialties, such as structures, powerplants, and electrical. There has to be a separation between the data and the process for these specifications. This is as much for intellectual property reasons as for problems that arise because engineers want to be ASIs, and vice versa. The data is

useless without the repair procedures, so it becomes more difficult for another repair station to "steal" process specifications from one another.

Industry representatives also addressed SUPs as an issue. The consensus among the representatives is that parts that have gone through process specifications should not be considered SUPs. Process specifications are a valid way to conduct work and more people in the industry need to understand them, since some industry association members have reported other members for issuing SUPs due to misunderstandings related to the use of process specifications. The DoD is also moving toward treating critical safety parts differently, and keeps better records for these parts as well. Now, the most common SUP issues are documentation designation issues. They are categorization issues—not ones of safety.

A question that comes up often in industry is whether a process specification can be bought and sold. In other words, is it a commodity, like an STC? The common wisdom in the industry is that because process specifications require specific approvals for their use, they should be considered a commodity.

Industry representatives stated that a recent trend is to put work order numbers on parts. Repair stations are also putting new data tags to indicate that an item was overhauled or repaired by a particular repair station. The use of the process specifications is also shown on the FAA Form 8130-3s. This is done for several reasons:

- Intellectual property/liability concerns
- Advertising and marketing (to show that the part was saved from being scrapped by XX repair station's work)
- Traceability for safety and to remove ambiguity (to prevent mix-ups from occurring, e.g., when the wrong part was installed on an aircraft involved in an accident/incident and the part under investigation was actually installed in a different aircraft)

Industry representatives raised several questions and issues that the industry thinks the FAA should address in future guidance on process specifications:

- What is a process specification?
- What is a process specification versus a repair, or maintenance, specification?
- How should process specifications be used?
- How should a repair station document that a process specification was used for a particular repair?
- What maintenance entries are needed when process specifications are used?
- How should components be identified when process specifications have been used?

- What is the definition of technical data? (It should be in 14 CFR 21.31)

- What is maintenance data? (It should be in 14 CFR 43.13(b))

- Part-marking standards need to be reviewed (by FAA AIR, since this falls under 14 CFR Part 21). For example, as part of new process specifications, there may be a need to add or change markings.

- Explain that process specifications need to be on the repair station's Operations Specifications and at what level within the FAA does the process specification approval take place.

- Is a process specification like a glorified field approval, or is it more like an STC?

The FAA also should not limit itself to a review of process specifications. They should also look at the oversight of process specifications. Process specifications should be reviewed and the FAA should have a way to revoke them. At the moment, there is no formal way to issue them; therefore, there is no way to revoke them. The FAA should consider a rule to this effect.

Some representatives argue that 14 CFR 21.305(d) is too broad a regulation to address process specifications, in the respect that it is like a field approval and the regulation requires that the end product has to be "as safe as" the original. The FAA still has the catch-all 14 CFR 43.13(b) enforcement mechanism that can be used as a way to fix questionable process specifications if a repair station returns aircraft to service in anything other than an airworthy condition. Industry representatives caution that anything the FAA does regarding process specifications has to be grounded in the regulations. It may be that process specifications have to be separated from the repair/maintenance specifications, and the AFS does not need to be involved in cases such as a CMM change. The FAA also needs to respond in a timely manner.

To avoid confusion, some industry representatives prefer the terms "maintenance specifications," or "repair specifications," over "process specifications" to avoid confusion with the more generalized types of specifications. Canada has an equivalent to the process specifications called a Repair Design Certificate (RDC); however, Transport Canada (TC) may not have the same guidelines as the FAA for the use of these variants of the process specification. For example, TC may not require repair stations to label a part to indicate that an RDC was used. The RDCs generally are used for component-level changes, as with an STC, and a formal certificate is issued for their use. This information should also appear on the Canadian Authorized Release Form 24-0078 (the Canadian equivalent to the FAA Form 8130-3). Industry representatives described a case in which a product was no longer supported by the manufacturer and the RDC became the only reference on the airworthiness form when the product was returned to service.

