Federal Aviation Administration

Aviation Safety, (AVS) Repair, Alteration and Fabrication (RAF) Study

May 22, 2009
Revision 1

FEDERAL AVIATION ADMINISTRATION

DEPARTMENT OF TRANSPORTATION

AVIATION SAFETY, (AVS)

REPAIR, ALTERATION AND FABRICATION (RAF) TEAM STUDY

REVISION 1

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AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

Revision History		
Rev	**Description of change**	**Date**
v7	**Original as published in the Federal Register for comments on September 5, 2008**	**8-6-08**
Final Issue	**Post-Federal Register Notice of availability for comment**	**1-30-09**
Revision 1	**Revised to address additional comments from the Federal Register publication which were missed in the prior release. Those additional comments are contained in Appendix D, pages D-80 through the end of the report.**	**5-22-09**

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AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

BACKGROUND

PROJECT DESCRIPTION:

An FAA Aviation Safety (AVS) Repair, Alteration, Fabrication (RAF) team was chartered in 2007 to assess the adequacy of current and in process regulations, policy, guidance and past practices in relation to industry trends for obtaining non-Type Certificate (TC) holder developed replacement parts, alterations, and repairs. The Team was tasked to provide recommendations to close any gaps existing in both current and in-process regulations, policy and guidance necessary to ensure an acceptable level of continued airworthiness commensurate with the criticality of affected parts. The RAF team completed a thorough review of all existing regulations, policy and practices governing approval of replacement, repairs and alteration of critical engine parts. The team further reviewed all of the concerns raised by TC holders and other stakeholders including evaluation of common approval methods used for repair stations and owner/operator maintenance facilities.

The team met with many industry groups and companies to obtain input and validate the various stakeholders' concerns and needs. Based on that study and industry input the team developed a number of conclusions and recommendations to improve FAA's approval processes and the consistent application of the safety standards for replacement part fabrications, repairs, and alterations. The FAA is developing business plans to implement the teams recommendations.

This report is not an official regulatory or policy document and does not constitute any new or revised policy. This report is to provide information and recommendation for FAA leadership to consider and implement as they see fit through appropriate official regulatory or policy development procedures.

KEY ISSUES:

Concerns were raised by certain industry Type Certificate and Production Certificate (TC/PC) holders about the design integrity and regulatory compliance of non-TC/PC holder developed repairs, alterations, and replacement parts fabricated during the performance of maintenance or an alteration as well as those fabricated under a FAA Parts Manufacturer Approval (PMA). Some TC/PC holders claim that neither the non-TC/PC holders nor the FAA and FAA designees have sufficient knowledge about their products needed to develop safe, compliant repairs, alterations and replacement parts.

They believe this is especially true for safety critical, complex parts that function as a system with other parts.

Certain TC/PC holders and their revenue risk sharing component suppliers allege that FAA approved repairs, alterations, part fabrications and replacement part designs which were not developed by them are not adequately engineered and evaluated for compliance. Also TC/PC holders claimed that the non-TC/PC holders' quality control systems are not as robust as their PC quality control systems and do not adequately control the performance of repairs, alterations, and part fabrications at repair stations and air carriers. These positions are not unanimously held throughout the industry. It is worth note that not all TC/PC holders support these concerns.

Some TC/PC holders also note that, while these practices have been in place for many years, maintenance providers, owners/operators, and after-market parts fabricators (non-TC/PC holders) are now dealing with more safety critical and complex parts which increases the risk of an accident if not done properly. The TC/PC holders also claim that non-TC/PC holders are not required to repeat all of the product development, and compliance showing tests and analyses which TC/PC holders do for the original product type certificate. Hence, they claim that in addition to their safety concern, non-TC/PC holders have an unfair business competitive advantage because FAA does not make them repeat all of the original type certification testing and analyses. Because FAA regulations and policy do not require a complete re-certification of parts for repairs, alterations, and fabricated replacement parts, the TC/PC holders allege that such parts may not comply with the applicable airworthiness standards. They ignore the fact that even for repairs, alterations, and fabrications developed by the TC/PC holder, the FAA does not require a full re-certification of the parts to the degree they are proposing.

There are two primary issues at the root of this study which are the concern over safety and compliance (real or perceived) and the economic issue of business competition between TC/PC holders and the aftermarket maintenance, alteration and replacement parts providers including owners/operators who fabricate their own replacement parts and develop their own repairs and alterations.

Consequently, the FAA AVS management chartered a Repair, Alteration and Fabrication (RAF) Team in 2007 to identify and analyze the regulations, policy, current practices, relevant data, and differing views related to those concerns. The team was also tasked to identify alternatives to close any gaps and conflicts in AVS rules, policies, and work practices

in order to maintain an acceptable level of continued airworthiness while minimizing the adverse impact of any changes on stakeholders and aviation business efficiency.

HOW DID THIS START?

The basis of the U.S. aviation system statutory requirements, regulations and policy with respect to the aircraft is to support the owners/operators who are responsible for the airworthiness of their aircraft. After an aircraft design is initially type certificated and manufactured under the production certificate, the aircraft receives a Certificate of Airworthiness when it has been shown that the aircraft conforms to the approved design and is safe for operation (14 CFR 21.165, Responsibility of [production certificate] holder). The TC/PC holders, STC holders and FAA PMA holders have the responsibility to design and manufacture aircraft, engines, propellers and parts that comply with the applicable airworthiness requirements conform to the approved design data, and which are safe for operation ***before*** they sell them to owners/operators.

After its original production an aircraft is sold to an owner who by regulation, along with any operator of the aircraft, is responsible for maintaining the continuing validity of the Certificate of Airworthiness. This is what is commonly called "maintaining the continued airworthiness or continued operational safety." That includes complying with any airworthiness limitations, airworthiness directives, and other requirements pursuant to 14 CFR 21.181, Duration [of certificate of airworthiness], which states that the original Certificate of Airworthiness remains valid ***"…as long as the maintenance, preventive maintenance, and alterations are performed in accordance with Parts 43 and 91 of this chapter and the aircraft are registered in the United States."*** Other countries may establish different airworthiness requirements but under U.S. bilateral agreements with many countries and the ICAO requirements, other countries typically base their airworthiness certification on the state of design's requirements.

To maintain their aircraft owners/operators need to periodically have parts and components repaired, altered or replaced. In today's competitive global environment, with rising fuel cost and other economic demands, owners/operators need and want less costly maintenance services, parts and components that are safe and compliant with the regulations. They also need world-wide acceptance that their aircraft are safe and compliant for both operational approval and if they wish to sell or export the aircraft.

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

There are a variety of means permitted under the CFRs for owners/operators to maintain their aircraft and restore or replace parts and components. Those are:

- Purchase parts from a:
  - TC/PC holder
  - STC/PC-PMA holder
  - PMA holder
  - TSOA (or Letter of TSO Design Approval) holder
- Repair or alter existing parts and components
- Fabricate their own parts during maintenance or alteration (owner/operator produced parts or fabrication under the guidance of AC 14-18)
- Have parts approved "in any other manner approved by the Administrator" under 14 CFR 21.305(d) *Approval of materials, parts, processes, and appliances.*

What is the difference in airworthiness of parts from these sources? The answer is "no difference." They all must comply with the applicable airworthiness standards, be repaired, altered, or fabricated such that they conform to the approved or acceptable data and be safe for operation. For example the airworthiness of a PMA fabricated part is no different than an owner/operator fabricated part. However, an owner/operator fabricated part is not "for sale for installation in…" because it is only for the owner's/operator's use on their own product and the data is not approved pursuant to 14 CFR 21.303. A PMA part is not fabricated pursuant to conducting maintenance or by the owner/operator and the PMA approval holder is not the installer of the part.

A PMA part, owner/operator produced part, and a part fabricated during maintenance or alteration (AC 43-18, Fabrication of aircraft parts by maintenance personnel) will have appropriately approved or acceptable data and quality control requirements. A PMA holder will have a quality control system and owner/operators or maintenance providers will have quality control requirements under their operational certificate, airman certificate, or Air Agency Certificate requirements. Also, pursuant to 14 CFR 43.13, Performance rules (general), they "…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)." The question was raised about when approved data versus acceptable data was needed and the applicability of 14 CFR 21.305, Approval of materials, parts, processes, and appliances to repairs, alterations and fabrications. As 14 CFR 21.305 states; "Whenever a material, part, process, or appliance is required to be approved under ***this chapter***, it may be approved—…" This ***chapter*** of the CFRs referred to in 14 CFR 21.305 includes 14 CFRs 1 through 59. Hence, the requirement to have approved data is governed by 14 CFRs 1 through 59 and any other CFRs incorporated by reference that would require the use of approved data. Typically, except for the specific certificates and approvals required pursuant to 14 CFR 21; that requirement for approved data predominately applies to major repairs and major alterations.

Maintenance providers (repair stations, certificated mechanics, etc.) who support the owners/operators are required to conduct maintenance and alterations in accordance with the applicable CFRs so that the aircraft's airworthiness is maintained throughout its life. This is often called recurrent airworthiness certification which means the aircraft continues to conform to its approved design and be in a condition for safe operation. That attests to the fact that over time, as maintenance and alterations are performed, the aircraft continues to meet its approved design which includes the original type design (14 CFR 21.31, Type design) plus any repairs and alterations (design changes) made to it.

Keep in mind also that there are operational requirements that require operating limitations and other conditions established by the Administrator to be adhered to operationally that indirectly affect maintenance but are not part of maintaining the currency of the Certificate of Airworthiness under 14 CFR Sub-Chapter C, Aircraft. To maintain the currency of the Certificate of Airworthiness, as previously noted, 14 CFR 21.181 requires only that ***"… the maintenance, preventive maintenance, and alterations are performed in accordance with Parts 43 and 91 of this chapter and the aircraft are registered in the United States."***

Repair Stations and other aftermarket maintenance providers and parts suppliers want to meet the needs of owners/operators who are responsible for the airworthiness of their aircraft. Aftermarket providers often have lower costs because they don't have the large organizational infrastructure like a TC/PC holder who produces and supports a complete product. Thus, they can often conduct maintenance, perform alterations and fabricate equivalent replacement parts for less money.

After sale of the aircraft TC/PC holders have historically played a large role in supporting the owners/operators in many ways principally for business and liability reasons. They have also supported the FAA and NTSB in accident investigations since they have a vested interest if it were determined that the accident was caused by a

design or production deficiency in one of their parts. The only true regulatory obligation after sale of the aircraft that TC/PC holders' have is to:

- Report malfunctions, failures or defects in their products and parts under 14 CFRs 21.3, Reporting of failures, malfunctions and defects, and 21.4, ETOPS reporting requirements,

- Distribute the initial Instructions for Continued Airworthiness for their product under 14 CFR 21.50, Instructions for continued airworthiness and manufacturer's maintenance manuals having airworthiness limitations sections, including revisions thereto whenever they make a design change that would require changes to the ICA, and

- Make any required design changes under 14 CFR 21.99, Required design changes, to preclude unsafe conditions and correct non-compliances when the FAA finds that an unsafe condition exists or is likely to develop which requires an airworthiness directive to correct under 14 CFR 39 Airworthiness directives.

It is worth noting that TC/PC holders are not otherwise legally obligated by the CFRs to promulgate repairs, design changes, produce replacement parts, or provide any of the other business support services they provide their customer owners/operators. However, if they choose to develop repairs, design changes or produce replacement parts then they are only bound by the very same CFRs that the non-TC/PC holders are held to for those same activities.

SAFETY CONCERNS:

The AVS RAF Team agrees that the design, development and compliance of repairs, alterations, fabrications and PMA, when dealing with safety critical parts, needs to be consistent and of a high level of integrity commensurate with the parts criticality. The RAF Team found that there were occasions where a PMA part or non-TC/PC holder repairs or alterations were associated with failures in service and occasionally with accidents. Airworthiness Directives have also been written for non-TC/PC holder parts, repairs and alterations as they have been for TC/PC holder parts. It was noted that, through no fault of their own, PMA holders unknowingly replicated design flaws that existed in the TC holder's type design. In such cases the FAA had to issue an AD against both the TC/PC holder's and the PMA holder's parts. In the PMA approval process it is not the responsibility of the PMA applicant or the FAA to search out and fix deficiencies in the TC/PC holder's design.

The RAF Team also found that there have been some repairs, alterations, fabrications, and PMAs that were not properly classified or did not have a clearly documented showing of compliance. However the team did not find any substantial evidence of failures or unsafe conditions arising from non-TC/PC holder developed data that would indicate a systemic lack of compliance or capability in either the non-TC/PC holders' designs or the FAA's oversight of compliance. The general population of PMA parts and non-TC/PC holder repairs, alterations has increased substantively in past years particularly in the commercial aviation sector yet the occurrence of service difficulties and airworthiness directives on such parts for design, production or compliance shortfalls have not increased proportionally.

The FAA agrees with industry that due diligence must be exercised by TC/PC holders, non-TC/PC holders and the FAA alike when designing and using replacement parts, repairs and alterations. This is especially true for commercial transport aviation as well as general aviation. The general aviation sector and owners/operators have used their own repairs and fabricated parts for decades much more extensively than most people realize. The safety concern, though largely unfounded to date, led one TC/PC holder to recommend a complete prohibition on all repairs, alterations, fabrication and PMAs that are not developed by the TC/PC holder for critical parts and any parts that touch or influence those critical parts. The RAF Team is by no means implying that because of the aviation industry's good track record to date, that we should not take steps to improve the integrity and consistency of all repairs, alterations and PMA and other fabricated replacement parts. The RAF Team's recommendations, taken in to-to, are aimed at improving the integrity and oversight of those types of approvals and their applications.

Two points became clear to the team regarding concerns about the adequacy of compliance showings and FAA findings during the approval of repairs, alterations, and fabricated parts, including PMA parts.

First, many stakeholders are confused by the variety of means accepted by the FAA for showing compliance of repairs, alterations, fabricated parts. The basis for beginning a compliance evaluation starts with the assumption that the original product design and part thereof being repaired, altered, or fabricated for replacement is already compliant with the airworthiness standards. The objective for performing maintenance and alteration as stated in 14 CFR 43.13(c), Performance rules (general), is to "…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)."

For a repair or alteration the compliance focus is on what affect the work performed and resulting configuration of the repair or alteration will have on the part and product. This is frequently a comparative assessment using appropriate tests and analyses, especially for repairs, and does not require a full direct certification compliance showing to all the applicable airworthiness requirements. Similarly, for the fabrication of a part; either a PMA, a part fabricated pursuant to performing maintenance, or an owner/operator produced part; the objective is to replicate an equivalent part with respect to the airworthiness and functionality of the product. Aside from PMA by identicality, this is typically done by comparative test and analyses to show equivalency to the original type design but not by repeating all of the original type certification testing or analyses. The underlying assumption is that the original type design part is compliant with the airworthiness requirements and conforms to its approved design data. If an applicant can not adequately show identicality or any comparative analyses and testing can not adequately show equivalence to the original type design part with respect to its airworthiness, then direct compliance showing to the applicable airworthiness requirements may be necessary.

PMA parts may be equal to or better than the original TC/PC holder's part as long as any differences are no more than minor changes to the type design that do not adversely affect airworthiness and form, fit and function. This is implied also by the fact that PMA parts (as with repairs and alterations) may have supplemental ICAs issued for maintaining the part due to any differences from the TC/PC holders parts. For more substantive changes that qualify as a major change to the type design under 14 CFRs 21.113, Requirement of supplemental type certificates and 21.93, Classification of changes in type design, would require a supplemental type certificate (STC). For an STC the compliance showings can be substantial even to the point of complete recertification of the respective design changes and any original parts in the product that are affected by the alteration being introduced by the STC.

Secondly, many also do not understand the role of the FAA's discretionary authority regarding our judgment and decision making about what the FAA does or does not review before granting an approval. It is the responsibility of the applicant for any FAA approval to comply with all of the applicable airworthiness standards. The FAA has the discretion to look at all or a portion of the applicant's data based upon the criticality of the part, the experience and track-record of the applicant, the scope of the change, and other factors within the bounds of FAA directives governing how the FAA performs its compliance oversight responsibilities. The objective of the FAA, when making any approval for aircraft in service, is to a.) Achieve an acceptable level of

continued airworthiness based on the applicable rules and policy even though the acceptable methods of showing compliance vary based upon the type of approval being sought, and b.) Assess the applicants showing that they have not introduced any new features that could be potentially unsafe. Again, this presumes as a starting point that the original product and part design complies and is safe for operation. The repair, alteration, or fabrication of a replacement part is therefore intended to return the product to its original or properly altered condition. In those instances within the scope of maintenance work under 14 CFR 43 there should be no changes to a product substantive enough to be a change to the type design. If there were a change in design then it would be an alteration, not a repair or fabrication of a replacement part. If the design was altered and if it was a substantial enough change, it may require an STC and a more expansive compliance showing for approval.

The FAA and FAA designees place added emphasis on the criticality and scope of a repair, alteration, PMA or design change (i.e.; a TC holder's design change or an STC) when judging how deeply to scrutinize the applicants compliance showing. When striving for a comparable level of certitude across the various types of approvals FAA makes for aircraft in service, it must be emphasized that a "comparable level of certitude" does not mean that the exact same methods of showing compliance must be repeated by everyone or are applicable in every case. The methods of showing compliance for a repair, alteration or fabrication, although different than the original TC/PC holder's showing, must show that the certification basis of the product is not invalidated and that an unsafe condition is not introduced.

One TC/PC holder recommended that all applicants for repairs or alterations to critical parts and parts that can influence critical parts should have to repeat the complete compliment of certification testing that they did for the original TC. The current FAA rules and policy do not require that and FAA's experience with most non-TC/PC holder applicants does not support the need to make this change. Also, there is no substantive part failure, event, or safety data to warrant such a change.

LIABILITY CONCERNS:

The TC/PC holders and owners/operators are concerned about the liability that a failure of an aftermarket part may affect their credibility and costs. The TC/PC holders are claiming that with non-TC/PC holder approved parts and repairs in the product that their ability to fulfill their Continued Operational Safety (COS) responsibility is compromised. TC/PC holders continue to call the product, "their product" and cite the fact the data plate required by 14 CFR 45, Identification and registration marking, identifies them as the manufacturer when in fact there are replacement parts in the product that were produced by other entities. That has been the situation for decades

but now TC/PC holders are contesting that long standing reality. The TC/PC holders forget that the product is not "their product." It belongs to the owner/operator who is ultimately responsible for the airworthiness of the aircraft. The TC/PC holder is only responsible for the parts they design and manufacture just as any aftermarket maintenance or replacement part provider is responsible only for the work they perform (including repairs) and the design and fabrication of parts they provide. The fact that there are aftermarket parts, repairs and owner produced parts in an aircraft only means, as has always been the case, that any accident/incident investigations must be a cooperative effort of all the affected design, production, operations, and maintenance provider stakeholders.

Another aspect is that the TC/PC holders want parts that are fabricated during maintenance and parts with extensive repairs and alterations to not be marked [or re-marked] with the original TC/PC holder part numbers. They also noted that the traceability of non-TC/PC holder parts is often questionable because aftermarket companies do not have tracking systems that are as comprehensive as theirs. The team concluded this is likely true in most cases. There is no regulatory basis that requires marking of any parts other than parts subject to an Airworthiness Limitation (14 CFR 45.14), PMA parts (14 CFR 45.15) and TSO parts or articles (14 CFR 21 Subpart O). Also, there is no requirement for manufacturers and fabricators of parts to track them or to have a tracking system. The owner/operator is responsible for their aircraft configuration management, conformity, airworthiness, and records management to ensure that airworthiness limitations are adhered to, ADs are accomplished, maintenance records are kept per the CFR, and the aircraft configuration conforms to its approved design. The fact that the TC/PC holders support the owners/operators in fulfilling some of those responsibilities is often misrepresented as the TC/PC holder being responsible.

The FAA is aware of and sensitive to the TC/PC holders' liability concerns. In today's world of litigation anyone associated with an aircraft involved in an accident/incident regardless of their culpability could be forced to share in a legal settlement. As a result of that concern some TC/PC holders have recommended that the product data plate listing them as the manufacturer should be removed from aircraft and engines that include a substantial number of non-TC/PC holder repairs, alterations and replacement parts because they claim that the product no longer conforms to their TC type design. The FAA disagrees with that proposal for both practical and regulatory reasons. There is a subtle point to remember that the TC/PC holder owns the original type "design" but not the "product" once it is produced and leaves their quality control system. Once in service, aircraft configurations very quickly diverge from the pure TC holder's type design configuration due to maintenance and alterations that are performed.

It is also noteworthy that in most investigations the owner/operator, who is ultimately responsible for ensuring the aircraft's airworthiness, is rarely involved except for major accidents. In the past owners/operators and the FAA have expected the TC/PC holders to investigate service events and accidents. In today's environment when owners/operators are using a higher percentage of repairs, alterations and replacement parts that were not developed by the TC/PC holder, the owners/operators need to become more active in leading investigations and engaging the responsible non-TC/PC holders when aftermarket repairs and parts are involved.

ECONOMIC CONCERNS:

Owners/Operators want and need cheaper, yet safe, parts to stay competitive in today's global economic environment. They are also more frequently contracting out maintenance to both domestic and overseas providers. That is necessary not only to obtain more cost effective maintenance but also to obtain maintenance wherever the aircraft may be located around the world. There are follow-on impacts for owners/operators as doubt is increasingly cast on the integrity of non-TC/PC holder parts and services by the TC/PC holders. Those impacts include higher insurance costs, lost warranties, liability concerns, lower aircraft resale value, and eroded public confidence. The owner/operator needs to have their aircraft with non-TC/PC holder developed parts, repairs, and alterations to be accepted globally as readily as those with the TC/PC holders parts and repairs installed. Similarly non-TC/PC repair and alteration approval holders and PMA holders need to have their parts, repairs, and alterations to be accepted globally as readily as those of the TC/PC holders because they are marketing their products and services to a global customer base.