Regarding the standardization of process specifications with European authorities, the industry organization representatives stated that approvals of process specifications at the DER level would be defensible in the BASA with Europe. The Europeans currently do not recognize field approvals made by FAA ASIs. Normally, ASIs merely acknowledge the use of process specifications by listing them in the repair station's Operations Specifications. Therefore, a

concern exists about parts that undergo process specification work in the U.S. and are then exported to Europe, which may not be recognized through the BASA.

To illustrate another issue, an industry representative described how a repair station was seeking to repair pitot tubes and how it developed the "how to" instructions for the repair. It then tested the tubes to the same TSO standards as new ones and used DER-approved data. It is unclear to the industry representative why the FAA requires that these process specifications must be listed on the repair station's Operations Specifications. Perhaps the FAA approval would make them more acceptable by the European authorities, even though this is a double approval. The repair station developed a memorandum of understanding (MOU) with an FAA regional office regarding these pilot tubes and did not want them to go to an ACO. In this case, the FAA requirement seems to be unnecessary and casts doubt on its own DERs. There is no legal requirement for process specifications to go on a repair station's Operations Specifications for approval. Only generic specifications, such as NDI and heat treatment, are required.

According to the industry representative, there was more unnecessary duplication in this case when the ASIs involved in the approvals wanted to witness certain tests in wind tunnels and other testing facilities used for the validation of the pitot tube repair data, which had already been approved by the FAA. The industry representative thinks ASIs should not be concerned about liability, as they are not responsible if something happens as long as they follow the proper procedures. It is only when they deviate from their governmental role that the ASIs can be held liable according to the Federal Tort Claims act.

14 CFR Part 145 states that a repair station can perform work if it has the necessary tools, facilities, and equipment, and a repair station's capability list only shows the make and model; therefore, all a repair station should need to use a process specification is an FAA Form 8110-3. ASIs are constantly verifying repair stations' capabilities through their regular surveillance. The repair station's addition of process specifications should be handled like any other CMM change according to the repair station's procedures for making such changes.

4. RECOMMENDATIONS.

4.1 PROCESS SPECIFICATION.

Foreign repair stations certificated by the FAA under 14 CFR Part 145 can send any changes to their maintenance processes and procedures to their respective PMI/PAI for review and acceptance or approval. Currently, 14 CFR Part 145 repair stations can add a capability to their capability list or accomplish a repair without requiring prior FAA approval. Normally, the repair station has procedures in its manuals to perform an internal audit, as well as performance audits to ensure that the repair data and inspection requirements for the new capability or repair meet OEM standards.

If a particular repair is outside the OEM's written requirements, then a DER or ACO engineer must provide the data and requirements for the repair. This data is normally allowed only for that single repair. Continuous repairs involving a change to repair station manuals are allowed only when the OEM and/or the ACO are involved. The new repair process is then added to the repair station's Operations Specifications by the principal ASI.

It should be noted that the BASA MIP and AC 145-7A state that the capability list will be maintained by the responsible NAA office. However, it appears that this list is not normally available to the IFO that has responsibility for a given repair station. As a result, some FAA ASIs interviewed for this study feel that AC 145-7A is no longer in line with the new regulations, such as 14 CFR Part 145. Process specification changes should be routed through the FSDO/IFO for approval prior to the repair station performing any repair process covered under the capability list. This change only should be approved by the responsible CHDO/FSDO/IFO office and should not fall under the BASA MIP. The added repair capability should not be allowed until the CHDO/FSDO/IFO performs an on-site "over-the-shoulder" inspection of the repair station's capabilities to ensure all the proper maintenance and inspection processes are in place.