There is fierce competition between TC/PC holders (including their revenue/risk-sharing suppliers) and the independent aftermarket parts providers of repairs, alterations and fabricated replacement parts and other maintenance services to owners/operators. Also many owners/operators provide maintenance services or have entered into partnerships with non-TC/PC holders to develop repairs and fabricate replacement parts. As the major TC/PC holders themselves diversify into maintenance, aftermarket parts supply, and aircraft/engine leasing, they are thus vying for a share of the very market that they are criticizing and they are at the same time lobbying for regulation and policy changes in their favor. For example; a major TC/PC holder owns over 25 repair stations worldwide, is repairing and fabricating parts and applying for STCs and PMAs. Another TC/PC holder owns a major aircraft leasing company and an estimated 20 repair stations worldwide. Some engine TC/PC holders also lease engines on a power-by-the-hour basis. Consequently, TC/PC holding companies are increasingly in a position to control what parts, repairs and alterations go into aircraft they own or for which they offer warranties and maintenance

services. The TC/PC holders are cutting back or eliminating customer product support if the owner/operator incorporates non-TC/PC holder developed repairs, alterations or replacement parts in their aircraft. TC/PC holders have also acquired independent companies that held PMAs or had developed their own repairs and alterations. Once a TC/PC holder acquires an aftermarket company, the repairs and parts which they had previously complained about suddenly became acceptable. As a consequence of the above factors TC/PC holders and the leasing companies and repair stations they own are putting pressure on owners/operators with restrictions on customer support services, warranties, the use of Instructions for Continued Airworthiness, etc.

The FAA understands the economic needs of all the stakeholders, TC/PC holders included. However, the FAA's statutory obligation is to regulate in the interest of safety, not economics. The AVS RAF Team concluded that regardless of the outcome and actions from this study, the allegations and desires of the principle stakeholders on both sides of the issues will not substantively change due to the economic competition pressures. Certain major issues such as the above are outside of FAA's control and are being driven by the global business environment side of the equation. One of the principles that the AVS RAF Team applied and must continue to be challenged is "What are the safety substantiation and the regulatory basis for anything the FAA requires today or intends to change for the future?"

The AVS RAF Team also recognized that non-standardization not only across Aircraft Certification but also between AIR and AFS has been a significant contributor to past difficulties and to burdens placed on industry. It is also noteworthy that the FAA must be sensitive to industries needs to meet a host of other governmental regulatory requirements such as EPA, OSHA, DDTC (Directorate of Defense Trade Controls) and other regulatory requirements in addition to what FAA requires. That creates a daunting task for industry so the FAA must be clear about the safety substantiation for any requirements and not burden industry with unnecessary requirements or due to FAA's non-standardization.

STAKEHOLDER ANALYSIS

The AVS RAF Team concluded that the stakeholders in these issues are extremely diverse and have conflicting needs. Some stakeholders did not understand the regulatory obligations of other stakeholders thus adding confusion to their diverse views and needs. As the TC/PC holders are diversifying into maintenance, aftermarket parts supply, and aircraft/engine leasing they are increasingly in a position to influence market decisions of other stakeholder groups. For example, TC/PC holders have begun to deny warranty and product support for their products if an owner/operator uses non-TC/PC holder developed

parts or repairs. TC/PC holders have also been careful to level their criticisms at independent PMA and repair station holders. TC/PC holders have not been critical of the air carriers who buy or lease their aircraft or of the PMA holders and repair stations they own or support through license agreements. This diversification has caused difficulty for entities that hold multiple certificates/approvals who therefore must meet a wider variety of different regulations and business obligations. A company that is a TC/PC holder and is also a repair station certificate holder, STC or PMA holder and/or a leasing company owner of aircraft may have competing internal interests. For example; one TC/PC holder made a recommendation to FAA to eliminate all non-TC/PC holder developed repairs, alterations, fabrications, and PMAs of critical parts. However, that TC/PC holder forgets that they are also a repair station certificate holder and an owner of lease aircraft and thus they would still want the ability to develop repairs and alterations on other TC/PC holders' products which is what they were recommending against.

To put this in perspective, the following is a brief summary of the various stakeholders' wants and needs collected by the AVS RAF Team. There were numerous other stakeholder comments and concerns collected of lesser consequence which were considered by the FAA as the AVS RAF team recommendations and detailed proposed projects were developed. However, there were several very significant issues and concerns in each of the major stakeholder groups that are worthy of note in this report.

The AVS RAF Team noted that all of the stakeholders shared certain common interests of wanting:

- Compliant and safe aircraft.
- Enhanced reliability.
- Timely availability of Airworthiness Authority approvals.
- To make money on the sale of their maintenance services, repairs, alterations, and fabricated replacement parts.
- Less expensive but timelier replacement parts and maintenance to reduce operating costs and ticket prices.
- The ability to utilize enhanced state-of-the-art maintenance (including repair) and alteration methods that improve the quality of the products

- Standardized application of FAA compliance requirements and policy. (level playing field)

- Global acceptance of their aircraft, parts, repairs, and alterations.

There were also some key differences in the needs and interests of all the stakeholders as well as slightly differing views of about what the above generic interests mean to them. This was complicated by the fact that the different stakeholder groups all operate under different sets of regulatory CFR requirements which affect both their needs and the impact of any potential changes.

The AVS RAF Team reviewed numerous communications sent to the FAA by companies and industry groups, documents sent between companies, and past FAA communications and policy statements sent to industry. The AVS RAF Team results were also briefed to a large sector of industry groups and individual companies to obtain feedback and clarify stakeholders' positions before finalizing this report. The following is a generic synopsis of the stakeholder information collected by the team:

PUBLIC:

The public (non-industry and non-owners/operators) perceive that less expensive after market parts are less durable both due to their experience with less controlled non-aviation products such as the automotive industry and also due to the adverse marketing image being created by the TC/PC holders.

AIRCRAFT OWNERS/OPERATORS (AIR CARRIERS AND GENERAL AVIATION):

Owners/Operators expressed concern over the non-standardization of FAA with regard to what is required for their maintenance programs and operations specifications, capabilities lists, etc. They also noted that different FAA regions have differing views on what repairs are major, what needs an STC and on what parts need a PMA. The lack of standardization in FAA's interpretation and application of rules and policy creates problems, delays and added costs with no safety benefit. The concerns over lack of standardization were applicable to both the FAA Flight Standards and Aircraft Certification Services. The resulting confusion has for example led to FAA inspectors and industry persons filing unwarranted Suspected Unapproved Parts (SUPS) reports due to differing views on what is acceptable.

Owners/Operators were concerned that any change to FAA's current policy on part marking could have a significant impact on their ability to manage aircraft configuration

and conformity. Unless an aircraft is altered by incorporating an alteration (including an STC, PMA part or a TC/PC holder's type design change) there is no need or requirement to change a part's original part number. Under the CFRs a repair or other maintenance is not supposed to have an appreciable effect on the product's type design. They stated that the AVS RAF teams original proposal to mandate part number marking for major repairs, major alterations and fabrications (other than PMAs and STCs) could create far too many new part number configurations which would be a recordkeeping and configuration management nightmare with no safety benefit.

Aircraft owners/operators also expressed that:

1. They don't want to lose their existing regulatory authority and ability to determine major/minor repair or alteration classification and to develop their own maintenance program requirements, repairs, alterations, and fabrication of owner produced parts.

2. They object to the proposal that all repairs & alterations of critical parts be classified as major, even using a more standardized definition of critical. They believe the FAA call too many parts critical when service experience and safety assessments show that the failure consequences of many parts are not hazardous even though the FAA and TC/PC holders call them critical.

3. Making more repairs major also creates additional recordkeeping for negligible safety benefit.

4. They object to the fact that after decades of conducting maintenance, including designing and performing repairs, they are now being accused by TC/PC holders of being incapable or unqualified to develop and conduct repairs, alterations and fabrications.

5. Major repair and alteration data submittals require too much time to obtain FAA approval because FAA is often overly critical of submittals and they do not let designees perform approvals of certain data because the FAA does not trust the designees to make an adequate assessment of compliance.

6. They object to TC/PC holders holding back repairs from the ICAs, trying to channel more repair and parts replacement work to the TC/PC holder's own repair stations, and putting restrictive statements about non-TC/PC holder developed parts and repairs in the ICAs and other service documents. Those actions by TC/PC holders cast doubts on the integrity of non-TC/PC holder developed repairs and restricts an

owner's/operator's ability to obtain timely, cost effective maintenance when there are no repair instructions in the manuals. By the TC/PC holders not placing repair instructions in the ICA they actually create the need for more non-TC/PC holder repairs to be development and they increase the time and costs of owners/operators to obtain repairs for their aircraft.

7. They object to FAA creating different approval coordination processes for engine parts and constraining engine DERs in an attempt to control major repair and PMA approvals through the Engine & Propeller Directorate. Those actions add time and cost to obtaining approvals with negligible safety benefit.

8. They object to TC/PC holders restricting warranties and customer support if they use non-TC/PC holder developed FAA approved parts and repairs in their aircraft.

TC/PC HOLDERS AND THEIR SUPPLIERS/REVENUE – RISK SHARING PARTNERS,

TC/PC holders, including their supplier revenue – risk sharing partners and TC/PC holder owned or licensed PMA holders want to avoid liability by association when problems are caused by parts repaired, altered, fabricated or manufactured by other parties. However, they still want to be able to obtain PMA, STC and repair approvals for other TC/PC holders' product lines but don't want others doing the same for their parts. TC/PC holders continue to believe non-TC/PC holders and the FAA do not have sufficient knowledge and data about their products and its compliance requirements to adequately develop and certify repairs, alterations, fabrications, and replacement parts for critical and complex parts or components.

TC/PC holders and their partners would prefer to not permit any non-TC/PC holder repair, alteration or replacement parts activity at all for critical and complex parts. However, if that is not an option, then they wanted non-TC/PC holder PMA parts, repairs, alterations, and fabrications to go through the exact same developmental and compliance process and requirements that they had to for the original product's TC/PC.

One TC/PC holder stated that parts fabricated by owners/operators or fabricated pursuant to performing maintenance should be removed from service when the aircraft is sold since under 14 CFR 21.303(b)(2), Replacement and modification parts, those parts are only for the owner's/operator's own use.

TC/PC holders expressed concern that FAA and non-TC/PC holders need to ensure that the reliability and durability of repairs, alterations and replacement parts is maintained. This is

especially true for extended range operations (ETOPS) where there are FAA required reliability thresholds that must be met so that the current levels of reliability owners/operators are maintaining is not degraded. They also recommended revising the ETOPS reporting requirements of 14 CFR 21.4, ETOPS reporting, which are not equitable since non-TC/PC holders do not have to report and also because the CFR requires redundant reporting of the same data by owners/operators, aircraft TC holders and engine TC holders. Under 14 CFR 21.4 (b) redundant reporting to the FAA is required of the same data by both the aircraft and engine TC holders and some of that data required under 14 CFR21.4 is also redundant to reporting required of ETOPS operators under 14 CFR 121.374, 121.704, and 121.705. This redundancy burden was levied on the industry because the FAA does not have a process for sharing data and reports internally between the Aircraft Certification Office and the Engine Certification Office nor between the Flight Standards Service and the Aircraft Certification Service.

Additionally the TC/PC holders objected to:

1. The original TC/PC holder part numbers remaining on owner's/operator's non-TC/PC holder fabricated parts and extensively repaired or altered parts. They felt that the presence of that part number implied that they had fabricated, altered or repaired the part and thus they may be held liable. They consider the part number as their intellectual property because it is on the drawings that define their approved type design and they placed the original number on the part when it was originally manufactured.

2. Being held responsible or liable for COS, reporting and investigations on aircraft and engines which incorporate non-TC/PC holder developed fabricated parts and extensive repairs. They understand that the CFR only hold them responsible for the parts they design and manufacture. However, they fear that in the event of an accident, because they know nothing about the design of other person's repairs, alterations, or fabricated parts, they may not be able to determine whose part failed first and caused the accident. Thus they may be held accountable by FAA or in a court of law when failure of their part was not the root cause of the accident.

3. ICAs the TC/PC holders develop being used for designing and maintaining non-TC/PC holder developed fabricated parts and repaired parts.

4. Maintenance records and aircraft configuration only being required by the CFR to be kept for 1 to 2 years. They believe that configuration management and parts compatibility documentation of aircraft is inadequate to substantiate the conformity to an appropriate approved design.

It became clear that past initiatives in the 1980's and 1990's to solve some of the repair, alteration, fabrication and PMA issues were largely unsuccessful because of the diverse stakeholder interests. Those varied positions have not changed substantively over the years with one exception. Competition for maintenance, alteration and replacement parts business between TC/PC holders and non-TC/PC holder has increased substantially. The TC/PC holders have not all unanimously embraced the concern over non-TC/PC holder parts, repairs and alterations because some of them realize that:

1. the volume of product support needed in today's global aviation market with the ever increasing aircraft population can not be managed by the TC/PC holder alone, and

2. Some TC/PC holders are heavily diversifying into the maintenance and leasing market so they want to be able to develop and perform non-TC/PC holder maintenance on other TC/PC holders' product lines.

Some TC/PC holders don't want to be seen as lobbying against the very maintenance and replacement parts business they are getting into and they don't want to be adversely affecting the owners/operators' costs and flexibility who are the very people they want to sell aviation products and services to.

INDEPENDENT LEASING COMPANIES:

Leasing companies are concerned about TC/PC holder claims that aftermarket parts and repairs will void warranties or are unsafe. (Liability and financial issue) This adversely affects their ability to insure and sell or lease their aircraft to customers and to export it to another country due to repairs, parts, and modifications that are non-TC/PC holder developed being perceived as having lower integrity.

LEASING COMPANIES OWNED BY TC/PC HOLDERS:

Leasing companies owned by TC/PC holders want to have only their own TC/PC holder approved parts, repairs and alterations in their aircraft or engines particularly for critical and complex parts. That creates parts and maintenance sales for the parent TC/PC holding

company, improves the resale value and acceptability of the aircraft globally, and controls their legal liability. However, when they own an aircraft or engines of someone else's type design they want the ability to obtain PMA, STC, and repair approvals on other company's products.

TC/PC HOLDER OWNED OR SUPPORTED PMA HOLDERS:

TC/PC holders owned or licensed PMA holders want to avoid liability by association when problems are caused by parts repaired, altered, fabricated or manufactured by other parties. They still want to be able to obtain PMA for other TC/PC holders' product lines but don't want others persons obtaining PMA for their parts. While some TC/PC holders claim that non-TC/PC holders and the FAA do not have sufficient knowledge and data about their products, these same TC/PC holders claim to know enough about other TC/PC holders products in order to obtain approval of repairs, alterations, and fabrications on their competitor's products.

The AVS RAF Team was aware that some TC/PC holders have purchased companies that are repair stations and/or held PMA and STC approvals. Following such acquisitions those PMAs, major repairs, and STCs at those facilities they now owned were suddenly OK.

INDEPENDENT PMA HOLDERS:

Independent PMA holders also want a level playing field of requirements and oversight with other PMA holders but are concerned that recent trends may be leading toward overregulation. The requirements and degree of FAA involvement are not always aligned with relative safety risk of the part. Similar to the STC and repair community, PMA holders are concerned that PMAs are not accepted globally as having the same integrity as a TC/PC holder designed part. They are concerned about the false perceptions being promulgated that after-market parts and repairs are not as safe as TC/PC holder developed parts and repairs. Similar to the STC and repair community, PMA holders are concerned that PMAs are not accepted globally as having the same integrity as a TC/PC holder designed part even though the parts are airworthy and FAA approved. The PMA community through the Modification and Replacement Parts Association (MARPA) for example has come together to work diligently with the FAA on ensuring the integrity of their industry and products by developing industry continued operational safety (COS) management guidelines for PMA holders. Also, some air carriers have actually entered into business agreements with PMA holders to procure a source of low cost yet higher quality spare parts and are participating in the oversight of those PMA part sources from a business liability standpoint.

PMA holders noted that FAA is inconsistent in deciding what the definition of a part is and when a PMA is needed. They stated that FAA has issued PMAs for things that were not "installable parts" as required by 14 CFR 21.303, Replacement and modification parts, and that PMA has been issued for things that should be standard parts or were even minor alterations or major repairs under 14 CFRs 1.1, Definitions and abbreviations, and 43, Maintenance, preventative maintenance, rebuilding, and alteration.

The PMA community believes that during investigations of in-service failures the facts have not always been accurately represented and PMA parts have been falsely accused of being the root cause failure precipitating the event. The PMA holders have not been informed of service events in a timely manner by the FAA or TC/PC holders who become aware of events that involve a PMA part. The FAA, PMA holders and TC/PC holders alike agreed that investigations are a collaborative effort and timely sharing of information regarding service events is crucial to ensuring a swift response to correcting potentially unsafe conditions.

Like the owners/operators, PMA holders object to:

1. The proposal that all repairs & alterations of critical parts be classified as major, even using a more standardized definition of critical.

2. The fact that after decades of producing PMA parts that have operated safely they are now being accused by TC/PC holders of being incapable or unqualified to develop and fabricate parts.

3. TC/PC holders holding back repairs from the ICAs, trying to channel more repair and parts replacement work to their own repair stations, and putting statements questioning the integrity of non-TC/PC holder developed parts and repairs in the ICAs and other service documents.

4. FAA creating different approval coordination processes for engine parts and constraining engine DERs in an attempt to control major repair and PMA approvals through the Engine & Propeller Directorate.

5. The lack of standardization in FAA's interpretation and application of rules and policy that create problems, delays and add costs.

STC HOLDERS:

The STC holders don't want to lose the existing ability to fabricate parts without PMA during the performance of their STC in a repair station environment and during follow-on maintenance of the aircraft. They are also concerned about the continuing trend that STCs are not accepted globally as having the same integrity and compliance showing as a TC/PC holder's design changes. Like the PMA community, STC holders object to being accused by TC/PC holders of being incapable or unqualified to develop and fabricate parts.

STC holders are also concerned about TC/PC holders putting statements in their ICAs and other service documents questioning the integrity of non-TC/PC holder developed parts and restricting warranties and customer support if owners/operators use non-TC/PC holder parts.

STC holders were also concerned about a lack of standardization across FAA regarding when an STC is or is not needed. Industry stated that in some cases they believe an STC was issued just because the applicant requested an STC even though the design change was not major under 14 CFR 21, Certification procedures for products and parts.

INDEPENDENT REPAIR STATIONS:

Independent repair stations' concerns are virtually identical to the owner/operator community. Repair stations are also concerned that both the approved data for and the performance of their repairs, alterations and fabrications are not accepted globally as having the same integrity as those designed by a TC/PC holder. This is compounded by not only the TC/PC holders communications to the industry and authorities world-wide but also by differences between the U.S. regulatory and policy view of repairs, alterations and fabrication versus that of other airworthiness authorities.

Corporations who own multiple repair station facilities have noted that the FAA's lack of standardization has created situations where one of their facilities is able to conduct business in a way that is not allowed by the inspector at another facility. Also, on the engineering side they indicate that when one facility approaches their local aircraft certification office for a data approval they get different compliance and policy requirements than at another aircraft certification office who deals with another of their facilities.

Repair stations also noted a lack of standardization across FAA regarding when a PMA is or is not needed. Industry stated that in some cases they believe PMAs are issued for repair details and consumables that do not qualify as a "replacement part" which is in a finished installable configuration. They also noted that PMAs have been issued for what they considered to be standard parts.

TC/PC HOLDER OWNED REPAIR STATIONS:

They want the ability to maintain and alter other TC/PC holder's product lines but don't want others doing the same to their TC/PC product lines. By virtue of TC/PC holders owning repair stations, it has created the ability for the TC/PC holders to retain repair and alteration data in-house within their own repair stations as a sole-source provider rather than putting those repairs and alterations in the ICA for use by a broader audience.

Similar to the independent repair stations, TC/PC holders noted that the FAA's lack of standardization has created situations where one of their repair facilities is able to conduct business in a way that is not allowed by the inspector or an aircraft certification office at another facility.

FAA AND OTHER AIRWORTHINESS AUTHORITIES:

FAA and other airworthiness authorities, like industry, want compliant and safe aircraft. The authorities also want standardized application of compliance requirements (level playing field) to both ensure an acceptable level of continued airworthiness and to facilitate the mutual acceptance of each countries products by other countries and their respective airworthiness authorities. It was noted by the AVS RAF Team that there is a prevalent belief across the global airworthiness authority community that the TC/PC holder is the only one capable of developing safe and complaint design changes, replacement parts, repairs and alterations because of the complexity, historic developmental data, and expertise needed. While this is obviously not true, the authorities do need to ensure that applicants for such approvals are doing the right things during design, compliance showing, and production or maintenance to instill confidence in the safety of the aviation system. The globalization of the aviation industry makes it imperative that the FAA take actions to correct the misconception that U.S. PMAs, STCs and non-TC/PC holder developed repairs, alterations and fabricated parts are not compliant and not of comparable integrity to TC/PC holder developed equivalent approvals.

CONCLUSIONS

During the AVS RAF Team's research and analysis they stayed objectively focused on the stakeholders' needs from their perspective and balanced those needs in the interest of:

- Safety, including compliance,
- Customer service and cost impact,
- FAA business efficiency and standardization, and

- Global acceptance of FAA findings of compliance and approvals.

An over-arching conclusion that sets the context for the following conclusions and recommendations is that the current FAA regulatory and policy structure is deemed adequate to govern the vast majority, if not all, of the process and policy improvements needed to address the concerns raised by all industry stakeholders. The current regulations and policy, while agreeably needing clarification, permit the following which were the predominate areas of focus for all stakeholders:

- Fabrication of parts during maintenance of higher level assemblies and sub-assemblies.
- Fabrication of Owner Produced Parts.
- Repairs to parts of any extent, short of 100% fabrication, that restores them to an airworthy condition when the applicant has determined that repair is more economic than purchasing or fabricating a complete new part.
- Altering parts under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration, regardless of criticality to any extent that does not constitute a major change to the type design
- PMA of parts regardless of criticality.
- PMA of parts with differences in design from the TC/PC holder's parts provided such differences constitute no more that a minor change to the type design under CFR 21.93.
- STC of major type design changes regardless of the criticality of parts or the area of the product affected by the STC.

The AVS RAF Team derived certain key conclusions from assessment of the data and industry input which are summarized below:

CONCLUSION 1:

Fabrication of parts without obtaining a PMA is permitted by current rules and policy during the conduct of maintenance when returning a higher level assembly or product to service pursuant to AC 43-18, Fabrication of aircraft parts by maintenance personnel, or by an owner/operator.

The principle concern of the FAA is oversight of safety and compliance, not the extent of part fabrication or arguing the economics of whether it is cheaper to buy or fabricate the parts. Even TC/PC holders' maintenance and alteration instructions often call for local fabrication of parts or sub-parts of assemblies. Given that such extensive fabrications are virtually always major under 14 CFR 1.1, Definition and abbreviations, and 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration; the design data, materials & process specifications, and technical data for performing the work would be FAA approved. The fabrication of such parts is not considered to be maintenance, repair or alteration. Fabrication is permitted under 14 CFR 43.13, Performance rules (general), and 43 App. A, when a maintenance provider is maintaining or altering and returning the next higher level assembly or product to service. Persons conducting the fabrication for example, similar to original parts production, are not subject to the drug testing requirements even though those installing the fabricated parts and returning the higher level assembly or product to service are subject to the drug testing program.

Past FAA legal determinations have concluded that such part fabrications when performed pursuant to performing higher level maintenance to return an assembly or product to service does not constitute fabrication for sale under the 14 CFR 21.303, Replacement and modification parts, "…for sale for installation on…" clause. The maintenance provider is both the fabricator and the installer responsible for the airworthiness determination so technically there is no "sale for installation in" taking place. This is the same rational that for decades has permitted owners/operators to produced parts under the exclusion in 14 CFR 21.303(b)(2) and the fabrication of parts throughout general aviation such as addressed under ACs 43.13-1B Acceptable Methods Techniques Practices, Large Aircraft Inspection-Repair, and 43.13-2A, Acceptable Methods Techniques Practices.

CONCLUSION 2:

Repairs to restore wear or damage to a part of any extent short of 100% fabrication of a part is considered to be maintenance under 14 CFR Part 43, Maintenance, preventative maintenance, rebuilding, and alteration, and are allowed by current rules and policy. Such repairs, however extensive, even though they may involve the fabrication of sub-elements of the part, are still considered to be "repair" and are not "fabrication" as defined within the scope of AC 43-18, Fabrication of aircraft parts by maintenance personnel.

Many years ago FAA attempted to establish what percentage of a part could be repaired or fabricated before it was necessary to obtain a PMA. Percentages from 2% to 50% by volume or weight were kicked around but were never able to be defended. The

logic always broke down because of the long standing policy of the FAA allowing complete fabrication of parts during maintenance and during accomplishment of alterations (including STCs) in the field without PMA. Similarly, owners/operators have produced parts for decades without PMA. The line between very extensive repairs and complete fabrication is not an airworthiness issue but rather an economic determination. When does it become uneconomical to repair a part and the owner would decide to purchase a new part or fabricate a part within the context of maintaining an aircraft under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration? In either case the end state outcome is that the product, and hence the parts thereof, must be returned to an airworthy condition. The AVS RAF Team concluded that it is not within the FAA's authority to regulate industries economic decisions except where they would have an unacceptable adverse effect on safety.

The issue from FAA's perspective has been that such cases of extensive repair were acceptable if safety and compliance are preserved through the data approval and quality control of performing the repair; and that someone is not violating the "for sale for installation on" clause of 14 CFR 21.303, Replacement and modification parts. Whether a part is repaired or fabricated the airworthiness standard that must be met is the same i.e.; it must conform to the approved/accepted design data and be safe for operation such that the product will "…be at least equal to its original or properly altered condition…"

The principle concern of the FAA is safety and compliance not the percentage of the part repaired. Even repairs and combinations of repairs by TC/PC holders lead to very extensive re-fabrication of parts during maintenance. Such repairs are not fabrications within the scope of AC 43-18, Fabrication of aircraft parts by maintenance personnel or owner produced parts, nor are they "manufacturing." Given that such extensive repairs are virtually always major under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration, the design data, materials & process specifications, and work procedures are required to be FAA approved by 14 CFRs 43, Maintenance, preventative maintenance, rebuilding, and alteration, and 21.305(d), Approval of materials, parts, processes, and appliances. The FAA has historically been unable to prove that a "repair" is uneconomical or is being done solely with intent to circumvent the "for sale for installation on" clause of 14 CFR 21.303, Replacement and modification parts. There is no regulatory or policy basis for limiting the extent of repair, whether by percentage or by weight of a part, as long as the resultant repaired part is safe and complies with the applicable airworthiness requirements. The issues and complaints have revolved more around the semantics and definitions of repair versus fabrication versus production rather than the safety and compliance of each.

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

The AVS RAF Team does not see any advantage to FAA expending resources trying to prove intent to circumvent obtaining a PMA when owners/operators and maintenance providers functioning within the aviation system are producing airworthy parts, obtaining approvals for the data and performing the repairs within the quality controls of their certificate responsibilities. The primary intent to the 14 CFR 21.303, Replacement and modification parts, requirements for PMA is to prevent someone outside of the aviation system from independently fabricating parts without approved design data and without any quality controls and then selling those parts to persons inside of the aviation system for installation in their aircraft. That is also born out by the fact that 14 CFR 21.303 provides owners/operators an exemption from obtaining a PMA because they are within the governance of the aviation system and subject to the CFRs that hold them responsible for airworthiness and which are designed protect the integrity of the fabricated parts and the aircraft.

The FAA understands the view that when a substantial portion of any part has been repaired or fabricated that TC/PC holders do not want the original part number associated with those part any longer because they view the part number as their property and not the owner's. The CFRs hold the person performing the repair responsible for the work they perform regardless of the extent. Hence, the TC/PC holder has no regulatory liability for a part that someone else extensively repaired. The part numbering issues are addressed elsewhere in this study.

The AVS RAF Team does see a need to clarify the regulations and policy that allows doing such extensive repairs. If such extensive repairs are allowed to continue FAA will need to ensure the following are adequate and there is "comparable level of certitude" across repairs, alterations, PMA, STC, TC, and PC for:

a.) the data approval,

b.) the process specifications & quality control, and

c.) the part marking to identify the data approval holder and who performed the repair since maintenance records are only kept for a limited time.

It must be emphasized that a "comparable level of certitude" does not mean that the same compliance methods must be repeated or are applicable in every case. The compliance method although it may be different must show that the certification basis of the product is not invalidated and that an unsafe condition is not introduced.

One TC/PC holder recommended that all applicants for extensive repairs should have to repeat the certification testing that they did for the original TC or follow an approval process similar to obtaining a STC. The current rules and policy do not require that. The objective of the FAA when making approvals is to achieve an acceptable level of continued airworthiness even though the acceptable methods of showing compliance vary by rule and policy depending upon the type of approval being sought and scope of the repair, alteration, PMA or design change whether developed by a TC holder or non-TC holder.

CONCLUSION 3:

The determination of major or minor for repairs and alterations is not a significant issue. Most if not all of the things that certain TC/PC holders complained about were classified as major repairs or PMAs. The classification was not a point of contention.

Most of the repairs and alterations (and the PMAs) that certain TC/PC holders have complained about were correctly classified as major and were FAA approved as required by the CFR. The concerns were not that they were misclassified but rather the TC/PC holder claimed that:

- The compliance showings were not adequate
- There were differences or inconsistencies in the part from the TC/PC holder configuration which the approval holder and FAA had missed or improperly assessed, and
- Non-TC/PC holder applicants for repairs, alterations or PMA are not being held to the same level of compliance showing that the TC/PC holders' have to do for the original TC/PC.

One TC holder expressed concern that if a maintenance provider did not understand the criticality or complexity of their parts that they might attempt to perform a minor repair that could have and appreciable effect on the part. Experience seems to indicate that such a risk may be minimal since industry is aware that even for minor repairs they have to have acceptable data and restore the part to at least its original condition with respect to airworthiness. The team noted that regarding the use of "acceptable data" for minor repairs and alterations, case law shows that if FAA disagrees with a maintenance provider's determination of major-minor and the acceptability of data for minors; it falls upon the FAA to prove it is unacceptable. The FAA has not been successful in doing so in the past largely because closer scrutiny often leads a reasonable person to conclude that the minor repair or alteration did return the product to an original or properly altered condition with respect to airworthiness. That determination rooted in 14 CFR 43.13, Maintenance, preventative maintenance, rebuilding, and alteration, does not require exact equivalency of parts to original since for example virtually all repaired parts are not "like new" not only because of the repair itself but also because repaired parts are used and thus have given up some of their durability and remaining service life.

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

It is the responsibility of air carriers, repair stations, certified mechanics, and authorized maintenance personnel to determine whether a repair or alteration is major or minor under 14 CFRs 1.1, Definitions and abbreviations, and 43, Maintenance, preventative maintenance, rebuilding, and alteration. They have been doing so for decades without significant concern. Most situations that created safety concerns were not due to misclassification but rather were inadequate design data or human factors issues where repair or alteration procedures were not followed. Those type of human errors can and have occurred with TC/PC holder developed repairs and alterations just as easily as those developed by others persons.

The team noted that TC/PC holders had identified some parts which incorporated differences that led FAA to question whether the parts were really a repair or an alteration and too what extent its performance characteristics may be impacted. In some cases parts were being repaired and at the same time being altered to a different approved configuration such as a later design configuration released by a TC/PC holder's service bulletin. The team noted that additional clarity is needed when FAA or a designee is evaluating repair data for approval to ensure that a major alteration or major change to the type design is not being mis-represented as a repair.

The AVS RAF Team determined that FAA should develop guidance on best practices for determining major-minor under 14 CFR 1.1, Definitions and abbreviations, and on determining what constitutes a major change to the Type Design under 14 CFRs 21.113, Requirement of supplemental type certificates, and 21.93, Classification of changes in type design. Then applicable orders and policy should be revised to provide guidance to FAA employees, designees, air carriers, and maintenance providers to assess major repairs and major alterations for whether or not they may be a major change to the Type Design before proceeding for approval. At present FAA policy prohibits designees from making determinations of major-minor change to the type design under 14 CFR 21, Certification procedures for products and parts.

The team determined that the major-minor repair or alteration determination under 14 CFR 1.1, Definitions and abbreviations, had only become an issue with industry because the FAA has tried to create policy which would drive more repairs and alterations to be major. The FAA has been using that to increase FAA oversight of industry and designees by requiring direct FAA approvals of data and in some cases only by the FAA TC managing offices.

The other aspect of the major/minor determination for repairs under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration, which states "… if improperly done …" considers what the effect would be if the performance of the work scope for repair is improperly done. It does not mean, and is not typically applied, to

address the potential of improperly engineering the design of the finished repaired part. The "if improperly done" provision is also not considered with respect to the adequacy of the applicant's CFR compliance showing, as opposed to the conduct of the work procedures and processes for getting to that end design.

The Team found a great deal of confusion and differences of opinion around determining major/minor with respect to the 14 CFR 1.1 use of the terms:

- "if improperly done"
- "appreciable affect"
- "accepted practices" and
- "elementary operations"

Any future activities related to clarification of major/minor determination must also clarify these elements which have a significant bearing on the determination. Also many applicants and designees admitted to classifying many repairs as major and getting the data approved even though they felt the repairs were really minor just to avoid disagreement with FAA inspectors and other international aviation authorities. The issues around terminology, the line between repair and alteration, and the disparate views of all stakeholders make this issue very difficult to clarify.

The FAA has in recent years been paying more attention to that repair/alteration designs and compliance data. Another example of an area needing attention when determining major-minor is the need for considering "other qualities affecting airworthiness." The person making a major-minor determination needs to know enough about the product to know what "other qualities" to consider. For a life limited part such as an engine disk one would need to consider the impact on lifing and rotor burst margins. The impact on reliability would need to be considered since reliability is a characteristic of the original condition that the product must be restored to especially for an aircraft operating in extended range operations (ETOPS).

There have been numerous attempts to more clearly define and reach consensus on major-minor repair and alteration determination all of which have failed due to a.) The lack of any clear safety shortfall justifying the need to change certificate holders' major-minor determination processes under 14 CFRs 1.1, Definitions and abbreviations, and 43, Maintenance, preventative maintenance, rebuilding, and alteration, that have been acceptable to the FAA for years and b.) The diverse views and opinions of the involved stakeholder groups. For example, some industry groups see such moves as

unnecessarily reducing owners'/operators' and maintenance providers' authority and flexibility to determine major/minor under 14 CFRs 1.1 and 43. However, the AVS RAF Team concluded there is still a need for some standardization in the major-minor classification process without becoming overly restrictive. Part of the rationale is that newer aircraft are more complex and the performance and strength margins are smaller than older vintage aircraft. New design/production methods and aviation technology have allowed companies to make aircraft lighter, more efficient, and have tighter performance margins which must be understood and accounted for when developing repairs or alterations. The margin for error in developing repairs and alterations on modern aircraft is correspondingly narrower. This was also born out during past discussions with the European Aviation Safety Agency (EASA) during bilateral discussions for mutual acceptance of repairs and alterations where both FAA and EASA recognized that need.

The AVS RAF Team also noted that AC 120-77, Maintenance and Alteration Data, was originally developed for transport category airframe operators to help make minor changes to major repairs for airframe repairs. Over time its application has been expanded. That AC 120-77 also assumes that whoever determines major/minor repair and alteration determinations has an engineering organization but there is no criterion for the fact that other entities like repair stations and A&P mechanics also make such determinations and there is no guidance for what the qualifications of the "engineers" are or for how to make the determination other than using 14 CFR 43 App A. The AVS RAF Team concluded that AC should be considered for revision.

CONCLUSION 4:

The issue of determining the criticality of parts and components was not a significant issue. The criticality or consequences of a failure was not in contention for most of the parts that TC/PC holders were concerned about.

The TC/PC holders were concerned about the perceived lack of integrity in either the design or the compliance showing because of a lack of knowledge about the part and the systems effects of its interaction with other parts. The concerns were not that they were misclassified or that the importance of the parts was not recognized but rather that adequacy of compliance showings and the part designs as compared to the TC/PC holder's original configuration.

It should be noted that although the term "critical part" is used extensively in this report, there is currently no clear consensus on its definition and many FAA documents define it differently. Part criticality is a function of the risk to safety if the part should fail or malfunction. Hence, part criticality, like risk, is relative and varies from part-to-

part. The FAA also uses the term "critical" in relation to parts, components, systems and functions often without a consistent criteria that relates them all back to a common safety based standard.

It was noted that the TC/PC holders have a more encompassing or conservative definition of critical than both the FAA and EASA. Some TC/PC holders' definitions of critical include any part that touches or that has any influence on a critical part, plus any part of a fluid carrying system, and any part of a control system. The FAA does not dispute the fact that many other parts than those that meet FAA's definitions of "critical" are still very important such as those the FAA calls Category 2 parts. (See FAA Order 8120.2E, Production Approval and Certificate Management Procedures, Appendix 4) The FAA AIR uses a three level Category Parts classification system called Category Parts List (CPL). All "critical parts" using the FAA's and EASA's definitions are Category 1 parts. However, all Category 1 parts are not "critical." The determination of critical within the FAA system is based on objective data driven assessment of the relative risk of causing an aircraft accident including the risk of serious injury or fatality to passengers and crew. Contrary to certain TC/PC holder's allegations, the FAA has no intention of permitting non-compliances or a lesser level of compliance showing to airworthiness standards for parts that are not defined as "critical." It is the responsibility of the owner/operator and their supporting maintenance and parts providers to ensure the compliance with all applicable CFRs. The FAA's risk based, data driven process for oversight of industry focuses more heavily in the high risk areas such as critical parts but it does not ignore others areas.

The FAA understands the concerns and potential risks of repairing, altering or fabricating critical parts. The two key areas for improvement noted by the AVS RAF Team were the integrity of data approvals and the quality control of performing the work.

With regard to the data FAA should continue to develop the design and compliance guidance templates for critical parts in engines and evaluate the need for similar guidance on other product types. Also, FAA should continue its present activities to improve the standardization and integrity of the FAA designee management system particularly with regard to critical parts. The existing AIR designee management team as part of the AVS designee standardization and AIR Safety Management programs could be leveraged to accomplish this.

AVS already has work in progress to improve the alignment and consistency of quality control requirements across AVS approval holders by leveraging future 14 CFR 21, Certification procedures for products and parts, changes and the AVS SMS initiatives to implement and reinforce consistent quality system requirements. The basis already

exists in the CFR for requiring comparable quality control system requirements for repair, alteration, fabrication, PC, and PMA that are graduated based on a data driven, risk based criteria including part criticality similar to how PCs are set up today. The fabrication AC 43-18, Fabrication of aircraft parts by maintenance personnel currently directs fabricators to have a Fabrication Quality Control System (FQCS) similar to that of a PMA holder. When the next revision of 14 CFR 21 is published, AC 43-18, Fabrication of aircraft parts by maintenance personnel, will be revised to realign the quality system guidance with that of PMAs. The 14 CFRs 121, Air carriers and operators for compensation or hire, 135, Operating requirements commuter and on demand operations, and 145, Repair stations, certificate holders will need to have a Safety Management System by 2009 per ICAO requirements and the AVS Safety Doctrine Order and AVS SMS requirements. The SMS requirements will provide added assurance of compliance and conformity through SMS subsystems. FAA requirements also need to maintain parity with EASA POA and ICAO requirements for quality and conformity.

There have been numerous attempts to more clearly define "critical parts" which have met with limited success. There has been a lack of any clear systemic safety shortfall on less critical parts other than those that are obviously critical such as disks. For example, FAA Category 2 parts like blades or vanes are claimed to be critical by some in FAA and industry even though the consequences of their failure are not hazardous. Also, the very diverse views and opinions of the affected stakeholder groups make reaching any agreements on what is critical is virtually impossible without applying an objective risk assessment to determining the severity and probability of any part's failure. For example, industry groups understand the criticality of the parts in dispute but see moves by TC/PC holders and FAA to restrict repairs, alterations, or PMA of those parts as mandating business for the TC/PC holders. However, existing policy should be standardized, clarified, aligned with EASA, and reinforced with industry and FAA's workforce. FAA and industry should be careful to not over emphasize the few highly "critical parts" since there are many more parts and components that can significantly degrade safety margins or create unsafe conditions if not managed appropriately.

Guidance on what constitutes a "critical part" should be composed of a high level generic criteria plus product type specific CFR criteria guidance to be developed by each AIR Directorate. For example, the AIR Rotorcraft Directorate has a regulatory requirement defining critical that has served that community well. Such guidance development should also consider:

i) That AC 43-18, Fabrication of aircraft parts by maintenance personnel already requires that fabrication of any Category Parts List (CPL) Cat. 1 or 2 parts are

Major and require approved data. That is in part due to the relative criticality of such parts but also because the higher level maintenance is considered to be a major repair or major alteration of which the fabrications are a part of.

ii) That the guidance should be a risk based performance criterion or categorization and not a "list," which would result in a very limited subset of what is today called Category 1 parts under the CPL. A part that may be critical in one TC/PC holder's aircraft may not be critical in another's application, so the guidance needs to be broadly applicable.

iii) Any revised guidance needs to maintain consistency with:

(a) The AIR Safety Management Program,

(b) AIR AC39-8,

(c) NTSB Recs. A-06-36/37/38 & NTSB Report SR-06/02, and

(d) EASA definitions and application under the BASA.

iv) Clarifying how the part criticality lists and related critical parts management plans and ICAs are documented, transmitted, and used.

v) Clarifying with industry, designees and FAA that the intent of the Engine and Propeller Directorate's Disk Inspection Initiative was to identify and require inspection of the most critical areas on life limited parts and that it should not be used to assume that other areas on the parts that are not labeled in the ICAs as critical can be repaired or altered indiscriminately.

CONCLUSION 5:

Many past FAA policy changes that have added to the confusion resulted from:

- Attempts to provide greater scrutiny of repairs, alterations and PMAs by defining different approval procedures for the most critical parts, and
- Concerns that designees, aftermarket companies, and non-TC managing FAA Aircraft Certification Offices lacked knowledge, expertise, and available data/information to make adequate compliance findings particularly on complex and critical parts.

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The AVS RAF Team determined that the part criticality determination had only become an issue because the FAA tried to create policy which would require more repairs, alterations, and PMAs of critical parts to have increased FAA oversight and direct involvement of the FAA product Directorate to obtain a data approval. Hence, the FAA has in recent years been paying more attention to such critical part design and CFR compliance data. However, the tighter controls of that FAA policy surfaced many disagreements and hidden assumptions about what parts were truly critical and what constituted an adequate showing of compliance by the applicant for approval. Many of those policy changes have been aimed at limiting the authority of the designees, companies, and non-TC managing aircraft certification offices (ACO) by increasing Directorate involvement in projects for critical and complex parts rather than addressing the underlying issues of training, staffing, designee oversight, and gaining clarity and consensus on compliance requirements.

Policy changes such as restrictions in the DER Handbook, Directorate policies on different processing of approvals for critical parts, and the FAA ACO-to-ACO coordination process all have their roots in these issues. The concept was that the FAA TC managing certification office for the particular product would have more knowledge of and have access to data about the type certificated product in order to make a better compliance evaluation of an applicant's data submittal and do it in a more timely fashion. History has shown that is not always the case. The TC managing FAA aircraft certification office knowledge and capability is also compromised by personnel turn-over, more records and data being kept at TC/PC holders to protect their intellectual property, and increases in FAA workloads. The AVS RAF Team concluded that FAA TC managing aircraft certification offices do not always have any better corporate knowledge, data or compliance requirements understanding of the product than the field aircraft certification offices or designees do. Thus such policies for additional coordination often lengthen the time for applicants to get data approvals and provide a questionable net gain to safety.

CONCLUSION 6:

Part marking is a significant issue to the TC/PC holders commercially and to owners/operators who use part marking as a means to identify installation eligibility and manage aircraft configuration but was not found to be a notable safety concern.

The AVS RAF Team became aware of a FAA rulemaking proposal to change 14 CFR 45, Identification and registration marking, and require the marking of all parts down to the component parts level. That rule met with substantial resistance from the industry including the TC/PC holders. The outcome of that proposed rulemaking will have a bearing on the viability of recommendations made by the AVS RAF Team which

initially was to undertake rulemaking to require marking for fabricated parts, major repairs and major alterations. In addition to industry resistance to production part marking the FAA rule owner for 14 CFR 45 did not want to expand the scope of that section to include marking and identification during repairs or alterations conducted under 14 CFR 43 in addition to during production.

The TC/PC holders are concerned about the liability of their name and original type design part numbers being associated with parts that have been extensively repaired, altered or had replacement parts fabricated by other persons. The FAA is appreciative of their concern. The TC/PC holders have no legal responsibility under the CFR for parts fabricated by others or for repair and alteration work performed by other persons. However, in today's litigious legal and political system the TC/PC holders association with the top level aircraft, engine or propeller product type design is not likely to go away unless the product's data plate is changed to show that someone else originally manufactured and sold the complete product which would not be true. Even if the data plate were changed for example to say that **airline X** now owns aircraft **model number Y and serial number Z**, the TC/PC holder would still be responsible under the CFRs for any parts in the aircraft they designed and manufactured. Ownership of aircraft today is managed through registration like cars and trucks.