4.2 RECOMMENDED APPROVAL PROCESS.

Based on interviews conducted with FAA and industry personnel, the following is an example of the steps a repair station may use during the approval of a complex process specification, or a change to such a process specification. Personnel involved in such approvals found it difficult to work through them without any guidance and many of them stated that they were "making it up" as they went along.

Under this scenario, a repair station may have a recommended repair process that will save its customer money and result in a product that will be equal to, or better than, the original product. The repair would require a change to one or several specifications and/or repair processes. Therefore, the repair would not qualify to be listed or considered as a capability. This repair would be considered a limited rating for specialized services once the data is approved by the ACO and the ASI approves the repair process. The repair would then be added to the Operations Specifications for that particular certificate.

The following are the recommended steps for a typical process specification approval.

1. The repair process is considered by appropriate repair station personnel and all research on the engineering requirements is provided to the repair station's department or person that is responsible for quality control, as per their RSM. (Some repair stations also have a quality assurance department where this responsibility lies.) The following information should be included in the repair station's RSM to facilitate this process:

   A certificated repair station with a limited rating may perform maintenance, preventive maintenance, or alterations on an article if it is listed in a current manual and is acceptable to the FAA for addition to the repair station's Operations Specifications. If the repair station chooses to add a process specification, the RSM must

   a. contain procedures for notifying the CHDO.

   b. include when the CHDO will be notified of revisions.

   c. contain the procedures for the self-evaluation required under 14 CFR 145.215(c) for revising the process specifications.

d. describe the methods and frequency of such evaluations.

e. contain the procedures for reporting the results to the appropriate manager for review and action.

The process specification itself may be included as a part of the RSM or as a separate document; however, the procedures for process specifications and for performing the self-evaluation must be in the RSM.

The process specification document should be detailed and contain the kind of information that will eliminate the chance of any "guess work" on the part of a mechanic, repairman, or inspector. This includes the following areas (as appropriate):

- Scope
- Identification of each part/product to which the process specification applies
- Applicable documents, including any FAA Form 8110-3 used by DERs to approve required data
- Quality requirements
- Materials used in the process, including parts listed by part number of reference to a manufacturer's maintenance manual or illustrated parts catalog
- Any specialized test equipment that must be used
- Fabrication operations
- Manufacturing controls, including measurable and quantifiable accept/reject criteria for inspections and repairs.
- Repairable defects should show their location and include specific "not to exceed" dimensions for repair
- Test specimen
- Tooling qualifications
- Tooling control
- Description of each task in sequence
- In-process specification
- Inspection records

- Inspection test setup and tolerances

- Inspection controls

- Calibration standards and requirements

- Identification of any special handling, storage, or protective measures that may be pertinent

- Any notes, cautions, or warnings for technicians that may be pertinent during the maintenance task

Research has shown that the individual performing the self-evaluation required under 14 CFR 145.215(c) should have the following qualifications, to address the lack of guidance for field personnel regarding process specification approvals:

- Experience in performing evaluations (or audits if that is the method selected by the repair station)

- An understanding of the requirements of 14 CFR Part 145

- Knowledge of the maintenance requirements for the particular make/model of article to be added to the list

The individual should follow the procedures in the RSM, using the checklists, working documents, and forms to record the self-evaluation. The checklists and forms may need to be customized for each self-evaluation and tailored to ensure that the repair station has the following:

- The appropriate limited rating
- Adequate housing and facilities
- Recommended tools, equipment, and materials (or equivalents)
- Current technical data and data that will be approved or accepted, as necessary
- Current technical data
- Sufficient qualified personnel

The individual conducting the self-evaluation should record the results and report them to the appropriate manager or management team for review and approval. The repair station's procedures should describe the acceptance process for the company officials and the FAA. The procedure used to revise the list should also describe the method used to indicate any changes made to the process specification. Any deficiencies found during the self-evaluation must be corrected before the PMI or PAI will consider it for approval.