Original product data plates and design part numbers are how the owners/operators manage aircraft configuration and conformity. They are not a good direct indicator of responsibility for the part or product since so many entities work on or operate an aircraft throughout its life and the ultimate responsibility always rests with the owner/operator. Some TC/PC holders have proposed that "their" data plate should not be on any product that has numerous repairs, alterations, and fabricated or PMA parts installed because it is ostensibly not the same product that they sold to the air carrier several years ago. The FAA disagrees with that proposal for both practical and regulatory reasons. If the data plate were to be changed, who should be identified on it? For example, an aircraft with half of the parts still original equipment and the other half coming from a mix of 20 or 30 different STC, PMA and major repair fabricated parts suppliers; would you list them all on the data plate? Also, keep in mind that the vast majority of parts in a TC/PC holder produced aircraft come from suppliers, and are not manufactured, fabricated or repaired by the TC/PC holder, even though the FAA holds the TC/PC holder responsible for the original TC type design and quality control exercised under their TC and PC. What needs to be clarified is that the ***original*** product's type design and the ***original*** manufacturer of a product to that type design are listed on the product's data plate. The TC/PC holder is not responsible for the subsequent maintenance, alteration, and operations performed on the product. The TC holder may have some culpability if they are the designer of the maintenance instructions or of a repair or alteration that is used by an owner/operator. The

owner/operator has the responsibility for the continued airworthiness of the product from that point on. With this responsibility come certain privileges for maintaining that product. The owner/operator can choose to do exactly what the TC/PC holder recommends or they can maintain, alter, and operate the aircraft in any other way permissible under the CFR. The product's type design is originally established by the TC/PC holder. Maintaining an aircraft in compliance with the type design would include installation of replacement parts of the same part number whether the parts are repaired or fabricated parts number. The only regulatory basis for changing a part number is when using a PMA part or if there is an alteration of the product to another properly altered condition which includes any new part numbers that are necessary to ensure installation compatibility and configuration management.

Production part marking is covered adequately in the current CFRs and is being updated during the AIR 14 CFRs 21, Certification procedures for products and parts, and 45, Identification and registration marking, changes. Re-marking of parts that have a major alteration or repair performed should be addressed by changes to 14 CFRs 21 and 45. Currently, AC 43-18, Fabrication of aircraft parts by maintenance personnel contains coverage for part marking fabricated parts during maintenance. The current AIR Order 8150.1, Technical Standard Order (TSO) Program, also requires the marking of modified TSO articles with a placard that identifies the modifier or fabricator and the method of the design modification approval. The Order also requires that the modifier demonstrate that the modified article still meets the TSO specification for the original TSO marking before returning it to service.

The intent of 14 CFR 45, Identification and registration marking, is essentially new production oriented therefore when a "fabricated" part replaces an original production part the "fabricated" part needs to be able to be identified as being made by the entity that fabricated it. Owner produced parts and repaired parts, particularly for very extensive repairs, are not as clear cut. Marking requirements for fabrication during maintenance, owner produced parts, extensive major repairs, and alterations should be codified in the CFR.

Part marking procedures also need to be addressed in policy for repair and alteration data approvals to define a.) When and how a part is to be marked or re-marked and b.) What identification for the person(s) who hold the data approval and performed the work. When you mark a part one needs to be careful where and how you do the marking so you don't create an airworthiness concern. There may be standard practices documents that can be used as guidance.

CONCLUSION 7:

Instructions for Continued Airworthiness is a significant issue to the TC/PC holders commercially who do not want the ICAs used for non-TC/PC holder repairs, alterations and parts. TC/PC holders are attempting to limit content and distribution of the ICA to meet their concerns. Owners/Operators who use the ICAs and the TC/PC holders Illustrated Parts catalogs to maintain aircraft and as a means to identify installation eligibility for parts need the ICA to cover their complete product. The ICA is not a significant issue with respect to safety in this regard.

The AVS RAF Team noted that ICA assessment of repairs, alterations, and PMAs is in need of clarification. The TC/PC holders place statements in the ICAs and tell owners/operators that the ICAs are only applicable to and permitted to be used on, their TC/PC holder parts. This is contrary to FAA policy which permits non-TC/PC holder applicants for approvals to conduct an assessment of the applicability of the existing TC/PC holder's ICA to their repaired, altered, or PMA part. If they determine and FAA agrees that their part can be maintained within the scope of the existing ICA then the applicant is not required to issue their own parts specific ICA supplement. However, FAA inspectors and owners/operators are confused by TC/PC holder statements in the ICAs saying that they can not be used and since 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration, states that when performing maintenance you need to follow the current ICA or an operators program, then the applicability of the ICA comes into question.

The need was noted for advisory circular guidance to require that all repairs and alterations need ICA assessments consistent with the FAA Order 8110.54, Instructions for continued airworthiness responsibilities, requirements, and contents.

The team also noted that AC 43-18, Fabrication of aircraft parts by maintenance personnel recommends an ICA assessment for fabrication but the documentation of those ICA and how such ICA supplemental information is distributed with the fabricated parts is questionable. Hence, clearer guidance may be needed on how supplemental ICA information (both TC and non-TC holders') is to be documented and transmitted for repairs, alterations, and fabrications. Such guidance for PMA parts is clear in FAA Order 8110.42C, Parts Manufacturer Approval Procedures, and in 14 CFR 21.50, Instructions for continued airworthiness and manufacturer's maintenance manuals having airworthiness limitations sections; that a PMA holder must make ICA available for their parts whether by reference to original type design ICAs or by providing supplemental ICAs for any part differences.

Another ICA issue is that TC/PC holders have occasionally placed statements in ICAs or issued other manufacturer's service documents implying that the ICAs are not valid

if the product has non-TC/PC holder developed repairs, alterations or fabricated parts installed. Such statements have implied that parts and repairs which are developed by non-TC/PC holders and approved by the FAA do not comply with airworthiness standards or are of lesser quality and durability than the TC/PC holder's part. Such statements in official ICA documents required under the CFR are not acceptable to the FAA and provide no benefit to ensuring airworthiness which is the sole purpose of the ICAs. The AVS RAF team concluded that the TC/PC holders should be informed of the FAA position and should remove any such statements from the ICAs. The FAA can not stop a TC/PC holder from making statements in their company literature or advertisements that question the integrity of other company's parts or that of FAA approvals. However, such misleading and inflammatory statements do a grave disservice to the U.S. aviation industry and the FAA which have worked hard to achieve the best safety record in the world. The FAA and others in industry recognize that the TC/PC holders have played a large role in achieving the level of safety aviation enjoys today. However, the FAA does not want to see the cooperative spirit that has served industry so well in the past deteriorate because of competitive business pressures.

CONCLUSION 8:

Certain TC/PC holders and their suppliers have not always been objective when investigating service events and have not accurately represented all the facts when aftermarket repairs or parts are involved. Some TC/PC holders have mis-represented a few random isolated events involving aftermarket parts as implying there is a systemic breakdown in FAA compliance oversight and the non-TC/PC holder industry's capability to design repairs, alterations and replacement parts.

As with TC/PC holder parts, aftermarket parts or repairs will occasionally fail or be involved in service events and accidents. FAA may even issue an AD on PMA parts as we have done many times on TC/PC holder parts. We need to have rigorous, objective investigations by owners/operators, the FAA, and TC/PC holders and their supplier revenue sharing partners so there are no more unfounded allegations of unsafe parts or repairs, and alterations. The non-TC/PC holders also have a need and obligation to be involved in any investigations that relate to their parts and repairs or alterations. There is also an underlying issue about timely and accurate "reporting." When TC/PC holders, owners/operators, component OEMs or non-TC/PC holders become aware of service events involving either their own parts or another parties parts, that information needs to be reported in a timely fashion to the FAA so it can be shared with appropriate parties who have a stake in the investigation.

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The RAF Team noted that during investigations of in-service failures the facts have not always been accurately represented. Occasionally, PMA parts and non-TC/PC holder repairs have been falsely accused of being the root cause of failures precipitating the event. The PMA holders have not always been informed in a timely manner by the FAA or TC/PC holders of service events affecting their parts. Also, operators who are responsible for the airworthiness of the aircraft have not always been engaged in investigations or informed of all the data and facts. Many operators lack the expertise, data and equipment to conduct in-depth failure analyses and they often rely on the TC/PC holder for failure analysis support. It is the owner's/operator's responsibility to report in service events, accidents and serious incidents, and to coordinate with FAA and NTSB when appropriate under Titles 14 and 49 of the CFR. They should also ensure that any affected manufacturers, parts supplier, or maintenance providers are involved in the investigation where appropriate. The FAA, Operators, PMA holders and TC/PC holders alike agree that investigations are a collaborative effort and timely sharing of information regarding service events is crucial to ensuring a swift response to correcting potentially unsafe conditions.

The team was also aware of cases where PMA holders during the process of designing their part replicated the original TC/PC holder's part including a deficiency in the original type design part. This is a risk with PMA parts and parts fabricated in service when an original TC/PC holder's part has some design or production deficiency. Both the TC/PC holder and non-TC/PC holder parts fabricators of type design replacement equivalent parts need to be aware of the service history on both populations of parts. It may not always be clear initially what the root cause of any failure may be. Sharing of service data, timely and accurate reporting, and objective investigations of events are critical to heading off potential safety threats. In the interest of safety we need to have rigorous and objective investigations and reporting rather than fighting over whose repair, alteration, or replacement parts are the safest or to blame for a service event.

It is also noteworthy that in most investigations the owner/operator, who is ultimately responsible for ensuring the aircraft's airworthiness, is rarely involved except for major accidents. In the past owners/operators and the FAA have expected the TC/PC holders to investigate service events and accidents. In today's environment when owners/operators are using a higher percentage of repairs, alterations and replacement parts that were not developed by the TC/PC holder, the owners/operators need to become more active in leading investigations and engaging the responsible non-TC/PC holders when aftermarket repairs and parts are involved.

CONCLUSION 9:

FAA approved PMAs and non-TC/PC holder developed repairs and alterations, and to a degree STCs, are not universally accepted around the world by other authorities and owners/operators as having a comparable level of certitude as those developed by the TC/PC holder.

Some of the reluctance around the world to view non-TC/PC holder parts as having adequate safety and compliance integrity is driven by three factors; a.) Allegations from TC/PC holders, b.) Misunderstanding of acceptable methods of compliance which the FAA accepts for the various types of approvals, and c.) Non-standardization of FAA's application of rules and policy. It must be emphasized that with respect to repairs, alterations, and fabricated replacement parts a "comparable level of certitude" to the original type design does not mean that the same tests, analyses and compliance methods must be repeated or are applicable for every type of approval. The current rules and policy do not require that. The objective of the FAA when making approvals on in-service products, based on current rules and policy, is to achieve an acceptable level of continued airworthiness even though the acceptable methods of showing compliance vary depending upon the type of approval being sought, and the criticality and scope of the repair, alteration, PMA or design change (i.e.; a TC holder's design change or an STC).

As previously noted, many are confused by the variety of means accepted by the FAA for showing compliance of repairs, alterations, fabricated parts. The basis for beginning a compliance evaluation starts with the assumption that the original product design and part thereof being repaired, altered, or fabricated for replacement is already compliant with the airworthiness standards. The objective for performing maintenance and alteration as stated in 14 CFR 43.13(c), Performance requirements (general) is to "…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)." For a repair or alteration the compliance focus is on what affect the work performed and resulting configuration of the repair or alteration will have on the part and product. This is frequently a comparative assessment using appropriate tests and analyses, especially for a repair, and does not require a full recertification compliance showing. Similarly, for the fabrication of a part; either a PMA, fabrication pursuant to performing maintenance, or owner/operator produced parts; the objective is to replicate an equivalent part. This is typically done by comparative test and analyses to show equivalency to the original type design and not by repeating all of the original type certification testing or analyses. For more substantive changes such as an alteration of the design which is so significant that it qualifies as a major change to the

type design under 14 CFRs 21.113, Requirement of supplemental type certificate, and 21.93, Classification of changes in type design, a supplemental type certificate (STC) would be required. For an STC the compliance showings can be substantial even to the point of complete recertification of the respective design changes being introduced by the STC.

When exporting parts that comply with FAA approved data for repairs, alterations and fabricated parts, some authorities and operators have refused to accept certain FAA approvals. Some difficulties have also been encountered with mutual acceptance of repairs which are treated by some authorities as type design changes and there is not a clear understanding with other authorities of how the FAA's processes and requirements align with theirs. Consequently, some have questioned why certain FAA approved repairs were not classified as major design changes or alterations perhaps even requiring an STC. Some authorities also place heavy emphasis on the need for a non-TC/PC holder to have linkage to or a relationship with the TC/PC holder for certain types of approvals. This is not practical nor is it required legally in the U.S. system.

In the U.S. system a repair of a part is merely restoring the part to its already approved original condition with respect to airworthiness. The data required for a repair is the data on how to perform the work of restoring the part to its original condition with respect to airworthiness. This should not be confused with an alteration which modifies or changes the part or product to a different design configuration. There are times when maintenance providers have repaired parts and at the same time altered the parts to a different design configuration. In such cases they must satisfy the regulatory requirements for both repair and alteration since they are two distinctly different functions. For example the repair portion could be minor but the alteration work may be major so they would need approved data for the alteration portion of the work.

There has also been some concern with other authorities and inspectors in the FAA over how to identify an FAA data approval. FAA data approvals can come in numerous forms such as:

- An FAA Aircraft Certification Office or Directorate Staff by letter, facsimile, e-mail, etc.
- An appropriately authorized designee of an aircraft certification office such as a DER via a FAA Form 8110-3, a Designated Alteration Station (DAS) when accomplished by STC, etc.

- A repair station or air carrier holding SFAR-36 Major Repair Authorization to use data developed by the holder other than that approved by the Administrator
- A FAA Flight Standards Inspector via an FAA Form 337 Field Approval
- Another Civil Airworthiness Authority for which there is a bilateral airworthiness agreement with that country covering FAA's acceptance of such data approval
- In a manufacturer's ICA or service documents where the data was pre-approved by a method acceptable to the Administrator such as a design change under 14 CFR 21.97, Approval of major changes in type design
- Any other manner acceptable to the Administrator under 14 CFR 21.305(d) Approval of materials, parts, processes and appliances

This has led to much confusion over how to identify what is or isn't FAA approved and has generated discussion on how to clarify or standardize data approvals.

CONCLUSION 10:

A major driver of the debate between TC/PC holders and non-TC/PC holders over the integrity of repairs and replacement parts is the economic business competition between them. That is not likely to change despite any actions taken by the FAA. Regardless, the FAA will take the necessary steps to ensure safety, compliance, and standardization shortfalls are corrected.

It became clear that past initiatives to solve some of the repair, alteration, fabrication and PMA issues going back into the 1980's and 1990's were largely unsuccessful because of the diverse stakeholder interests. Those varied positions have not changed substantively over the years with one exception. The TC/PC holders have not all unanimously embraced the concern over non-TC/PC holder parts, repairs and alterations because some of them realize that:

- the volume of product support needed in today's global aviation market with the ever increasing aircraft population can not be managed by the TC/PC holder alone, and

- Some TC/PC holders are heavily diversifying into the maintenance and leasing market so they want to be able to develop and perform non-TC/PC holder maintenance and alterations on other TC/PC holders' product lines.

Some TC/PC holders don't want to be lobbying against the very maintenance and replacement parts business they are diversifying into; and they don't want to be adversely affecting the costs and flexibility of the owners/operators' who are the very people they want to sell aviation products and services to.

The PMA community through their industry association, MARPA, has come together to work more diligently on ensuring the integrity of their industry and products. Also, some air carriers have actually entered into business agreements with PMA holders to procure a source of less costly high quality spare parts and participate in the oversight of those PMA part sources from a business liability standpoint.

RECOMMENDATIONS

The AVS RAF Team evaluated several alternative courses of action including certain industry recommendations. The alternatives evaluation is contained in Appendix B. The rationale for the team's final recommendations was a solution that would have the greatest benefits for managing safety and also:

- Clarify and reinforce rules and policy regarding repairs and alterations to insure the integrity of compliance findings and approvals.
- Improve standardization and communication of requirements.
- Control the safety and integrity through the data approvals and reinforce the need to include process and procedural specifications for performing the repairs, alterations and fabrications.
- Improve the credibility and global acceptability of FAA approved repairs, alterations, fabrications and PMA approvals.
- Require only those rule and policy revisions necessary to effectively manage safety most of which the Team believes can be effected through current initiatives. e.g.; AVS SMS program, current AIR revision activity for 14 CFRs 21 and 45, certified design organization (CDO) initiative, designee oversight, etc.
- Not adversely affect the balance of commerce and competition that will provide owners/operators with more sources for parts and maintenance resulting in lower costs and higher reliability parts and services as companies compete for market shares.

Consequently, after considering the team's conclusions and alternatives, the AVS RAF Team arrived at the following recommendations:

RECOMMENDATION 1:

This original recommendation was more of a conclusion than an actionable recommendation. Therefore it was moved to the discussion at the beginning of the Conclusions section. However, the numbering of the following recommendations was not changed in order to avoid confusion with regard to comments and past presentations of RAFT material.

RECOMMENDATION 2:

As the other AVS RAF team recommendations regarding major/minor determination and development of acceptable data for critical parts are being implemented periodic evaluations of their effectiveness should be conducted. If the desired outcomes are not adequate then FAA should require that all repairs, alterations and/or fabrications for critical parts of any extent which are not covered in the product's ICA are automatically defined as major and thus require FAA approved data. Additionally, retain the AC 43-18, Fabrication of aircraft parts by maintenance personnel guidance that the fabrication of any Category Parts List (CPL) Categories 1 or 2 parts are Major requiring FAA approved data.

Product/Deliverable: Rulemaking to CFR Part 1.1 re-defining major alteration and major repair as including **any** repair, alteration and/or fabrication of a critical part that is not covered in the product's ICA.

Product Owner: AFS-300

Objective: Eliminate the determination of major/minor classification related to repair, alteration and/or fabrications of critical parts not covered in the ICA by requiring them to automatically be major. This would require approval of all data for repair/alteration and/or fabrication for critical parts and reduce the likelihood of someone developing inadequate acceptable data for a minor repair or alteration on a critical part.

Boundaries & Considerations:

- Avoid confusion between major/minor under CFR 43 and major-minor type design changes under CFR 21.
- Industry has volunteered to provide a "Best Practices" snapshot of current best practices and procedures for determining major/minor classification.
- This will not apply to repairs, alterations and fabrications in the product's ICA and to alterations included in the product's "specifications as" cited in 14 CFR 1.1.
- Minimize the number/type of discriminators and categories related to determining major/minor and parts criticality.

Prerequisites:

- Evaluation of effectiveness of guidance material on best practices of determining major-minor and other recommendations and
- Establishing clearly agreed definition(s) of Critical per recommendation #3

Potential Obstacles:

- Industry concern over restrictions and impact on their existing procedures under their Operations Specifications.
- Potential workload increase and added turn-time to get FAA approvals due to more repairs and alterations being major?

RECOMMENDATION 3:

Clarify guidance on what constitutes a "Critical Part" composed of a single high level generic criteria plus CFR Part product criteria guidance to be developed by AIR Directorates and revise all applicable orders and policy to standardize.

Product/Deliverable: FAA Order and guidance material with general policy and guidance on the four Directorate product specific applications

Owner: AIR-100

Objective: Improve the scope, consistency and integrity of the data that supports showing of compliance for repairs, alterations and PMA on critical parts.

Boundaries & Considerations:

- Consider impact of Existing Directorate positions and policy.
- Maintain alignment with EASA harmonization effort.
- Ensure Risk Based Resource Targeting (RBRT) risk factors alignment with criticality.
- Minimize the number/type of discriminators and categories related to determining major/minor and parts criticality. Don't create new or extra unnecessary category(s) of parts. However, consideration must be given to adequately assessing repairs and alterations of parts which may have an influence on critical parts such as those parts that influence life limited parts under CFR 33.70 and draft AC 33.70-Y, Section 11.a.

Prerequisites: None

Potential Obstacles: Multiplicity of existing definitions and opinions within both FAA and Industry.

RECOMMENDATION 4:

Require all major repair, major alteration, fabrication and PMA submittals for design data approval be evaluated for whether or not they are a.) Properly classified as a repair or alteration and b.) A major or minor change to the type design in accordance with 14 CFRs 21.113, Requirement of supplemental type certificate, and 21.93, Classification changes in type design.

Product/Deliverable: An Advisory Circular (AC) defining an acceptable process for making a major/minor type design change determination under 14 CFR 21.93 and revisions to appropriate FAA orders directing FAA and designees to make those assessments as part of approval process.

Owner: AIR-110

Objective: This AC will provide a high-level process for making the major/minor type design change determination. The process will allow for each Directorate to produce supplemental information that can give more specific guidance for type design effects on specific product types that affect the determination.

Boundaries & Considerations:

- Needs to define "how to" make the evaluation of major/minor type design change.
- Clarify definition of repairs, alterations, fabrication, and type design changes for more consistency and clear distinction.
- Product from Recommendation #7 that will direct FAA and designees to do the evaluation when reviewing a data submittal.
- A revision to AC 120-77 from Recommendation #10 will emphasize the definitions of repair, fabrication, and the need to distinguish clearly between repairs and alterations. This should also consider any relevant differences between Transport

Category aircraft, commercial operations, and other normal category and general aviation aircraft.

- Consider how an ODA and other similar entities may or may not perform this task and what related policy documents need to be changed.

Prerequisites: None

Potential Obstacles: None

RECOMMENDATION 5:

Improve the alignment and consistency of quality control requirements across AVS approval holders to require comparable QC system requirements for repair, alteration, fabrication, PC, and PMA that are graduated based on a data driven, risk based criteria including part criticality.

Product/Deliverable: Revision to existing AC 43-18, Fabrication of aircraft parts by maintenance personnel to incorporate guidance similar to the quality system requirements for PMA which are being aligned with PC under the latest pending revision to 14 CFR 21, Certification procedures for products and parts.

Owner: AFS-300

Objective: Align the quality system guidance of FAA AC 43-18, Fabrication of aircraft parts by maintenance personnel, with the recent changes to 14 CFR Part 21.

Boundaries & Considerations: AVS SMS requirements and industry SMS implementation will also enhance controls through data driven, risk based SMS compliance and conformity management subsystems. Incorporate conclusion 2 discussion in AC 43-18 under the added definition Repair.

Prerequisites: Following the final rule release of the amended 14 CFR 21 expected in early 2009.