The repair station should keep records of the self-evaluation on file for the period specified in the manual. For repair stations located outside the United States, the records

of the self-evaluation may be in the national language; however, they should be made available to the FAA in English.

The procedures for revising the process specification and notifying the CHDO should include the title of the person responsible for maintaining the item(s) and communicating any revisions to the CHDO. The process specification and any other necessary technical data should be submitted with a cover letter to the FAA principal inspector at the CHDO.

The currency of the process specification list can be shown by a list of effective pages or equivalent document, which is signed by the authorized representative of the repair station and the FAA principal inspector. If the repair station no longer wishes to maintain an article on its list, the article should be deleted.

If the process specification list is maintained on electronic media, the repair station will need to work with the CHDO to ensure compatibility of the media, equipment, and software with that of the CHDO. Revision procedures will need to address documentation of approval by the company as well as acceptance by the FAA.

The repair station must have the necessary tools (or equivalent tooling), equipment, housing, facilities, and trained personnel to accomplish repairs per the process specification as required by the CFRs. The repair station should audit the process specification/repair processes on a regular basis to ensure that the repair station continues to have the housing, facilities, equipment, and technical data that meet all necessary requirements to maintain the articles listed in the document. Whenever equipment, tooling, personnel, and data must be obtained to perform the maintenance or alteration on an article that will be under repair, the repair station must explain how it will ensure these items will be available when the work is being performed.

The following questions are offered as a guide to help initiate the procedures in the manual. They should not be considered all-encompassing, because each facility is unique and may require additional procedures to verify regulatory requirements and the needs of the repair station:

- What is the title of the person who will maintain the process specification packages?
- How will the self-evaluation be performed?
- Who will perform the self-evaluation?
- How will the self-evaluation be documented?
- How will results of the self-evaluation be reported to management and how will management review the addition of process specifications?
- How will items be added to and deleted from the Operations Specifications?

- How are changes clearly indicated on the document?

- If electronic media are used, is the hardware and software compatible with that of the CHDO?

- Where, and by whom, will self-evaluation reports be maintained?

- How long are self-evaluation reports maintained?

- Was there any tooling developed? If so, the tooling has to meet the requirements called out in Order 8300.10 and the appropriate FAA Handbooks.

2. The package should be submitted to the FAA principal inspector for review. The inspector should establish the need for the process specification and ensure that the proposed process specification is not in the OEM's maintenance instructions or is a repair that is not in the OEM's maintenance instructions. Any process specification should involve a repair process or work scheme that is:

   a. Novel or unusual in application
   b. Going to be used for returning a component to its original condition
   c. Due to its novel or unusual nature, requires FAA engineering approval

   In addition, the FAA inspector should ensure that the process specification is specific to a product. For example, the process should be related to the repair of a specific aircraft/engine part. A mix of applicability to various types of products would probably not be appropriate on the same process specification. A prime consideration in the inspector's evaluation is whether the process specification is for a repair and not to manufacture new parts. Repairs are accomplished through a process specification and parts manufacturing is through a PMA.

   The processes or specifications should then be forwarded to the responsible ACO for review and approval of the engineering aspects. If the applicant is in the process of obtaining a repair station certificate they should be advised before they invest in the tooling and hiring of personnel that approval of the process specification is required prior to any repair procedures being implemented.

   Finally, the package should include any Required Inspection Item requirements to cover any and all airline requirements, which are determined by the air carrier customer.

3. The PMI/PAI will review the package to ensure that all the process requirements have been met. The inspector should add a memorandum from the FSDO to the package. The memorandum should state that the attached process specifications have been reviewed and found acceptable by AFS based on the experience and capability of the repair station applicant.

4. The package should be coordinated through the region, which then forwards it to the ACO for technical process approval. The ACO is responsible for reviewing and approving the engineering aspects of the process specifications. This approval can be indicated in a memorandum to the FSDO, or by the ACO signing the process specification document in the package.

5. The FAA principal inspector sends the package back to the repair station with any required recommended changes. The final inspection by the CHDO should not be performed until the package is approved by the CHDO or PMI/PAI.

6. The PMI/PAI will perform an on-site inspection. The inspection will consist of

   a. inspecting all tooling to ensure that it is equal, or equivalent, to the OEM's requirements. Since any new tooling will have to be accepted, the PMI/PAI can ensure that the repair station has all of the tooling called out in the new process specification.

   b. ensuring repair station personnel performing the task are trained and qualified to do the task.

   c. verifying repair station personnel can read and understand all the requirements.

   d. checking that repair station personnel follow all steps during the repair process including machine set up and calibration, as required.

   e. ensuring that all the steps are adequate. Occasionally, the repair process may not include all the processes needed to complete the task.

7. The principal inspector approves the process specification and adds the process specification, revision number, and date (if applicable) to the repair station's Operations Specifications.

   Note, when a repair station submits revisions to its process specifications, the principal inspector should review the revisions to the process specifications and determine what changes have occurred. There are two options:

   - If the change to the process specification is major (which involves a change to the engineering aspects of the process specification), the inspector should seek a review by the ACO. These should be routed through the Region for review and approval. Once this has taken place, the principal inspector can notify the repair station and update the repair station's Operations Specifications. At no time should the repair station start using the revised process specification until this has occurred.

   - If the process specification change is considered minor (does not involve a change to the engineering aspects of the process specification, such as for a typographical

change, then the principal inspector can accept the changes and notify the repair station and update the repair station's Operations Specifications.

4.3 FLOWCHART OF RECOMMENDED APPROVAL PROCESS.

Figure 2 shows a flowchart of the recommended approval process for a typical process specification submission.