Potential Obstacles: None

RECOMMENDATION 6:

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

Leverage Industry owners/operators and maintenance providers to gather best practices of how they determine major/minor repair and alteration classification under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration. Develop appropriate guidance and/or policy to improve the standardization of major/minor determinations.

Product/Deliverable: New AC providing guidance on best practices for determining major-minor for repair and alteration.

Owner: AFS-300

Objective: Improve consistency across industry major/minor repair and alteration determinations.

Boundaries & Considerations:

- Include guidance on the regulatory intent of "if improperly done" and "appreciable affect" used in determination of major-minor under 14 CFR 1.1.
- Include guidance on the regulatory intent of "accepted practices" and "elementary operations" used in determination of major-minor under 14 CFR 1.1.
- Clarify definitions of major/minor repair or alteration determined under 14 CFRs 1.1, Definitions and abbreviations, and 43, Maintenance, preventative maintenance, rebuilding, and alteration, versus major/minor type design changes under 14 CFR 21, Certification procedures for products and parts.
- Assess existing directorates' policies on critical parts and the Engine & Propeller Directorates repair and PMA ACs.
- Industry has volunteered to provide a "Best Practices" snapshot of current procedures and practices for determining major/minor classification.

Prerequisites: Obtain industry best practices to assist in development of sound policy, and accomplish this prior to implementing recommendation #2.

Potential Obstacles:

- Industry concern over restriction and impact on their existing procedures under their Operations Specifications.

- Potential workload increase due to more repairs and alterations becoming major.

RECOMMENDATION 7:

Continue to develop and deploy new category(s) and/or clarify authorization for designees related to CFRs to a.) Adequately control approval of major repairs, fabrications and alterations especially related to critical parts and b.) Assist in major/ minor type design change determinations of Recommendation #4.

Product/Deliverable: Revise orders 8110.37 and 8100.8 to incorporate any clarifications or new categories developed for designees for data driven, risk based oversight of designees. Remove of the restriction which currently does not allow designees to make a determination under 14 CFR 21.93, Classification of changes in type design.

Owner: AIR-140

Objective: Ensure risk based oversight of designees consistent with the relative criticality of parts and the risk based prioritization of the CFRs. Remove the policy restriction on designees to permit them to assist FAA in making determinations under 14 CFR 21.93, Classification of changes in type design.

Boundaries & Considerations:

- AVS delegation standardization team and the AIR Designee Management Team are already working this issue.
- Need AIR and AFS agreement on designee management and interaction with AFS inspectors as well as where the line is between major-minor repair or alteration under 14 CFRs 1.1, Definitions and abbreviations, and 43, Maintenance, preventative maintenance, rebuilding, and alteration, versus changes to the type design under 14 CFR 21, Certification procedures for products and parts.

Prerequisites:

- Need the 14 CFR 21.93, Classification of changes in type design, determination guidance currently under development by AIR-100
- Training on the determination for FAA and designees

Potential Obstacles:

- Impact on AIR SM Designee team and content plus their need to align with AVS Designee Steering Committee and delegation principles.

RECOMMENDATION 8:

Develop guidance to align part identification guidance for fabrication consistent with current AC 43-18, Fabrication of aircraft parts by maintenance personnel guidance and expand it to owner/operator produced parts, parts fabricated during maintenance, major repairs and major alterations. Reconsider the need for rulemaking on part identification after considering the recent proposed rulemaking on production part identification and the related revised 14 CFR 45, Identification and registration marking, Final Rule is published.

Product/Deliverable: 14 CFR 43 AC guidance on part identification for all repairs, alterations, fabricated parts and owner produced parts mirroring the existing guidance in AC 43-18, Fabrication of aircraft parts by maintenance personnel.

Owner: AFS-300

Objective: To develop AC guidance on part identification for owner produced, and parts undergoing major repair/alteration consistent with the policy contained in AC 43-18, Fabrication of aircraft parts by maintenance personnel.

Boundaries & Considerations:

- Guidance on how and where to identify parts as part of repair, alteration and fabrication approved data.
- Configuration control and the use of Illustrated Parts Catalogs, etc. are beyond the scope of this recommendation.
- Consider effect of 14 CFR 45, Identification and registration marking, changes in the 14 CFR 21 Final Rule project when they are published.

Prerequisites: None

Potential Obstacles: This may not go far enough to satisfy the TC/PC holders who do not want original P/Ns and data plates remaining on repaired, altered, and fabricated parts and on the products with such parts installed in them.

RECOMMENDATION 9:

Continue to develop and deploy repair, alteration and PMA compliance guidance templates for applicants to use when developing data packages for approvals for all product types.

Product/Deliverable: Evaluation and report-out by all Directorates on their need for specific guidance and/or templates on data development and compliance for repairs, alterations, and PMA, then proceed accordingly with guidance development.

Owner: AIR-100 and Directorate SMT members

Objective: Improve the scope and consistency of the data that supports showing of compliance for repairs, alterations and PMA in order to manage the integrity of data approvals for major repair, major alteration, PMA of critical parts, and parts which can have an influence on critical parts.

Boundaries & Considerations:

- Output for guidance or templates on repairs and alterations may go into AC 120-77 revision under Recomendation # 10.
- Actions on PMA may be done separately by Directorates or become part of the AIR-100 PMA AC development planned for the future.
- Focus is on managing integrity of data for major repair, major alteration, PMA of critical parts, and parts which can have an influence on critical parts.
- ANE Repair/Alteration/PMA templates are in development
- AIR-110 considering AC or Order on what a complete general compliance data submittal looks like. (See Recommendations # 4 & 7).

Prerequisites: None

Potential Obstacles: None

RECOMMENDATION 10:

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

Revise AC 120-77, "Maintenance and Alteration Data" to standardize and extend applicability to all maintenance providers and product types and to incorporate other pertinent input related to the other AVS RAF team recommendations.

Product/Deliverable: Revised AC 120-77

Owner: AFS-300

Objective: Revise AC 120-77 to expand applicability and improved standardization of policy application across all product lines.

Boundaries & Considerations:

- Consider incorporating repair and alteration output(s) of Recommendation # 9 as an addendum or appendix for other specific product type concerns e.g.; for engines, small airplanes, rotorcraft, etc.
- Consider references to CFRs and ACs defining "major" and take into account other related recommendations of this report (e.g.; 2, 4 and 6)
- Clearly define the difference between a repair and an alteration.
- Industry suggested an automated or on-line set of templates.
- Industry participation as on original AC development.
- Cover the definition issue of the difference between a repair vs. an alteration.

Prerequisites: None

Potential Obstacles: None

RECOMMENDATION 11:

Continue the implementation of COS programs and SMS with PMA holders, repair stations, and air carriers with the assistance of MARPA and ARSA for all product types.

Product/Deliverable: Revised AC 120-77

Owner: AFS and AIR with industry

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

Objective: FAA support of industry initiatives to provide guidance on COS management best practices and to implement appropriate SMS subsystems that will enhance compliance and conformity for repairs, alterations, fabrication and PMA.

Boundaries & Considerations: Industry participation and leadership needed.

Prerequisites: None

Potential Obstacles: None

RECOMMENDATION 12:

Revise 14 CFR 21.3, Reporting of malfunctions, failures, and defects, to be applicable to any design, production, fabrication, alteration or maintenance approval holders that for failures malfunctions or defects introduced by their respective design or their performance of manufacturing, fabrication, alteration or maintenance work. Revise 14 CFR 21.4, ETOPS reporting requirements to ensure alignment with 14 CFR 21.3 changes and eliminate redundancy of reporting requirements between aircraft and engine TC holders under 14 CFR 21.4.b and redundancy with reporting required of operators under 14 CFR 121.374, 121.704, and 121.705.

Product/Deliverable: Develop rule change to 14 CFRs 21.3 and 21.4.

Owner: AIR-110

Objective: Ensure equity, standardization, and eliminate redundancy of reporting requirements across all approval holders for their respective products and parts.

Boundaries & Considerations:

- To ensure consistency with 14 CFR 21 revisions recommendations 12 and 13 should be completed together during the next revision of 14 CFR 21.
- Consider reporting requirements and data from maintenance and operations reporting requirements under other CFRs to ensure alignment the regulatory responsibility of each stakeholder group and to eliminate any redundancy.
- Consider responsibilities and relationship of ODA and other similar entities to reporting requirements.

Prerequisites: None

Potential Obstacles: None

RECOMMENDATION 13:

Revise 14 CFR 21.99, Required design changes, to make the requirement applicable to all design and data approval holders.

Product/Deliverable: Develop rule change to 14 CFR 21.99

Owner: AIR-110

Objective: Ensure equity and standardization of requirements for developing needed safety corrective actions across all approval holders for their respective products and parts.

Boundaries & Considerations:

- To ensure consistency with 14 CFR 21 revisions recommendations 12 and 13 should be completed together during the next revision of 14 CFR 21.
- Consider responsibilities and relationship of ODA and other similar entities to 14 CFR 21.99, Required design change, requirements.

Prerequisites: None

Potential Obstacles: None

RECOMMENDATION 14:

Minimize the number of formats which FAA data approvals are documented in by creating an FAA data approval Form solution, that is electronically archived and retrievable, which would be required to be used by FAA employees or designees for executing FAA data approvals.

Product/Deliverable: FAA data approval documentation Form solution for use by FAA employees and designees for data approvals other than TC, STC and PMA.

Owner: AIR-110

Objective: Provide uniform documentation of FAA data approvals which is readily recognizable world-wide and is available to appropriate personnel by automated means. The objective is three fold.

1. For any FAA approvals that do not currently have an FAA Form or a certificate issued, an FAA Form would be required in the future to execute the approval. E.g.; Today an ACO engineer could send a letter or even an e-mail approving a repair. In the future the ACO would have to issue the approval via an official FAA approval Form X.
2. Where practicable approval Forms should be combined. E.g.; perhaps in the future both the FAA ACO engineers and DERs would use an FAA Form 8110-3 for data approvals.
3. The FAA Forms should be automated so they can be tracked and retrieve across the FAA system as needed and perhaps also by other airworthiness authorities under a bilateral aviation safety agreement.

Boundaries & Considerations:

- Effects on bilateral agreements with other airworthiness authorities and where appropriate maintain similarity with others.
- Possible nesting in pending data approval guidance from AIR-110
- Whether to continue with separate forms for designees or have one form for FAA and designees.

- Impact on Field Approvals.
- Industry recommendation to divorce the "data approval" function of an FAA Form 337 and only have the Form 337 be for return to service then use a separate form for data approval.
- Training for the single form and implement it through the appropriate course managers
- IT automation needs

Prerequisites: None

Potential Obstacles: None.

RECOMMENDATION 15:

Develop Advisory Circular guidance on ICA assessments for major repairs and major alterations to reflect the need for ICA assessments consistent with the FAA ICA Order 8110.54.

Product/Deliverable: Develop and deploy new AC on ICA assessments

Owner: AIR-140

Objective: New AC guidance for Instructions for Continued Airworthiness that emphasize the need for ICA assessments of repairs, alterations, fabrications and PMAs. Also, the AC should reinforce the obligations for making ICAs available under 14 CFR 21.50, Instructions for continued airworthiness and manufacturer's maintenance manuals having airworthiness limitations sections. The AC should also address confusion about the relationship of manufacturers' service documents that are not typically an official part of the ICA such as IPCs, service bulletins, letters to operators, etc. Such documents may under certain conditions be a part of the ICA or may still be required if an operator or maintenance provider has incorporated them into their maintenance program or manuals system under their Operations Specifications.

Boundaries & Considerations:

- Strengthen the guidance on ICA assessments of repairs, alterations, fabrications, and PMAs.

- Clarify documentation and distribution of ICA supplements for repairs, alterations, fabrications and PMA.

- Address ICA ownership and owner/operator and maintenance providers' authority to use the ICA despite restrictive words to the contrary that TC holders have put in ICAs. Reinforce that warnings or restrictions that TC/PC holder place in the ICA which are not strictly related to maintaining the airworthiness of the product are unacceptable to the FAA under the respective CFRs and policy governing ICA content.

- Add guidance on what is appropriate for information, warnings or restrictions that a TC/PC holder may place in the ICA which are not strictly related to maintaining the airworthiness of the product. Consider SAIB NE-08-40 which acknowledges that TC/PC holders have no knowledge or data about any PMA parts, owner/operator or maintenance provider fabricated parts, and STC parts installed in the product. Therefore, TC/PC holders can only assess the airworthiness, maintainability and systems effects of their parts installed in a product of their known type design configuration and they are not responsible for the effects of someone else's parts, repairs, or alterations.

- Notify process owner of other related ACs' affecting ICAs (e.g.; large and small aircraft, propellers, engines, rotorcraft, draft Order 8900 on field approvals, etc.) to change their references and align with new AC

Prerequisites: None

Potential Obstacles: TC/PC holders' practices of putting non-airworthiness information and restrictions in ICA and the reluctance of approval holders to distribute ICAs are still an issue. The past practice of FAA and industry incorporating non-ICA manufacturers' service documents by reference in the ICA continues to cause confusion for industry and FAA inspectors over what is and is not enforceable.

RECOMMENDATION 16:

Conduct FAA training curriculum review and develop FAA training course adjustments to imbed clear repair, alteration, fabrication, and PMA rule and policy information resulting from the other AVS RAF team recommendations. Conduct FAA, designee and industry training and briefings on the key rule and policy aspects and the outcomes of this report for

repairs, alterations, fabrication and PMA. Emphasize the integrated relationship of AIR and AFS rules and policies and clarify the respective regulatory responsibilities of all stakeholders.

16A Product/Deliverable: Provide **near term informal training/briefing material** to disseminate the information, lessons learned, and progress of the RAFT outcomes. Standardized briefing packages (short and long versions) explaining and clarifying all of the issues, lessons learned, and plans re; repairs, alterations, fabrications, and PMA.

16B Product/Deliverable: Provide **long term formal** FAA training course material to explain the inter-relationships of the revised rules, orders, policy, and clarifications, and lessons learned from the RAFT recommended outcomes re; repairs, alterations, fabrications, and PMA.

Owner: AFS-300 & AIR-100 jointly with AQS support

Objective: Presentation and training material for use at workshops, information sessions, and formal training for FAA workforce, designees, and industry. Content and delivery should emphasize not only the specific information associated with each rule or policy activity but also provide a high level generic understanding of the relationship of all the regulatory and policy pieces, including the integration of AIR and AFS rules and policy, and the regulatory responsibilities of all stakeholders.

Boundaries & Considerations:

- Leverage industry and FAA internal briefing materials, feedback, and lessons learned by the AVS RAF team
- This product will require frequent updates as the recommended projects progress to stay aligned with the over-all program big-picture.

Prerequisites: None

Potential Obstacles: Travel and training resources for deployment

AVS LEADERSHIP ACTIONS

The AVS leadership is committed to equitably addressing the concerns and needs of all the stakeholder groups in the interest of safety and to resourcing the development and implementation of the team's Recommendations. The analyses conducted by the AVS RAF Team indicate that many of elements of aligning the rules, policy and disseminating the results into the organization have potentially significant implications to both FAA and the industry stakeholders. There were also aspects of future work that need consultation from AVS RAF Team members, other FAA organizational elements and industry to ensure consistency as they develop.

The AVS leadership will be monitoring the development process and providing feedback or redirection as needed based on information contained in this study and future input from stakeholders. Beginning with this report and as each recommendation project is further developed; stakeholders will have opportunity to provide input. This will help the FAA and AVS leadership make informed decisions which may include:

- Identifying those concepts and recommendations which merit consideration for further development and implementation;
- Identifying the degree of change impact and commitment FAA and industry find necessary and desirable to move forward on any of the proposed actions;
- Defining the high level timeframes for which the actions should be targeted;
- Articulating leaderships vision of the future operating norms and expectations which will support the changes; and
- Endorsing the necessary actions for future integrated work between AFS and AIR to complete the resolutions of the issues identified in this study.
- Establishing an AVS focal point(s) or integrated oversight process for all follow-on activity related to repairs, alterations, fabrication and PMA.

The answers to the questions above or others will provide the basis for constructing a detailed ongoing action plan for resolution of the issues and better standardization and integration of rules, policies, and work processes across AVS and with external stakeholders.

STAKEHOLDER OUTREACH

After the AVS Leadership accepted the initial concepts and recommendations the AVS RAF Team briefed each of the major stakeholder groups and certain companies who had made specific recommendations to the FAA. The outreach to industry was done separately with each key stakeholder group rather than at one large meeting so FAA could focus on the specific interests and concerns of each stakeholder group and so the meetings didn't get sidetracked by different stakeholder groups' conflicting interests.

After the stakeholder outreach activity the AVS RAF Team reconsidered the recommendations and alternative courses of action in this report. The AVS RAF Team worked with the AVS process owners to finalize a more detailed plan and timeline to address the recommended actions.

The report was then made available for public comment through a notice in the Federal Register in September of 2008 (**Federal Register** / Vol. 73, No. 173 / Friday, September 5, 2008 / Notices). A summary of the comments received and their disposition which resulted in certain revisions to this final report are contained in Appendix D.

BUSINESS PROCESS/POLICY OWNERS

The principal owners of the follow on actions are the Aircraft Certification Service Aircraft Engineering Division, AIR-100, and the Flight Standards Service Maintenance Division, AFS-300. In addition to the data examined by the AVS RAF Team and their recommendations, the next phases will require greater involvement and leadership of those affected AVS business process owners and of the Industry.

AVS REPAIR, ALTERATION AND FABRICATION TEAM

The AVS RAF Team or selected members of the team if needed and their research documentation should be viewed by AVS as a resource to be consulted with during the ongoing development of the detailed solutions. The team spent considerable time exploring a wide range of issues relevant to this effort and they have a rich body of knowledge which could not be fully captured in this written summary of their study. Officially it has been decided that the AVS RAF team's work is concluded as of October 1, 2008, when the business performance plans for FY-09 and beyond were put in place with the process owners.

IMPLEMENTATION PLANNING

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY

The implementation of the AVS RAF Teams recommendations affects several AVS business process owners. Ongoing work will need to be done with the appropriate process owners to develop more detailed action plans, adjust timelines, and implement the projects for each of the recommendations realizing that there are already numerous business plan initiatives on everyone's plates. Every opportunity should be made to leverage existing initiatives where appropriate and integrate the actions into AIR and AFS business plans.

The work to be done will fall into one or more of the following categories:

- New and revised rules and policy documents (including any related QMS procedures documents).
- Corresponding adjustments to current business practices (FAA and Industry).
- Adjustment or inputs to related AIR and AFS business plan activities to accomplish the actions.
- Training and information development and dissemination.

Follow-on groups led by the appropriate process owner(s) should include input or representation from all segments of the AVS work force and should focus on the following objectives:

- Develop a detailed integrated AVS implementation plan for each project ensuring that the business process and culture changes continue to maintained and continuously improved;
- Integrate the AVS RAF work with the process owners' other rule and policy work to ensure consistency and that they meet the intent of the recommendations;
- Develop a standard briefing package(s) explaining and clarifying all of the issues and plans re; repairs, alterations, fabrications, and PMA that are final outcomes from this study to be used at designee seminars, FAA employee and industry briefings, and other workshops such as AIR program managers meeting, AVS management teams, regional or national inspector meetings, etc.
- Obtain additional data as needed to conduct a more detailed cost/benefit evaluation of the changes;

- Leverage the AVS SMS initiative to move forward on AIR/AFS integration and interface issues that impact needed changes including compliance and COS management sub-systems for SMS requirements.

- Conduct challenge sessions with AVS management and key stakeholders to make key decisions during development and implementation of each project then revise action plans as needed and coordinate revisions or new alternatives with AVS management;

- Work jointly to harmonize implementation plans across AVS;

- Coordinate the actions and any changes with Industry and EASA;

- Establish ongoing communications with the affected workforce and designated AVS advocates in each division/directorate to ensure implementation is effective; and

- Conduct periodic evaluations of the status of the above actions and their effectiveness, as well as to determine if further or different actions are warranted.

Respectfully submitted for your consideration,

The AVS Repair, Alteration, and Fabrication Team

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY
APPENDIX A: AVS RAF TEAM PROCESS

AVS RAF TEAM PROCESS

AVS RAF TEAM CHARTER

The AVS RAF Team was formed in February of 2007. The team was comprised of seven AIR and two AFS personnel plus three sponsors, AFS-301, ANE-100 and AIR-100. The ASA-1 and AIR-200 managers also supported the effort. The AVS RAF Team members included representatives from the four FAA product Directorates and FAA headquarters representing engineering and both AIR and AFS safety inspector disciplines. The AVS RAF Team members list and charter are provided below.

The AVS management chartered the AVS RAF Team to assess the adequacy of current and in process regulations, policy, guidance and past practices in relation to industry trends for obtaining FAA approvals of non-TC/PC holder developed repairs, alterations, and replacement parts. The team was tasked to identify gaps between regulations, policy and guidance as compared to FAA and industry practices and trends. They would then provide recommendations and alternatives to close those gaps in order to ensure an acceptable level of continued airworthiness commensurate with the criticality of the parts to assist AVS senior management in making decisions regarding the future direction of policy for repairs, alterations, and parts.

The AVS RAF Team was also tasked to consider improvements in the coordination and integration of AFS and AIR services in instances in which the two services have a common stakeholder base or related/overlapping functions. The team was further charged with the responsibility to obtain representative work force feedback and to obtain representative industry feedback on any proposals they developed. The final product to be delivered to AVS was to include a broad deployment strategy, and recommendations for work which must be completed by follow-on teams or FAA business process owner organizations.

Team		Sponsors & Support
Chris Carter; AIR-100	John Milewski; AIR-110	Rick Domingo; AFS-301
Angelia Collier; AIR-200	Ron Mochi; AEA-200	Fran Favara; ANE-100
Mark Fulmer; ANE-100	Jon Mowery; ANM-100L	Dave Hempe; AIR-100
Anthony Janco; AEA-200	Michael E O'Neil; ANM-100L	Jay J Pardee; ASA-1
Hal Jensen; AIR-100		Frank Paskiewicz; AIR-200

APPENDIX A: AVS RAF TEAM PROCESS

AVS Repair, Alteration and Fabrication Review Team Charter

Name: Repair and Fabrication
Project Sponsor(s): Dave Hempe, Fran Favara, Rick Domingo
Working Group Membership: **Lead:** **Members:** AIR-100, AIR-200, AFS-300, ANE-100, AEA-200/BOS-AEG, ANM-100 TBD Facilitator **Coordination Members:** AIR-40, ACE-100, ASW-100, and AVS-4
Project Team Overview and Objective: Overview: The current policy and regulations regarding repairs and alterations do not adequately account for repairs and alterations to safety critical parts. Past practices and current policy allow partial and complete fabrication of critical parts under the repair process. This includes re-identification of a fabricated part by a non original equipment manufacturer (OEM) source to a new OEM part number configuration. A single AVS solution is required to ensure that parts produced under part 21 or through repair and alteration meet the similar safety standards that were required by the OEM. Background: Large Air Carriers (i.e., 14 CFR Part 121) have historically obtained parts and repair data from the OEM to maintain their engines. The engine OEM historically sold new engines well below cost and relied on the spare parts and repair business to recover these costs and eventually make profit. The Air Carriers generally stayed away from obtaining their engine spare parts and aggressive repairs from non-OEM sources since the failure of some of these parts pose a significant flight safety risk. In response to the economic problems encountered by airlines, some operators are now shifting to a strategy of obtaining the most expensive and safety critical engine parts and repairs through non-OEM sources. This pursuit of non-OEM material and services is very aggressive with the airline industry providing resources to non-OEM companies to develop alternatives to OEM parts and services. One major obstacle the operators face is the restriction placed by many of the world's leasors that prohibits the use of non-OEM parts approved under Parts Manufacturer Approval (PMA) in their engines. (note: GE Capital Aviation Services is one of the world's largest aircraft leasors.) To avoid lease restrictions, operators are driving non-OEM sources to provide newly fabricated parts under the guise of repairs. They are using vaguely written 14 CFR Part 43 regulations and guidance to avoid approval through PMA (14 CFR Part 21, Subpart K). The regulations and policy associated with PMA identifies specific design and manufacturing requirements (for example, the need for a Continued Operational Safety Plan) that are not contained in the repair regulations and policy. These differences have led to inconsistencies in the approval certitude which has been questioned within the FAA and by foreign aviation authorities. Objective: Assess the adequacy of current and in process regulations, policy, guidance and past practices in relation to industry trends for obtaining non OEM parts and repairs. From this assessment determine if gaps exist between current and in process regulations, policy and guidance to that necessary to ensure a level of safety commensurate with the criticality of the parts. Provide specific recommendations that will close these gaps.

AVS Repair, Alteration and Fabrication Review Team Charter

Project Plan Milestones & Deliverable	Date Complete
1. Kickoff of project team & Charter complete with detailed milestones & deliverable(s)	2-15-07
In relation to repair, alteration, fabrication, PMA, and STC of critical parts; conduct the following:	
2. Develop Preliminary: 1. Issues list 2. Agreements list 3. Stakeholders list 4. Open questions	2-15-07
5. Validate initial issues list with sponsors and leadership	By 2-23
6. **Identify** Rules, orders, policy, guidance, legal interpretations (including in process items), and Past practices	3-16
3. **Define** scope of **Industry trends** across CFR 21, all product lines (25, 33, 23, etc.), and operations (e.g. part 91, 121, and 135) (Who [Stakeholders], what, why [drivers/needs]?)	3-16
4. **Identify** all past and existing teams, and business plan activities pertinent to the issues. (What do we do with it? Leverage those activities to achieve some of our end objectives.)	3-16
5. Determine how rules, policy, & practices **do or do not align** • with the identified issues and each other • With the flow chart	3-16
6. Consolidate results: • Final Issues list (rate & rank for priority and impact) • Agreements list • Stakeholders analysis • Consolidated research documentation	3-30
7. Meeting for Gap analysis and develop recommendations & action plan	Wk/April 9
8. Develop a high-level preliminary recommendations and **plan** to address any **gaps** identified in previous steps for follow-on action. This will **include a joint AVS strategy to:** • **ensure consistent** definition, interpretation and application of requirements • change rules or policy as needed determine which issues to tackle and why or why not • etc.??	E/O May
9. Reach agreement on Preliminary findings and plan	
10. Develop for public meeting: • agenda	E/O June

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AVS Repair, Alteration and Fabrication Review Team Charter

Project Plan Milestones & Deliverable	Date Complete
• expectations/desired outcomes • presentation materials	
11. Develop and issue Notice of Public meeting	
12. Public Meeting	late July
13. The plan must include provisions for **public meetings** to obtain customer feedback on FAA team(s) recommendations and findings.	
14. Based on step 7 **complete detailed plan and make specific recommendation** i.e., rule making, policy and guidance changes.	Early-mid Sept.

AVS Repair, Alteration and Fabrication Review Team Charter

Factors to be considered by the team.

- Sliver repairs and fabrication of complete parts or details consumed in repair (ref: AC 43-18)
- Part Marking (non-OEM practice of changing to a later OEM part number configuration through a repair/alteration)
- COS responsibilities, including ICAs
- Adequate technical and substantiation data for all major repairs (ref: AC 120-77)
- Airworthiness Standards templates, if applicable
- System level effects
- Lifing methodology for life limited parts
- Quality control system requirements PMA vs. fabrication during repair in light of part 21 rewrite
- FCAA (e.g., EASA) concerns
- Identify when a part fabrication or repair requires an STC
- Classification of repair vs alteration
- Field Approvals
- ETOPS & durability
- Prior service history (AD, SB, SDR)
- Definition of critical part to determine level of involvement and internal FAA coordination requirements.

CHARTER ACCOUNTABILITY:

Mark C Fulmer — Team Lead — 2-20-'07 — Date

CHARTER APPROVED:

John J Hickey — Director, Aircraft Certification Service — 3/2/07 — Date

Jan D Sally — Director, Flight Standards Service — 3/2/07 — Date

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AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY
APPENDIX A: AVS RAF TEAM PROCESS

OVERVIEW OF THE AVS RAF TEAM PROCESS

The members of the AVS RAF Team worked on a part-time basis for approximately 4 months. The team met twice as a group and worked at their home offices on specific tasks in smaller sub-groups and individual tasks completing their work in three phases. The first phase included data collection and evaluation of information to assess the strengths and weaknesses of current AVS organizational structure and processes as well as industry practices and positions around the AVS's customer base. This phase included collecting data from the AVS work force; collection of industry comments; and review of a large number of relevant regulations, policy, study reports, and past initiatives. A summary of the data and information which is maintained on the AVS RAF Team's SharePoint site is contained in Appendix F. Also, a glossary of acronyms and definitions that the team encountered is contained in Appendix E.

The second phase of the AVS RAF Team project was an iterative process of developing and evaluating alternatives. The team spent a significant amount of time educating each other on different aspects of the rules, policy and history related to the issues. It was good that the team came from such diverse background because it brought together the right expertise and corporate knowledge to get a full understanding of the critical pieces of the puzzle.

Because the volume of information was overwhelming, the team focused on what was legally defensible based on current rules, policy and legal interpretations. Secondly the team focused on whether the information, FAA or industry practices, case studies, and various allegations were driven by real safety issues, economic or liability concerns, or by FAA customer service shortfalls. Lastly the team focused on the specific interests and needs expressed by certain industry stakeholders and by certain internal FAA stakeholders.

The final phase of the AVS RAF Team effort was the development and evaluation of alternatives. This was the most difficult since there are diversely strong opinions among all of the stakeholders involved including within FAA. The team considered the potential transition issues, business process impacts and culture changes required to implement each alternative. This is detailed further in the alternative assessment in Appendix B.

The team concluded that due to the diversity of the stakeholders' needs and wants, that in the end analysis no one will be completely satisfied with the solutions. The team strove to find the best course of action in the interest of safety with a minimal impact on current business practices. The end result of the AVS RAF Team evaluation of alternatives was the development of a recommended course of action including identification of the recommended actions to be completed by follow-on teams or the

rule/policy process owner organizations as detailed in the Executive Summary at the beginning of this study.

One of the AVS RAF Team responsibilities was to include the AVS work force and key stakeholders as much as possible. During the course of the team's work, several meetings were held between FAA and ATA, GE, MARPA, HEICO, and PW. Also, RAF Team members talked with FAA employees who were involved in related projects and/or investigations related to repairs, fabrications, alterations, and PMAs. Much of the feedback gained from those contacts verified what the team was finding in its research about current practices, the issues and where the gaps in understanding or rules and policy were.

The process exercised by the AVS RAF Team was demonstrated in the best practices of teaming that supported the open, honest and objective assessment of all the issues. Future planned outreach to industry and the public to get feedback after this study is accepted by AVS leadership is also a part of getting effective stakeholder involvement in a change process.

The AVS RAF Team results will be instrumental in helping the industry, FAA process owners, and public to fully understand the many facets of the issue. The return on the investment for the time and effort required to involve the work force and stakeholders as part of the change will be the AVS work force and the external stakeholders' committed to making a successful transition to resolving the issues identified by the study. The AVS RAF Team believes that in the end, it is this commitment that is the essential ingredient for a successful implementation of the recommendations.

DATA COLLECTION AND ANALYSIS

The primary purpose of phase one of the AVS RAF Team project was to clearly define the issues and collect information on related rules, policies, current and past initiatives, industry practices and business trends, and project work. The team was then to evaluate the data, identify areas of conflict (gaps), areas of agreement, identify alternatives for closing the gaps, and then develop a proposed action plan to close the gaps.

The team also assessed the strengths and weaknesses of the current policy and work practices, determine the needs and expectations of AVS stakeholders, and assessed industry trends which might affect AVS's direction to resolve the issues. To make their assessment of the current organization and aviation environment, the AVS RAF Team obtained data from several different sources:

- Rules and Policy Documents (past and present);

- Related Past and Current Activities or Reports;
- Industry Information;
- Legal Interpretations and Prior FAA Positions; and
- Global Environment Information;

Appendix F provides a complete list of these source documents. A summary of each of these major data sets is described below:

RULES AND POLICY DOCUMENTS;

The AVS RAF Team systematically collected and reviewed an overwhelming number of documents to extract relevant information. These sources included researching the current regulatory basis and historic policy development related to current industry and FAA practices. Also, internal and external reports related to the subject matter as well as past FAA and industry initiatives were considered. It became evident as the research unfolded that most of the current practices were consistent with existing regulations and policy.

The evaluation criteria and issues extracted from the team's charter were further developed by the AVS RAF Team to serve as a framework for conducting a content evaluation to extract key points and information from each document.

FAA AND INDUSTRY PRACTICES;

The team researched current practices based largely on known project work and investigations that many of the team members had been involved in. Data was also collected from numerous meetings with, and submittals from, industry including a variety of presentation materials and related e-mail discussions. A team member also explored air carrier practices regarding major/minor determination for repairs and alterations. Much of this was very useful in clarifying what the various stakeholder groups' positions, needs and interests were.

RELATED PAST AND CURRENT ACTIVITIES;

The AVS RAF Team considered results of current and past initiatives such as major/minor determination, RTCA Taskforce 4, field approval studies, FAA Fresh AIR study, Commercial Airplane Certification Process Study (CPS), etc. There are a number of current initiatives that were studied relating to 14 CFRs 21 and 45 revisions, designee policy updates, PMA policy and the AVS Safety Management Systems (AIR and AFS)

initiatives, and the Engine and Propeller Directorate's policy regarding repair and PMA.

It became clear that past initiatives to solve some of the repair, alteration, fabrication and PMA issues going back into the 1980's and 1990's were largely unsuccessful because of the diverse stakeholder interests. Those varied positions have not changed substantively over the years with one exception. The TC/PC holders have not all unanimously embraced the concern over non-TC/PC holder parts, repairs and alterations because some of them realize that:

- The volume of product support needed in today's global aviation market with the ever increasing aircraft population can not be managed by the TC/PC holder alone, and

- Some TC/PC holders are heavily diversifying into the maintenance and leasing market. They want to be able to develop and perform non-TC/PC holder maintenance and alterations on other TC/PC holders' product lines but do not want others doing the same on their TC/PC products.

Some TC/PC holders do not want to be lobbying against the very maintenance and replacement parts business they are getting in to. They also do not want to be adversely affecting the costs and flexibility of owners/operators' who are the very people that they want to sell aviation products and services to.

The PMA community through MARPA for example has come together to work more diligently on ensuring the integrity of their industry and products. Various air carriers have actually entered into business agreements with PMA holders to procure a source of less costly high quality spare parts and participate in the oversight of those PMA part sources from a business liability standpoint.

LEGAL INTERPRETATIONS AND PRIOR FAA POSITIONS;

The AVS RAF Team found the relevant legal interpretations and past case law relatively consistent regarding repair alteration and overhaul of aviation products. There were two exceptions.

Many years ago FAA attempted to establish what percentage of a part could be repaired or fabricated before it was necessary to get a PMA. Percentages from 2% to 50% by volume or weight were kicked around but were never able to be defended. The logic always broke down because there has been a long standing practice of FAA allowing complete fabrication of parts during maintenance, during accomplishment of STCs, and as owner produced parts in the field without PMA. The FAA's perspective has been that such cases were acceptable if safety and compliance are preserved

through the data approval and quality control of its performance; **and** that someone is not intentionally violating the "for sale for installation on" clause of 14 CFR 21.303, Replacement and modification parts. The intent of the regulations governing maintenance is to return the article to at least its original or properly altered condition. There is no consideration given to percentage of damage, only that the result of the repair must be airworthy meaning it must conform to the approved data and be safe for operation. The financial aspects of determining whether a part should or should not be repaired, should not be of the FAA's concern.

The Statutory law authorizes the FAA to regulate in the interest of **safety** and not economics. The law does not state that FAA's functions include the determination of economic burdens when deciding whether to repair a part versus replacing it with a completely new part. It is FAA's function to decide the safety criticality of our judgments and actions. This was one of the tenants behind authorizing owner produced parts as long as such parts are shown to comply with the applicable regulations and the design and fabrication performance data are FAA approved.

The second area the team noted was the use of "acceptable data" for minor repairs and minor alterations. Case law shows that if FAA disagrees with a maintenance provider's determination of major/minor and the acceptability of data for minors; it falls upon the FAA to prove the unacceptability of the determination and the related data. The teams study concluded that FAA has not been successful in doing so in the past.

GLOBAL ENVIRONMENT INFORMATION;

The team considered bilateral agreement developments such as those currently underway with the EU/EASA regarding repair data acceptance and comparable EASA regulations and definitions such as major/minor and critical parts.

The team studied articles and industry material relating to TC/PC holders diversifying into the maintenance and replacement parts business as well as the independent repair stations and PMA holders teaming with owners/operators.

The globalization of the aviation industry makes it imperative that FAA address the issue that U.S. PMAs, STCs and non-TC/PC holder repairs and alterations are perceived as not having adequate or comparable integrity and consistency as TC/PC holder developed equivalent approvals. EASA for example has taken actual rule and policy steps to require linkage to the TC/PC holder for certain types of approvals. They did that for two reasons. One is that their agency is not staffed to handle a high volume of complex repair, alteration and replacement parts approvals. Secondly, they have taken the position that they do not have enough data, and that the data and expertise they would need to make such approvals is mostly intellectual property

which resides with the TC/PC holder. In the U.S. economic and political system it would be virtually impossible to promulgate similar requirements which have the effect of restraining free commerce and stifling innovation unless there was a very compelling safety need. This also highlights a basic difference between FAA and other authorities in assigning responsibility for continued operational safety which is more oriented to the owner/operator in the U.S. system. Also, in today's global technology it is easily possible for an applicant with the means and desire to develop the necessary analyses, test techniques, data, and compliance showings to be granted an approval. Hence, it is not logical in the U.S. aviation system and business culture to regulate away that option.

Part of this perception that non-TC/PC holders are not held to the same level of integrity from both a design and a regulatory compliance standpoint is driven by a.) The myriad of ways that data can be approved by FAA or our designees and b.) The practice that has grown up of approving data for minor repairs and minor alterations because the recipient just wants it to be approved incase someone (FAA or another authority) questions whether it was really minor versus major.

AVS REPAIR, ALTERATION AND FABRICATION TEAM STUDY
APPENDIX B: ALTERNATIVES EVALUATION PROCESS

DEVELOPMENT AND EVALUATION OF ALTERNATIVES

Two of the issues initially addressed by the AVS RAF Team in phase two of the project were how to develop and then evaluate an appropriate range of alternative concepts. The team did not believe that evaluating alternatives would be simple because of the complexity of the issues and the wide range of orders, advisory circulars and other policy documents involved. Instead, the group decided to develop an approach using certain guiding principles and evaluation criteria which would guide the development of various alternatives that would minimize the amount of change while providing an acceptable level of continued airworthiness and providing maximum flexibility for the industry stakeholders. It was concluded by the team that ending resolution would likely not satisfy all stakeholders but will be an equitable compromise of the stakeholders' interests while protecting safety.

GUIDING PRINCIPLES

Based on the data analyzed in phase one of the effort and the AVS RAF Team's general understanding of business process reengineering, the team determined that guiding principles should be kept in mind when developing alternatives. The team concentrated on the stakeholders' needs from their perspective and balanced those needs in the interest of:

1. Safety, including compliance,
2. Customer service and cost impact,
3. FAA business efficiency and standardization

That would include addressing:

- Inappropriate and conflicting rules and policies,
- The need for major stakeholders from large aircraft manufacturers to smaller stakeholders to receive equal treatment in the certification process for comparable type of products; and
- Improvements to the quality of communication and cooperation between offices across AVS and within AIR and AFS lines.
- Making the best use of AVS resources by focusing on areas of highest risk first
- Improving the use and oversight of designees and delegated organizations.

- Improving the education of FAA employees, applicants, and designees on rules, policies, and best practices of how the approval process works, facilitating the certification process for applicants, and working in partnership with industry to reduce confusion and conflict.

- Development of critical thinking skills in technical staff to enable them to appropriately apply rules and policy in a flexible manner without compromising safety or compliance with regulations.

- Development of a common understanding of safety and criticality

The team then developed a list of issues, determined which of the initial research results they could agree on, and then combined the results with the logical groupings that were used during the research phase. This was preceded by a stakeholder analysis documented earlier in this report. The results of the team's deliberations over that data and stakeholder information resulted in the team's conclusions which were followed by the development of alternative courses of action.

DEFINING THE ALTERNATIVES

Alternative courses of action were developed based on two factors:

1.) What gaps in the current rules, policies, and practices did the team see which could be addressed to improve the integrity and safety of repairs, alterations, fabrications and PMAs that the FAA approves, and

2.) What recommendations of merit and what objections were put forward by the various stakeholders.

The AVS RAF Team's conclusions noted earlier in this report were considered relative to each of the two above factors in order to assist in developing the key assumptions and the potential impacts for each of the seven alternatives below:

THE ALTERNATIVES

ALTERNATIVE 1:

WHAT IS THE ALTERNATIVE?

Maintain the current regulatory and policy structure which permits:

- Fabrication of parts during maintenance of higher level assemblies and sub-assemblies.

- Fabrication of Owner Produced Parts.
- Repairs to parts of any extent that restores it, short of 100% fabrication, and which the applicant determines is more economic than purchasing or fabricating a complete new part.
- Altering parts under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration, regardless of criticality to any extent which does not constitute a major change to the type design which would require an STC.
- STC of major changes to the type design regardless of criticality
- PMA of parts regardless of criticality provided they do not constitute a major change to the type design

RATIONALE FOR THE ALTERNATIVE:

This alternative would require minimal rule changes and policy revisions most of which can be effected through current initiatives such as the AVS SMS programs and the 14 CFRs 21, Certification procedures for products and parts, and 45, Identification and registration marking, rulemaking activity, as well as the ODA and CDO initiatives, to improve and disseminate requirements.

This alternative would not adversely affect the balance of commerce and competition that will provide owners/operators with more sources for parts and maintenance. That healthy competition will result in lower costs and higher reliability parts and services as companies compete for market shares.

FAA can evaluate the impacts and benefits of this over time and if appropriate relax these requirements or conversely develop more stringent controls such as those proposed in the other alternatives via rule making.

KEY ASSUMPTIONS:

FAA will take actions to:

- Clarify and reinforce rules and policy to insure the integrity of compliance findings and approvals, and to improve standardization, communication, and consensus building of requirements.
- Include an assessment by FAA and/or its designees of any submittal for data approval to determine that it is properly classified as a repair or alteration or whether it is a major change to the type design warranting an STC.

- Control the safety and integrity through the data approvals which will include process and procedural specifications for performing the repairs, alterations and fabrications.

- Improve the alignment of quality control requirements across AVS approval holders.

- Address the consistency of part marking for repairs, alterations, fabrication (including Owner produced parts) and PMA.

- Improve the credibility and global acceptability of FAA approved repairs, alterations, fabrications and PMA approvals

IMPACT ON INDUSTRY:

Public: Negligible direct impact but should improve their perception of safety and help reduce ticket prices.

Air Carriers: Minimal impact because the owners/operators retain their flexibility to find best cost and most reliable maintenance services and replacement parts to fit their program needs. However, the need for improving the consistency of major/minor repair and alteration determinations and compliance data development may cause some previously minor classifications to become major and require FAA approval

General Aviation (Private, Non-Commercial Owners/Operators): Negligible impact.

Leasing Companies: Negligible impact. As the owner they can continue to control what parts and maintenance services they desire for their aircraft.

TC/PC Holders: Negligible impact but they will likely continue to express concerns and rally around any repairs, alterations, or PMAs they believe look questionable or which encounter service difficulties.

STC Holders: Negligible impact.

Independent PMA Holders: Negligible impact.

TC/PC Holder Owned or Supported PMA Holders: Negligible impact.

Independent Repair Stations: Negligible impact.

TC/PC Holder Owned Repair Stations: Negligible impact.

IMPACT ON AIRWORTHINESS AUTHORITIES:

FAA: Initial and ongoing additional workload to accomplish those actions listed in the Key Assumptions section above.

Other Airworthiness Authorities: Minimal impact, but the actions should improve other authorities' confidence in the integrity of FAA approvals.

ALTERNATIVE 2:

WHAT IS THE ALTERNATIVE?

Alternative 1 plus the requirement that ALL repairs, fabrications, and alterations to any extent on critical parts are automatically defined as a major repairs or alterations.

RATIONALE FOR THE ALTERNATIVE:

This would facilitate FAA's increased oversight of compliance data for all critical parts and ensure that no inappropriate work was being accomplished on such parts because it was misclassified as minor.

FAA can evaluate the impacts and benefits of this over time and if appropriate relax these requirements or conversely develop more stringent controls such as those proposed in the other alternatives via rule making.