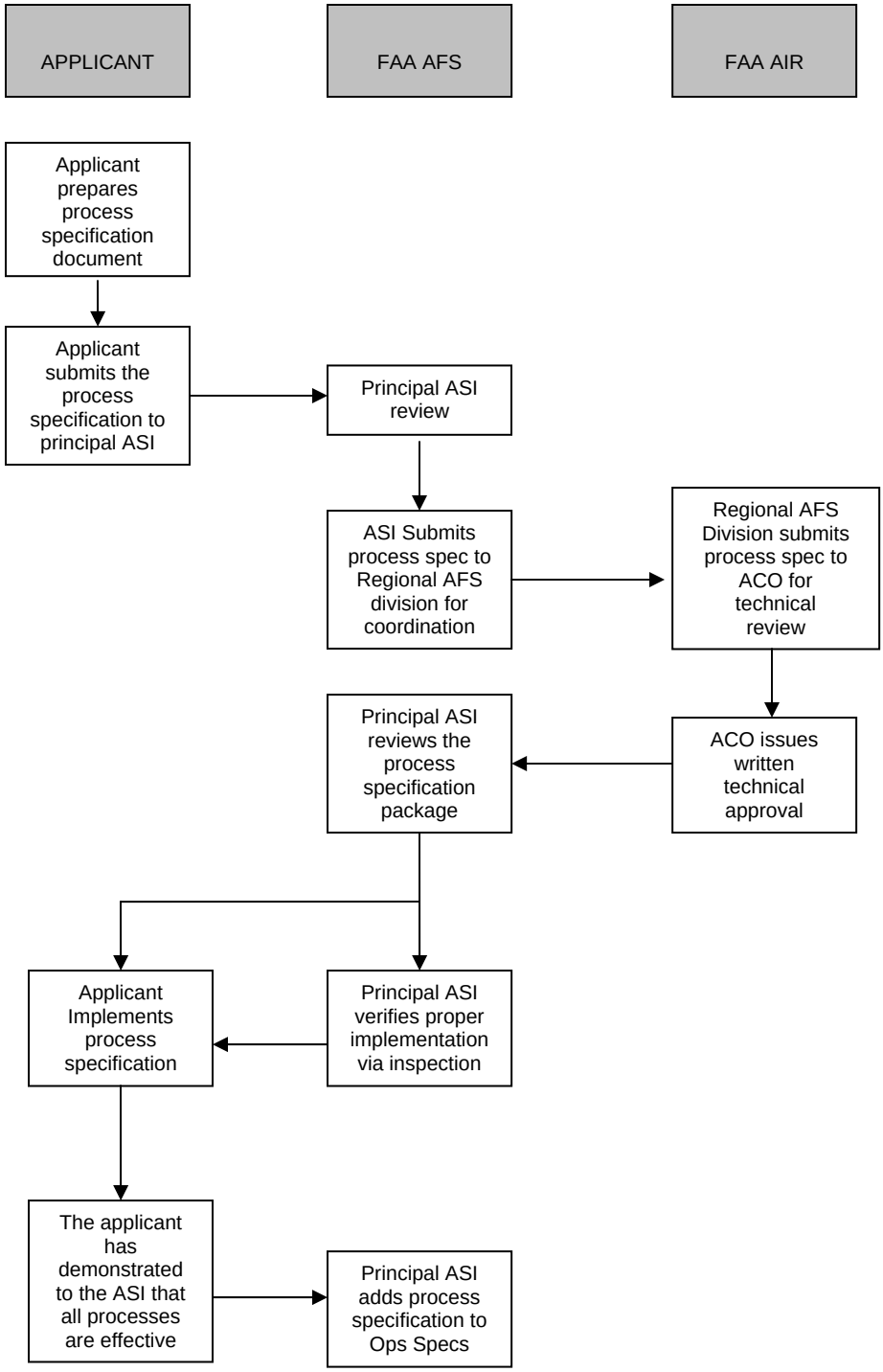

Figure 2. Flowchart of Recommended Approval Process

4.4 FOREIGN OPERATORS AND REPAIR STATIONS.

The process should begin at the IFO for foreign operators with N-registered products or maintenance programs for an airline's aircraft mandated by 14 CFR 129.14. Each operator is obligated to ensure that its aircraft are maintained in accordance with U.S. requirements, particularly if it is flying into the U.S. under a 14 CFR 129.14 maintenance program.

It is the responsibility of the foreign carrier to ensure that all maintenance is performed using repair data in accordance with their FAA-approved program. Any major repair that is outside the OEM's standards and requirements has to be approved by the ACO or DER prior to initiating the repair process. If a foreign operator accepts these repairs without approval, they may be in violation of Title 14 Code of Federal Regulations and the part, component, or aircraft involved in the repair may not be considered airworthy for flight. A foreign repair station that considers a change to a process specification or repair that could affect the airworthiness of N-registered aircraft should coordinate the new process through their IFO once the initial analysis process has been completed and the company has followed the latest ATA format. The PMI would then review the package and any data that could affect airworthiness of the product. That data should be sent to the ACO for approval, and the PMI should coordinate the package through the AEG group that has responsibility for the product after the package is completed for concurrence. The coordination step should ensure that none of the procedures or process steps has been overlooked.

4.5 DOMESTIC OPERATORS WITHOUT SFAR 36 OR ODA APPROVALS.

An air carrier that does not have engineering support, or has very little support, will have to use a DER for all its major repair determination. The operator is obligated to maintain its aircraft in accordance with OEM requirements to ensure that all repair data is FAA-approved and that all maintenance is performed in compliance with their FAA-approved program. Any repair that is outside the OEM's standards and requirements has to be approved by a DER prior to initiating the repair process. Some air carriers have in-house OEM support and the repair data is approved through their particular ACO office. This data will normally be provided to the repair station prior to beginning the repair process. A domestic repair station that considers a change to a process specification or repair that could affect the airworthiness of aircraft should coordinate the new process through their FSDO once the initial analysis process has been completed and the company has followed the latest ATA format. The PMI would then review the package and any data that could affect the airworthiness of the product, send the data to the ACO for approval, and coordinate the package through the AEG group that has responsibility for the product after the package is completed for concurrence. This coordination will ensure that none of the procedures or process steps has been missed.