KEY ASSUMPTIONS:

As in Alternative 1 above plus the FAA will need to:

- Clarify and reinforce the definition of critical parts.
- Retain AC 43-18, Fabrication of aircraft parts by maintenance personnel guidance that fabrication during maintenance of any Category Parts List (CPL) Categories 1 or 2 parts are major repairs or alterations.

IMPACT ON INDUSTRY:

This alternative trumps the major/minor repair and alteration determination regulatory authority of owners/operators and maintenance providers under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration for certain parts. However, it is not notably inconsistent with major/minor repair and alteration determination and some of today's related FAA policy such as guidance for FAA airworthiness inspectors in the Flight Standards Information Management System

(FSIMS) Order 8900.1. The team estimates that the population of parts involved and the additional number of submittals for those affected parts this would generate is minimal. It would however increase the number of submittals and the elapsed time for data approval for all stakeholders (TC/PC holders' included) who are developing repairs, alterations, fabrications on critical parts.

Public: Negligible direct impact but should improve their perception of safety and help reduce ticket prices.

Air Carriers: Minimal impact since the owners/operators will retain their flexibility to find best cost and most reliable maintenance services and replacement parts to fit their program needs. However, the need for improving the consistency of major/minor repair and alteration determinations and compliance data development may cause some previously minor repair/alteration classifications to become major and require FAA approval

General Aviation (Private, Non-Commercial Owners/Operators): Negligible impact.

Leasing Companies: Negligible impact. As the owner they can continue to control what parts and maintenance services they desire to purchase for their aircraft.

TC/PC Holders: Negligible impact but they will likely continue to express concerns and rally around any repairs, alterations, or PMAs they believe look questionable or which encounter service difficulties. This alternative still doesn't fully address their concern that even the FAA doesn't know enough about critical parts to issue such approvals.

STC Holders: Negligible impact.

Independent PMA Holders: Negligible impact.

TC/PC Holder Owned or Supported PMA Holders: Negligible impact.

Independent Repair Stations: Negligible impact.

TC/PC Holder Owned Repair Stations: Negligible impact.

IMPACT ON AIRWORTHINESS AUTHORITIES:

FAA: Initial and ongoing additional workload accomplish those actions listed in the Key Assumptions section and the additional submittals for data approval.

Other Airworthiness Authorities: Minimal impact.

ALTERNATIVE 3:

WHAT IS THE ALTERNATIVE?

Eliminate extensive repairs of the type called "sliver repairs" by establishing a threshold of how much of a part can be repaired even though economically it may be feasible to go further with a repair rather than replace the part.

RATIONALE FOR THE ALTERNATIVE:

The label "sliver repair" has become synonymous with a perceived intent to circumvent obtaining a PMA or with someone trying to fabricate a part during maintenance without having to return a higher level assembly as addressed in AC 43-18, Fabrication of aircraft parts by maintenance personnel. This has been largely unjustified and there is no evidence that entities are knowingly trying to fabricate large quantities of parts for sale under the guise of a repair. Since the FAA has been unsuccessful in the past at proving such intent, this alternative would reduce the likelihood of an applicant intentionally trying to make an alteration, fabrication, or a PMA look like a repair.

KEY ASSUMPTIONS:

Repairs to parts of any extent that restores it, short of 100% fabrication, when the applicant determines it is more economic to repair rather than to purchase or fabricate a complete new part, would no longer be permitted.

FAA would need to establish criteria for how to determine the maximum allowable extent of repair whether that is percentage of the part by weight or volume, or some part performance based criteria. This in effect requires that the FAA set allowable amounts of damage for parts beyond which they must be scrapped and a new replacement parts purchased. Also, note that 14 CFR 43.13(b), Performance rules (general), does not address the extent of damage that may or may not be repaired versus replaced. A rule change would be necessary to mandate when the FAA feels something is beyond economical repair which will likely vary part-to-part. How this would be achieved is purely a financial consideration and not an airworthiness consideration.

A repair, regardless of its extent, still has to show compliance to the applicable airworthiness standards, and be safe for operation.

APPENDIX B: ALTERNATIVES EVALUATION PROCESS

The FAA needs to take actions that improve the credibility and acceptability of FAA approved PMAs, repairs, alterations and STCs around the world both with other airworthiness authorities and with non-U.S. industry.

TC/PC holders will be subject to the same restrictions limiting the extent of repair that can be made to a part.

Logic dictates that it will appear inconsistent to not permit extensive repairs, or to force applicants' for such repairs to obtain a PMA, and yet still allow:

- Fabrication of parts during maintenance of higher level assemblies and sub-assemblies pursuant to AC 43-18, Fabrication of aircraft parts by maintenance personnel,
- Fabrication of Owner Produced Parts,
- Major alterations of parts to an extent greater than the allowable repair threshold without getting a PMA or STC. i.e.; this alternative could just create "sliver alterations" as another means to do the same thing if someone is really trying to circumvent PMA, and
- TC/PC holders to accomplish more extensive repairs than everyone else even if they issue them as design changes to be performed as alterations and not as repairs in the ICA.

IMPACT ON INDUSTRY:

Public: Negligible

Air Carriers: Negligible if the repair developers just get an approval by another means (alteration or PMA) since most such repairs are all major and go through an FAA data approval process already. This also assumes that their ability to fabricate parts during maintenance or as an owner produced part is not affected.

General Aviation (Private, Non-Commercial Owners/Operators): Negligible if the repair developers just get an approval by another means (alteration or PMA) since most such repairs are all major and go through an FAA data approval process already. This also assumes that their ability to fabricate parts during maintenance or as an owner produced part is not affected.

Leasing Companies: Negligible if the repair developers just get an approval by another means (alteration or PMA) since most such repairs are all major and go through an FAA data approval process already.

TC/PC Holders: Since they will be held to the same repairable threshold limits they will likely process those that are beyond the threshold limits as design changes and not as repairs, and also not put them in the repair section of the ICAs.

STC Holders: Negligible

Independent PMA Holders: Negligible

TC/PC Holder Owned or Supported PMA Holders: Negligible

Independent Repair Stations: Negligible if the repair developers just get an approval by another means (alteration or PMA) since most such repairs are all major and go through an FAA data approval process already. This also assumes that their ability to fabricate parts during maintenance or to support an owner produced part is not affected.

TC/PC Holder Owned Repair Stations: Negligible if the repair developers just get an approval by another means (alteration or PMA) since most such repairs are all major and go through an FAA data approval process already. This also assumes that their ability to fabricate parts during maintenance or as an owner produced part is not affected.

IMPACT ON AIRWORTHINESS AUTHORITIES:

FAA: Negligible

Other Airworthiness Authorities: Could be a substantial impact. Those authorities will have to accept and validate PMAs or major alterations that were formerly or still are in their determination, repairs. The FAA also would not be able to accept repairs from other countries that exceed the allowable repair threshold limits.

ALTERNATIVE 4:

WHAT IS THE ALTERNATIVE?

Eliminate all fabrication of parts during maintenance without obtaining a PMA including:

- Fabrication of parts during maintenance of higher level assemblies and sub-assemblies,
- Fabrication of Owner Produced Parts, and

- Fabrication of parts when accomplishing an STC.

RATIONALE FOR THE ALTERNATIVE:

This would ensure that anyone accomplishing such fabrications would not only go through a consistent data approval process but would also need to have a fabrication quality inspection system (FQIS) in place to accomplish the fabrications under the PMA and be subject to MIDO certificate management oversight.

KEY ASSUMPTIONS:

PMA of such fabrications would need to be broadly type design compatible and not owner/operator unique designs or custom fit parts because a PMA has certain fleet-wide type design installation eligibility requirements.

IMPACT ON INDUSTRY:

Public: Negligible

Air Carriers: Could be some impact for one-off or custom-fit type fabrications but would not be significant where they need to fabricate multiple parts with eligibility across the aircraft type design.

General Aviation (Private, Non-Commercial Owners/Operators): Could be significant impact because in GA fabrications are more often for one-off or custom-fit type fabrications. It would not be significant where they need to fabricate multiple parts with eligibility across an aircraft type design. Such fabrications are often done by A&P mechanics and could not meet the FQIS quality system requirements for producing multiples of the parts.

Leasing Companies: Negligible

TC/PC Holders: Negligible

STC Holders: Could be an impact to STC holders who are fabricating during maintenance when accomplishing the STC alteration in their repair station or DAS and would now need a PMA and an FQIS.

Independent PMA Holders: Negligible

TC/PC Holder Owned or Supported PMA Holders: Negligible

Independent Repair Stations: Negligible assuming their fabrication design data approval and existing quality system could easily be translated into a PMA.

TC/PC Holder Owned Repair Stations: Negligible assuming their fabrication design data approval and existing quality system could easily be translated into a PMA.

IMPACT ON AIRWORTHINESS AUTHORITIES:

FAA: Increase in PMAs to be processed and overseen. This could be substantial especially for GA applications.

Other Airworthiness Authorities: Negligible. They would likely welcome the increased consistency and visibility provided by all fabrications being a PMA.

ALTERNATIVE 5:

WHAT IS THE ALTERNATIVE?

Require a new TC or a STC for any [product] fitted with non-TC/PC holder developed repairs, [alterations] or PMA on critical parts. *[This Alternative was proposed by a TC/PC holder]*

RATIONALE FOR THE ALTERNATIVE:

This is based on the TC/PC holder's assumption that:

a.) An STC requires a higher level of compliance than a PMA or repairs and alterations. i.e.; that all of the same compliance showing requirements (tests and analyses) that were done for the original TC will be re-done for the STC or the new TC,

b.) it would relieve the original TC/PC holder of any obligations for the remaining parts of the product that were originally manufactured by them, and

c.) it would make the original TC/PC holders ICAs no longer applicable to the product

The AVS RAF Team considers all of these assumptions to be erroneous without major changes to today's regulations. It is unlikely that the aftermarket community would be willing to accept full and complete responsibility for a product just because they accomplished a repair, alteration or PMA of a critical part or parts in the larger product.

KEY ASSUMPTIONS:

FAA will need to:

- Reach clear consensus with industry as to what constitutes "safety critical" parts since there is much more at stake economically in this alternative. The TC/PC holder's definition presented with their recommendation is currently different and more encompassing than the FAA's.

- Change rules and policy to permit non-TC/PC holder developed repairs, alterations and PMAs to be approved via STC since applicants who can no longer get repair, alteration, or PMA Test & Computation data approvals will be looking for another avenue to get an approval.

- Get FCAAs to accept FAA STCs for export that are actually repairs, alterations or replacement parts and are not major changes to the type design under 14 CFR 21.93, Classification of changes in type design, and

- Conduct rulemaking to transfer total responsibility to a new TC holder if we required a new TC for a product that incorporates a non-TC/PC holder developed repairs or PMA of a critical part.

IMPACT ON INDUSTRY:

Public: Negligible impact if non-TC/PC holders are able to obtain STCs for repairs and alterations they develop, otherwise the increase operating costs of owners/operators would be passed on in ticket costs.

Public perception of safety may be slightly improved, but their perception that FAA (government) is in bed with big industry would be confirmed.

Air Carriers: Costs would increase due to less competition on high cost critical parts and due to recordkeeping and other requirements for STCs. They would lose the ability to fabricate certain owner produced parts. Also, they would be heavily impacted by the original TC/PC holder walking away from any further support for the product, its warranty, the ICAs, and maintenance. They may feel compelled to only buy original TC/PC holder repairs and parts in order to avoid fragmentation of their fleet from a product support standpoint.

General Aviation (Private, Non-Commercial Owners/Operators): Costs would increase due to less competition on high cost critical parts and due to recordkeeping requirements for STCs. They would no longer be able to locally fabricate certain parts and would be more dependent on TC/PC holders some of whom are no longer in business today.

Leasing Companies: Costs would increase due to less competition on high cost critical parts and due to recordkeeping requirements for STCs.

TC/PC Holders: They would gain additional sales of repairs, alterations, and replacement parts. Their customers would demand more product support to develop data and approvals and to supply parts.

STC Holders: Existing STC holders have negligible impact but there would be a proliferation of new STCs or of TCs that were formerly approved as repairs, alterations or PMAs.

Independent PMA Holders: Would have to apply for STCs or perhaps even a TC on products with their critical parts in them. It is likely that they would not be able to or be willing to do so.

TC/PC Holder Owned or Supported PMA Holders: They would likely gain additional sales due to owner operators' not wanting to jeopardize their product support and warranties.

Independent Repair Stations: Repair and alteration development on critical parts would become uneconomic. Fabrication of certain parts would no longer be permitted.

TC/PC Holder Owned Repair Stations: Would realize increased business on their own product lines as TC/PC holders funnel data approvals directly to their own repair stations. However, they would lose other business because they would be unable to develop repairs, alterations and PMAs on other TC/PC holders' product lines without getting an STC.

IMPACT ON AIRWORTHINESS AUTHORITIES:

FAA: The impact of implementing this Alternative has substantial regulatory implications unless a clear case can be made in the interest of safety. i.e.; substantiation that non-TC/PC holder developed designs for repairs, alterations and PMAs are less safe than those of TC/PC holders.

Other Airworthiness Authorities: The ramifications are substantial for FAA not accepting foreign non-TC/PC holder repairs, alterations, and replacement parts or for if the FAA has to issue an STC to validate those submittals. Also, there would be substantial international impact if original TC/PC holders were permitted to walk away from any culpability in the product they originally manufactured.

ALTERNATIVE 6:

WHAT IS THE ALTERNATIVE?

Do not permit any non-TC/PC holder developed repairs, alterations, fabrications, and PMA on "safety critical" parts except for PMA identicality by license agreement and STC. *[This Alternative was proposed by a TC/PC holder]*

RATIONALE FOR THE ALTERNATIVE:

This is based on the TC/PC holder's belief that:

a.) no one but the TC holder has sufficient data, understanding of the product as a complete system, understanding of the compliance showings, and corporate developmental knowledge to deal with such critical and complex parts, and

b.) an STC requires a higher level of compliance than a PMA or repairs and alterations. i.e.; that all of the same compliance showing requirements (tests and analyses) that were done for the original TC will be re-done for the STC.

The AVS RAF Team considers these assumptions to be erroneous.

KEY ASSUMPTIONS:

FAA will need to reach clear consensus with Industry regarding what constitutes "safety critical" parts since there is much more at stake economically in this Alternative. The TC/PC holder's definition is currently more encompassing than FAA's.

TC/PC holders will be subject to the same restrictions.

Unless the FAA is willing to permanently exclude all but the TC/PC holder from repairing, altering, fabricating and manufacturing certain critical parts; the FAA will need to:

- Change rules and policy to require non-TC/PC holder developed repairs, alterations and PMAs of critical parts to be approved by STC since applicants who could no longer get repair, alteration, fabrication or PMA Test & Computation data approvals, and

- Get FCAAs to accept FAA STCs for export that are actually repairs, alterations or replacement parts but are not major changes to the type design under 14 CFR 21.93, Classification of changes in type design.

IMPACT ON INDUSTRY:

Public: Negligible impact if non-TC/PC holders are able to obtain STCs for repairs and alterations they develop, otherwise the increase operating costs of owners/operators would be passed on in ticket costs. The public perception of safety may be slightly improved, but their perception that FAA (government) is in bed with big industry would be confirmed.

Air Carriers: Costs would increase due to less competition on high cost critical parts and due to recordkeeping and other requirements for STCs. They would lose the ability to fabricate certain owner produced parts.

General Aviation (Private, Non-Commercial Owners/Operators): Costs would increase due to less competition on high cost critical parts and due to recordkeeping requirements for STCs. They would no longer be able to locally fabricate certain parts and would be more dependent on TC/PC holders some of whom are no longer in business today.

Leasing Companies: Costs would increase due to less competition on high cost critical parts and due to recordkeeping requirements for STCs.

TC/PC Holders: They would gain additional sales of repairs, alterations, and replacement parts. Their customers would demand more product support to develop data and approvals and to supply parts.

STC Holders: Existing STC holders have negligible impact but there would be a proliferation of new STCs that were formerly approved as repairs, alterations or PMAs.

Independent PMA Holders: Would have to apply for STCs on critical parts.

TC/PC Holder Owned or Supported PMA Holders: They would likely gain additional sales due to reduced competition from after market companies.

Independent Repair Stations: Repair and alteration development on critical parts would become uneconomic. Fabrication of certain parts would no longer be permitted.

TC/PC Holder Owned Repair Stations: Would realize increased business on their own product lines as TC/PC holders funnel data approvals directly to their own repair stations. However, they would lose other business because they would be unable to develop repairs, alterations and PMAs on other TC/PC holders' product lines without getting an STC.

IMPACT ON AIRWORTHINESS AUTHORITIES:

FAA: The impact of implementing this Alternative from a political and rulemaking standpoint is substantial unless a clear case can be made in the interest of safety. i.e.; substantiation that non-TC/PC holder developed designs for repairs, alterations and PMAs are less safe than those of TC/PC holders.

Other Airworthiness Authorities: The political ramifications are substantial for FAA not accepting foreign non-TC/PC holder developed repairs, alterations, and replacement parts or if FAA must issue an STC to validate those submittals.

ALTERNATIVE 7:

WHAT IS THE ALTERNATIVE?

In addition to any of the above alternatives; minimize the number of forms that a FAA data approval takes such as creating a single FAA Form, electronically archived, that would be required to be used by FAA employees or any designees for executing FAA data approvals.

RATIONALE FOR THE ALTERNATIVE:

As noted in CONCLUSION 9 of this study, the lack of clarity, awareness, and ability to locate FAA data approvals has added to the confusion around post TC continued operational safety management of products and approvals. Other airworthiness authorities have also expressed concern over the variety of forms FAA approvals take and the apparent lack of documentation consistency. Over the years the FAA has worked to standardize evidence of approvals for certain delegations like DERs using FAA Form 8110-3 but has not done so for all approval types. The ability to evidence all FAA data approvals through a standardized means that is electronically archived and available to be searched and overseen by FAA personnel would be of great benefit to FAA and other airworthiness authorities.

KEY ASSUMPTIONS:

- The FAA can leverage the existing AVS Electronic File Service (EFS) portion of the SMART automation integration initiative. The AVS RAF Team is aware of past cases where FAA approvals could not be located and the FAA had to go to the companies and designees to retrieve copies.

- This recommendation would need to consider how to replace or align existing Form 337, designee and delegated organization forms and issue appropriate policy to define allowable form s for data approval.

- The EASA transition model should be looked at as a means to grandfather the acceptance and re-identification of existing and past data approvals.

IMPACT ON INDUSTRY:

TC/PC Holders, STC Holders, General Aviation, and Air Carriers: Negligible since existing designee and delegated organization approval FAA Forms could be used in conjunction with, or replaced by, a new single FAA Form to be used by FAA personnel and all delegations.

Public, Leasing Companies, Independent PMA Holders, TC/PC Holder owned or supported PMA Holders, Independent Repair Stations, and TC/PC Holder Owned Repair Stations: Negligible.

IMPACT ON AIRWORTHINESS AUTHORITIES:

FAA: Negligible, existing FAA approvals such as letters, e-mails, etc. would be replaced with a new single FAA Form to be used by all FAA personnel executing FAA approvals of data.

Other Airworthiness Authorities: Would welcome improved consistency in the evidence of FAA approvals being exported to their countries. e.g.; Similar to the JAA and EASA Form 1 approvals.

EVALUATION AND SELECTION OF THE ALTERNATIVES:

OVERVIEW OF THE EVALUATION

Before considering the alternatives, it is important to briefly review key assumptions AVS RAF Team agreed on regarding the global operating environment trends, work processes and cultural issues which affect the development and evaluation of potential solutions. Both FAA and Industry must deal with these pressures in a balanced and fair way. The AVS RAF Team made the following assumptions that impact all the alternatives considered:

- Overall demands for safe products, services and certification products will increase because of rising pressures for both real and perceived safety improvements.

- The trend toward globalization of the aviation industry will continue and result in an increased demand for international services. This is inexorably linked to the need for freer flow and acceptance of repair and alteration data and parts.

- Competition in the global aviation industry will continue to increase due to competition from international maintenance providers and manufacturers. This will create the demand for more timely and responsive rulemaking and certification services, such as approvals, from the FAA.

- Solutions need to:

    1. Allow maximum flexibility, and minimum cost to industry while maintaining an acceptable level of continued airworthiness (real and perceived) for the flying public.

    2. Maintain a consistent level of repair, alteration, and PMA design data certitude, including assessment of system effects on the products. It must be emphasized that a "comparable level of certitude" does not mean that the same compliance methods must be repeated or are applicable in every case. The current rules and policy do not require that. The compliance method although it may be different must show that the certification basis of the product is not invalidated and that an unsafe condition is not introduced. The objective of the FAA when making approvals, based in current rules and policy, is to achieve an acceptable level of continued airworthiness even though the acceptable methods of showing compliance vary depending upon the type of approval being sought and the criticality and scope of the repair, alteration, PMA or design change (i.e.; a TC holder's design change or an STC).

    3. Maintain a consistent level of quality system and process specification control for repairs, alterations, fabrication, and production of like parts.

COMMON STRENGTHS

The AVS RAF Team members identified a set of specific business process and cultural changes factors that affect any alternatives and AVS's ability to meet the challenges posed by the future environment. It is assumed that all alternatives will require greater emphasis on, or increased use of, the following:

- Delegation and designee management;

- The ability to transition to, and be compatible with, ODA and CDO systems engineering approaches;

- AVS Engineers and Inspectors will be trained in an integrated way and be empowered to work in a standardized, cooperative fashion when overseeing and/or performing approvals of repairs and alterations;

- AVS and specifically AIR and AFS need to move closer to a common understanding and application of safety management systems as a tool. This includes moving towards:

    1. A more consistent understanding and use of risk analysis methods/processes
    2. Agreement on what is or is not a risk to safety within the each organization's respective areas of responsibility including what constitutes critical parts and components,
    3. Increased standardization of terminology, and
    4. Increased consistency and traceability in processing FAA approvals,

- Employees who are empowered and trained to think critically and systemically with regards to rulemaking and policy development so that in the future we do not recreate conflicting policy nor make decisions and give stakeholders conflicting answers or approvals.

- Automation as a means of efficiently developing and sharing a central repository of corporate knowledge accessible to all AVS employees and stakeholders; and for more efficiently communicating and exchanging data with external stakeholders;

COMMON WEAKNESSES

There were certain common weaknesses through some of the alternatives which were that the alternative(s):

- Would require substantial regulatory and policy restructuring that in some cases would put FAA out of alignment with other airworthiness authorities around the world with whom we have done much work in the past to harmonize definitions and requirements.