4.6 REVIEW AND MONITORING OF PROCESS SPECIFICATION ACTIVITIES.

Research shows that there are currently a number of initiatives that have been established within the FAA to address the issue of repair/process specifications. For example, an FAA committee is currently in place that is composed of eight AIR and AFS personnel, which has been named Standardized Procedures in Alterations, Repairs and Certification (SPARC). This committee is

working on repair/process specifications topics, with the aim of providing guidance to FAA personnel, as well as its designees and industry personnel.

The SPARC committee is reviewing practices within various FAA Regions and any MOUs between the FAA and repair stations regarding repair/process specifications, as well as industry, to learn if there are some "best practices" that may be currently in place. The committee is also looking at the use of "repair specifications," and a proper definition for what are collectively known as "process specifications," and hopes to standardize the use of each term differentiating between their uses within the FAA to clarify the issue for all personnel involved in their development and approval. The long-term goal of the committee is to issue an AC and possibly an FAA Order to achieve a national standard in the development of repair and process specifications. The repair specification development process would include appropriate coordination between the FAA AIR and AFS offices.

Another issue that the SPARC committee could examine is that, currently, there is no review process standard that involves the AEG during the approval of major repairs or repair/process specification changes. The AEG is an important part of the checks and balances required to maintain the airworthiness of U.S. products. The Aircraft Certification Service Directorates should address bringing the AEGs into the review process loop to ensure that all aspects of maintenance are addressed during the approval process. To improve this process, AEGs could have system experts available during the review step to ensure that all necessary requirements are addressed.

4.7 RECOMMENDED FOLLOW-UP RESEARCH AND COORDINATION.

4.7.1 Definitions.

One of the biggest challenges involved in describing process specification issues is simply one of terminology. It is obvious that the term "process specifications" means different things to different people in the industry, which has led to a proliferation of terms to distinguish between so called "generic" process specifications and what some call "repair specifications" or "maintenance specifications." There are almost certainly other terms in use (including the RDC used by Canada), but what is clear is that process specifications are split into two separate categories.

In one, the specifications are standards that have been established by a government or technical society, such as SAE or Military Standards. These standards are approved and/or accepted by the ACO during the development of a type certificate, STC, or PMA for airframes, engines, or components. Any deviation from these standards requires approval from the FAA ACO. In such cases, that deviation is approved for that repair station only.

The other represents the process, data, and repair method that a repair station will use to return an airframe, engine, or component to service per 14 CFR 43.13 (a) and (b).

It would be worthwhile for the FAA to simply clarify what is a process specification and what is a repair/maintenance specification and revise existing guidance to reflect whether each is

addressing one or the other type of specification. This would also require a substantial education process for FAA personnel and the industry to avoid any further confusion.

4.7.2 Coordinating Office.

One possible initiative that the FAA may consider could serve to enhance the standardization of process specification approvals. This initiative would create a centralized group with expertise in process specifications and their approvals, similar to the National Resource Specialists that are in the process of being phased out. There is significant expertise among FAA personnel in many aeronautical disciplines and FAA personnel who encounter process specification issues should have designated experts for them to go to in order to tap their expertise in a variety of fields. The FAA could establish process specification specialists in several general areas such as:

- Mechanical/structural
- Electrical/electronic
- Chemical/NDI

These specialists not only would have expertise in their particular area, but would also have intimate knowledge of the process specification development, review, and approval mechanisms. These specialists would ideally be located within FAA headquarters in Washington, DC, to allow them to have a general view across FAA lines of business and give them the ability to walk into a particular manager's office and discuss ideas and concerns. The establishment of such a group of specialists would provide an impartial and knowledgeable resource for all concerned parties to direct any questions or comments.