- Would stifle commercial competition by creating an un-level playing field that favors the TC/PC holders thus having a notable negative impact on

owners/operators and aftermarket companies seeking to develop repairs, alterations or replacement parts.

- Assumed that no one but the TC/PC holder, including the FAA, knows enough about a type certificated product to be able to develop safe repairs, alterations, and replacement parts and provide an adequate level of consistency, certitude, and oversight of approvals granted for safety critical complex parts.

- Were based on a perception that many unscrupulous stakeholders are intentionally trying to circumvent or manipulate regulations and policy to avoid obtaining a PMA or STC approval, and

- Were not supported by any substantive evidence or data of a systemic threat to safety or that the alternative would have a substantive beneficial effect on safety.

ALTERNATIVES SELECTION

Based on the above, Alternatives 1, 2 and 7 were identified as the most viable. The AVS RAF team also determined that other alternatives, or portions of each, were not necessarily ruled out. Periodic evaluations of the progress should be conducted on any actions taken as a result of this study. Based on the findings of those evaluations some of the more aggressive alternatives could be reconsidered in the future if necessary. In light of the AVS RAF Team's conclusions and assessment of the alternatives, the AVS RAF Team's recommendations documented earlier in this report were developed.

end

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
A		
Accident	An unplanned event or series of events resulting in death, injury, occupational illness, or damage to or loss of equipment or property, or damage to the environment.	AVS Doctrine
Accident	An unplanned event or series of events that results in death, injury, or damage to, or loss of, equipment or property.	JPDO SMS Standard v1 12/15/06
Accident Precursor	A condition or combination of conditions that precedes and signals the potential occurrence of an event.	AIR SMS Operational Overview Document
ACO	Aircraft Certification Office	
ACSEP	Aircraft Certification Systems Evaluation Program	
Actor	The entity that performs the activity (uses the tool). May be a person, organization (e.g. AIR-100), or a system (e.g., CMIS)	AIR SMS Operational Overview Document
AD	Airworthiness Directive	
AEG	Aircraft Evaluation Group	
AFS	Flight Standards Service	
AGC	Office of General Counsel	
AIR	Aircraft Certification Service	
Air Transportation System	The entirety of the aviation system, including the FAA; entities that design, manufacture, or operate aircraft or components of aircraft; training entities; people; infrastructure; and other systems and subsystems.	AVS Doctrine

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Term, Acronym, Phrase	Definition	Source
Aircraft Accident	An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and until such time as all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage	AVS Doctrine
Aircraft Accident	An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and until such time as all such persons have disembarked, and in which any person (including those on the ground injured as a result of the essential operation of the flight) suffers death or serious injury, or in which the aircraft receives substantial damage. This definition excludes maintenance, ramp positioning and ground personnel movement, unless injuries are a direct result of the aircraft's action or malfunction.	Risk Analysis Specification v7.0 10/11/06
Aircraft Incident	An occurrence other than an accident, associated with the operation of an aircraft, that affects or could affect the safety of operations	AVS Doctrine Risk Analysis Specification v7.0 10/11/06
Alteration	The modification of a product or appliance from one configuration to another airworthy configuration using accepted or approved alteration data as appropriate, including data approved under 14 CFR 21 for type design changes.	14 CFRs 1.1 and 43
Analysis	The process of identifying a question or issue to be addressed, examining the issue, investigating the results, interpreting the results, and possibly making a recommendation. Analysis typically involves using scientific or mathematical methods for evaluation.	JPDO SMS Standard v1 12/15/06
ASE	Aviation Safety Engineer	

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Term, Acronym, Phrase	Definition	Source
ASI	Aviation Safety Inspector	
Assess	Reviewing and comparing for accuracy or validity	AIR SMS Operational Overview Document
Assessment	Process of measuring or judging the value or level of something.	JPDO SMS Standard v1 12/15/06
Asset	An item of significance to the FAA, or other party within the aviation community, that may be owned, managed, physically located, provide a service, require maintenance and/or preservation, monitored, and/or monetarily assessed.	AIR SMS Operational Overview Document
Audit	A scheduled or unscheduled review of an organization's operations to determine the level of compliance with established standards or protocols	AVS Doctrine
Audit	Formal reviews and verifications to evaluate conformity with policy, standards, and contractual requirements. Internal audit – an audit conducted by, or on behalf of, the organization being audited. External audit – an audit conducted by an entity outside of the organization being audited.	JPDO SMS Standard v1 12/15/06
Automated System	Mechanized actor performing an activity (i.e. CMIS)	AIR SMS Operational Overview Document
Aviation System	The set of organizations, regulations, designs, manufacturing, operations, maintenance, oversight and environment in which aircraft are operated.	AIR SMS Operational Overview Document
AVS	Office of Aviation Safety	
B		

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Business Architecture	A set of blueprints that define the AIR SMS and thereby guide the structure and operation of AIR. It is a tool which can be used to determine how AIR can most effectively and efficiently achieve its' current and future objectives. It is also the discipline of monitoring the As-Is (i.e., current state), defining the To-Be (i.e., future state), and developing the transition plan that accounts for the people, processes, information, services, and technology required to implement the plan.	AIR SMS Operational Overview Document
Business Rule	Guidance that there is an obligation concerning conduct, action, practice, or procedure within a particular activity or sphere. A declaration of policy or condition that must be satisfied within the business.	AIR SMS Operational Overview Document
C		
Causes	Underlying circumstances or occurrences that contribute to, directly cause, or indirectly cause, the event. For example: recent changes to operating environment that conflict with training; material defect; improper or inadequate monitoring; convective weather. Note the relationship to hazard, in that causes are those hazards that were manifested in a particular event.	Risk Analysis Specification v7.0 10/11/06
Certificate Management	A discretionary audit method by which the FAA monitors a design and/or production approval holder's continued compliance with those pertinent regulations that govern the design control and manufacturing of its particular products or parts thereof.	AIR SMS Operational Overview Document
Certification	FAA process for approving an applicant's showing of compliance. The approval aspect of D&PA.	AIR SMS Operational Overview Document

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Term, Acronym, Phrase	Definition	Source
CDO	Certified Design Organization - An organization that has been selected, examined, and certified by the Administrator to have an enhanced system of engineering design and testing capabilities controlled by appropriate processes and safeguards to ensure design compliance with specific airworthiness standards.	AIR SMS Operational Overview Document
CFR	Code of Federal Regulations	
Change	Change is the essence of continual improvement by defining, refining, and adapting the organization's business processes and systems in the context of an ever-changing environment. It is not an external event that is imposed on an organization or individual.	AIR SMS Operational Overview Document

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Term, Acronym, Phrase	Definition	Source
Change Leadership	Application of actions, skills and behaviors in order to achieve successful and lasting change via a leadership framework. Leadership in this context however is not the sole responsibility of the "management." Successful change is accomplished and sustained by cultivating a network of leaders at all levels of the organization who share a common vision, commitment and passion for achieving the desired outcomes. The framework must provide: Clearly defined and understood roles and responsibilities, authority and accountability of all stakeholders. Clearly defined and commonly understood vision, mission and a framework program plan to achieve the organizations strategic objectives. Timely identification and mitigation of barriers that might prevent the continuous improvement of business processes, systems and the efficient achievement of the organizations mission. Timely and consistent corporate decision making that supports integrated systems approaches to business processes, product realization, and customer service. Structure, skills, and systems that is aligned and supportive of achieving the goals for any desired change.	AIR SMS Operational Overview Document
Compliance	Demonstration of adherence to applicable FAA regulations/standards in support of FAA certification	AIR SMS Operational Overview Document
Conditional Probability	The probability that a condition or outcome will occur, given that a base event has occurred.	Risk Analysis Specification v7.0 10/11/06

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Term, Acronym, Phrase	Definition	Source
Conditions	Alternative states of the system when the event occurs. For example: an aircraft component failure may occur during flight, or on the ground; the departure of key personnel may occur during a tight employment environment or one in which many people are seeking work.	Risk Analysis Specification v7.0 10/11/06
Continual Improvement	A set of activities an organization routinely carries out to enhance its ability to meet requirements in response to ongoing system feedback. Continual improvement can be achieved by carrying out internal audits, performing management reviews, analyzing data, and implementing corrective and preventive actions	AVS Doctrine
Control	See safety risk control	
COS	Continued Operational Safety	
Critical Part/Component	A part/component which if it were to malfunction or fail could reasonably be expected to directly result in an unsafe condition. Includes, but is not limited to: Those subject to an Airworthiness Limitation or an Airworthiness Directive, and those which are part of a system were any safety assessment required by the CFR relies on their level of performance to preclude an unsafe condition OR their failure to perform the intended function is not covered to a depth required by regulation or policy.	Consistent with: AIR SM Program; AC39-8; NTSB Recs. A-06-36, 37, 38; NTSB Report SR-06/02; and with EASA definitions
Customer	Intended recipient of process/task output	

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Customer	The individual or organization that receives a product or service that is the result of a process. The customer may be internal to AIR, such as individuals involved in other functions or external such as other FAA organizations, manufacturers, operators, maintenance and repair facilities, National Transportation Safety Board (NTSB), other aviation authorities or end users.	AIR SMS Operational Overview Document
D		
D&PA	Design and Production Approval: Process for approving an applicant's design and production system. This involves determining if an applicant meets the requirements to obtain the desired certification approval, via certifying the applicants design, production system, and Safety Management System as compliant with applicable regulations and requirements.	AIR SMS Operational Overview Document
Decide	The passing of judgment in consideration of risks	AIR SMS Operational Overview Document
Delegation	The explicit decision to grant authorization to a qualified private person or organization to perform certification related function on behalf of the Administrator.	AIR SMS Operational Overview Document
Designee	Private persons (i.e., individuals) or organizations delegated to act as representatives of the Administrator.	AIR SMS Operational Overview Document
Develop	Create	AIR SMS Operational Overview Document

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Term, Acronym, Phrase	Definition	Source
Directly result in an unsafe condition	Directly means the failure of a part which: Is not the result of, or dependent upon, the prior failure of another part or system. (Same as EASA's Primary Failure), and The unsafe condition is not created by a subsequent failure of a protection provided for by the airworthiness requirements.	
Discretionary Authority	Our ability as a regulatory entity to decide, i.e., to apply judgment in, how we evaluate applicants' regulatory compliance.	AIR SMS Operational Overview Document
Doctrine	A statement of fundamental government policy	AVS Doctrine
Documentation	Information or meaningful data and its supporting medium (e.g., paper, electronic, etc.). In this context, it is distinct from records because it is the written description of policies, processes, procedures, objectives, requirements, authorities, responsibilities, or work instructions.	JPDO SMS Standard v1 12/15/06
E		
EASA	European Aviation Safety Agency	
Effectiveness	A measure of how well desired outcomes are achieved, generally in reference to a specified standard. Effectiveness in a safety management system (SMS) refers to the results of risk management activities in terms of the applicable standard and the intended results	AVS Doctrine
Emergency	A circumstance that requires immediate action to be taken.	Risk Analysis Specification v7.0 10/11/06
Enforcement	Process for applying either administrative or financial sanction against a holder of an FAA approval based on evidence of improper performance	AIR SMS Operational Overview Document

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Evaluate	Examine, by means of objective evidence, that a process or activity is compliant with a set of criteria. (Note; evaluation does not involve risk assessment -- risks have already been considered during the establishment of the guidance/policy that the evaluation is being performed to).	AIR SMS Operational Overview Document
Evaluation	A functionally independent review of company policies, procedures, and systems. If accomplished by the company itself, the evaluation should be done by an element of the company other than the one performing the function being evaluated. The evaluation process builds on the concepts of auditing and inspection. An evaluation is an anticipatory process, and is designed to identify and correct potential findings before they occur. An evaluation is synonymous with the term systems audit.	JPDO SMS Standard v1 12/15/06
Event	The triggering occurrence, condition, failure, malfunction, or circumstance to be evaluated in the risk analysis.	Risk Analysis Specification v7.0 10/11/06
Expert Opinion	Data, in the form of informed point of view, received from an individual or group of individuals with specialized knowledge or experience in the subject matter.	Risk Analysis Specification v7.0 10/11/06
F		
Fabrication	Producing replacement and modification parts or repair details without holding a production approval issued under 14 CFR 21, either as a.) Owner/operator produced parts or b.) Pursuant to accomplishing maintenance or alterations under the applicable maintenance and alteration airworthiness standards and policy.	

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Fail Safe	A characteristic of a system whereby any malfunction affecting the system safety will cause the system to revert to a state that is known to be within acceptable risk parameters.	AIR SMS Operational Overview Document
Fatal Accident	An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and until such time as all such persons have disembarked, and in which any person (including those on the ground injured as a result of the essential operation of the flight) suffers a fatal injury. This definition excludes maintenance, ramp positioning and ground personnel movement, unless injuries are a direct result of the aircraft's action or malfunction.	Risk Analysis Specification v7.0 10/11/06
Finding	Determination that the applicant meets all applicable regulatory requirements. Discreet, individual regulatory findings can support the overall compliance determination that leads to an approval.	AIR SMS Operational Overview Document
FSDO	Flight Standards District Office	
Functional Requirements	A description of the intended behavior/action/performance of the system. In the context of this Standard, functional requirements allow the SMS developer to focus on intended behaviors/functions rather than implementing the exact steps, provided that the organization's processes map functionally to the intent of the steps described in this Standard.	JPDO SMS Standard v1 12/15/06
G		
GAO	Government Accountability Office	
H		

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Hazard	Condition, object or activity with the potential of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribe function.	ICAO
Hazard	Any existing or potential condition that can lead to injury, illness, or death to people; damage to or loss of a system, equipment, or property; or damage to the environment. A hazard is a condition that is a prerequisite to an accident or incident. Note that a hazard may or may not result in a situation of high risk.	AVS Doctrine
Hazard	Any existing or potential condition that can lead to injury, illness, or death to people; damage to or loss of a system, equipment, or property; or damage to the environment. A hazard is a condition that is a prerequisite to an accident or incident.	JPDO SMS Standard v1 12/15/06
Hazard	Condition, occurrence, or circumstance that could lead to or contribute to an undesired event. Sometimes termed "threat."	Risk Analysis Specification v7.0 10/11/06
I		
Incident	A near miss episode, malfunction, or failure without accident-level consequences that has a significant chance of resulting in accident-level consequences.	JPDO SMS Standard v1 12/15/06
Input	That which is consumed by an activity. Output may be electronic data, information, knowledge, physical product, or intellectual property.	AIR SMS Operational Overview Document
Inspection	The verification that an asset conforms to a design, usually involving measurement to a set of criteria.	AIR SMS Operational Overview Document

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Integrated Defenses	The set of safety protections that work together to prevent a bad outcome.	AIR SMS Operational Overview Document
Investigation	An examination, initiated by an accident, incident or trend, of any factors that are related and/or contributed to the accident, incident, or trend.	AIR SMS Operational Overview Document
J		
JAA	Joint Airworthiness Authorities	
JPDO	Joint Planning Development Office: A coalition of Departments of Transportation, Defense, Homeland Security, Commerce, NASA, FAA and Office of Science and Technology to guide and oversee the development and implementation of the Next Generation Air Transportation System. (Vision 21 - Century of Aviation Reauthorization Act)	AIR SMS Operational Overview Document
K		
L		
Learning Organization	A group of people who are continually enhancing their capabilities to create the future they want. The basic rationale for such organizations is that in situations of rapid change only those that are flexible, adaptive and productive will excel.	AIR SMS Operational Overview Document
Likelihood	The estimated probability or frequency, in quantitative or qualitative terms, of a hazard's effect.	AVS Safety Management System Doctrine JPDO SMS Standard v1 12/15/06

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Likelihood	Often used as an alternative term for 'Probability'. However, 'Likelihood' has a specific definition in statistics that differs from probability. Therefore, the RAS will use the term 'Probability'.	Risk Analysis Specification v7.0 10/11/06
Line management	Management structure that operates the production/operational system.	JPDO SMS Standard v1 12/15/06
M		
MIDO	Manufacturing Inspection District Office	
MIO	Manufacturing Inspection Office	
MISO	Manufacturing Inspection Satellite Office	
MMF	Manufacturers Maintenance Facility	
Modification Part	A newly manufactured or fabricated part or a used airworthy part that is to be installed in a product when performing an alteration of a product.	14 CFRs 21 and 43
N		
NASIP	National Aviation Safety Inspection Program	
NRS	National Resource Specialist	
National Airspace System	The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared with the military.	AVS Doctrine

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Nonconformity	Non-fulfillment of a requirement. This includes but is not limited to noncompliance with Federal regulations. It also includes an organization's requirements, policies, and procedures as well as requirements of safety risk controls developed by the organization.	JPDO SMS Standard v1 12/15/06
O		
ODA	Organizational Designation Authorization	
ODAR	Organizational Designated Airworthiness Representative	
OIG	Office of Inspector General	
OJT	On the Job Training	
OMB	Office of Management and Budget	
Organizational Accident	Organizational accidents are those in which latent conditions, arising mainly from management decisions, processes or cultural influences, are added to local triggering conditions, such as weather or location. These conditions can coalesce to produce an accident, usually but not always when they are combined with active failures like errors and procedural violations	AIR SMS Operational Overview Document
Organizational Decisions	Decisions which consider the full impact throughout the Aircraft Certification Service including the impact on the related oversight of products and services.	AIR SMS Operational Overview Document
Organizational Issues	Breakdowns that occur within an organization's decision making processes, communication processes and culture.	AIR SMS Operational Overview Document
Output	What piece of information results from the process? Be specific on the type of data. A noun.	

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Output	That which is produced by an activity. Output may be electronic data, information, knowledge, physical product, or intellectual property.	AIR SMS Operational Overview Document
Output	The result or product of an organization's productive processes (i.e., the production/operational system).	JPDO SMS Standard v1 12/15/06
Oversight	The act of supervision, monitoring, and tracking of designee and delegated organization activities to ensure that authorized functions are performed in accordance with the appropriate regulations, policies, and procedures.	AIR SMS Operational Overview Document
Oversight	A function that ensures the effective promulgation and implementation of the safety related standards, requirements, regulations, and associated procedures. Safety oversight also ensures that the acceptable level of safety risk is not exceeded in the air transportation system. In this context, oversight is provided by an outside entity in a legal or regulatory framework.	JPDO SMS Standard v1 12/15/06
Owner	Body that has the authority to change a process	
Owner	See Process Owner.	AIR SMS Operational Overview Document
P		
PACO	Project Aircraft Certification Office	
Party	An organization or person conducting functions relating to or impacting aviation.	AIR SMS Operational Overview Document
PC	Production Certificate	

Term, Acronym, Phrase	Definition	Source
PLCM	Product Life Cycle Management: Process for managing the safety of aircraft from the cradle to grave (i.e. For the life cycle). It encompasses D& PA, certificate management, monitoring product safety, and development of standards.	AIR SMS Operational Overview Document
PMA	Parts Manufacturer Approval	
Probability	The ratio of the number of actual occurrences to the number of possible occurrences; for example, 1 in a million flight hours. Probability is often expressed with the denominator normalized to a single unit; therefore, 10^{-6} per flight hour. Probability also may be evaluated against total exposure of the fleet (or other relevant business parameter); for example, 40% probability that a failure will occur if the hazard is not addressed, or expected number of events. AIR SMS business processes should establish a consistent metric or metrics to quantify probability. To facilitate comparisons between similar AIR SMS business processes, a particular probability metric (for example, per flight hour) may also be tracked.	Risk Analysis Specification v7.0 10/11/06
Procedure	A specified way to carry out an activity or a process.	AVS Safety Management System Doctrine JPDO SMS Standard v1 12/15/06

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Process	A set of interrelated or interacting activities that transforms inputs into outputs.	AVS Safety Management System Doctrine JPDO SMS Standard v1 12/15/06
Process	Task performed or to-be performed. Should be a verb.	AIR SMS Operational Overview Document
Process Gaps	Identify when we should be tying to another process but do not.	AIR SMS Operational Overview Document
Process Owner	A person or group identified by management that monitors and continually improves the performance of a given process and the quality of the products produced by the process using data collected from the process metrics, Corrective and Preventive Action, Stakeholder/Customer Feedback, and Internal Assessments. For system-level processes, the Process Owner is the Management Representative.	AIR SMS Operational Overview Document
Product	The results of a process (activity), physical products or services that are intended for a customer.	AIR SMS Operational Overview Document
Product Life Cycle	The entire sequence from pre-certification activities through those associated with removal from service.	Risk Analysis Specification v7.0 10/11/06
Production/Operational System	The functional productive system used by an organization to produce organizational outputs.	JPDO SMS Standard v1 12/15/06
Q		

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Qualitative Analysis	A structured method of analysis primarily based on logic and logical inference.	Risk Analysis Specification v7.0 10/11/06
Quality Assurance	The part of quality management focused on providing confidence that requirements will be fulfilled.	AVS Safety Management System Doctrine
Quality Control	Activities after production of a product or service to ensure the final output has conformed to the desired parameters.	AVS Safety Management System Doctrine
Quality Management	Coordinated activities to direct and control an organization with regard to quality.	AVS Safety Management System Doctrine
Quality Management System	A set of interrelated or interacting processes with regard to quality, accomplished by the management of an organization by establishing policy and objectives and achieving those objectives.	AVS Safety Management System Doctrine
Quality System	The organizational structure, responsibilities, procedures, processes, and resources for implementing quality management.	AVS Safety Management System Doctrine
Quantitative Analysis	A method of analysis that relies mainly on mathematical or statistical methods.	Risk Analysis Specification v7.0 10/11/06
R		
Records	Evidence of results achieved or activities performed. In this context, it is distinct from documentation because records are the documentation of SMS outputs.	JPDO SMS Standard v1 12/15/06
RE&D	Research Engineering and Development	
Related Process	What processes use the info or be gathered from	AIR SMS Operational Overview Document

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Repair	Restoring a worn or damaged aircraft, airframe, engine, propeller or appliance (or part thereof) to an airworthy condition by performing the work in such a manner and using materials of such a quality that the condition of the product or appliance 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 43
Replacement Part	A newly manufactured or fabricated part, or a used airworthy part that will be installed in a product in order to replace a worn, damaged or otherwise unairworthy part and thereby restore the product to its original or properly altered condition.	14 CFRs 21 and 43
Resources	The tools (e.g., IT), or materials (Orders) that are used or would be needed to perform process/task	AIR SMS Operational Overview Document
Review	Inspect or examine a something against a defined standard or set criteria. Has no confirmation. The item being inspected is taken at face value.	AIR SMS Operational Overview Document
Risk	Expression of the impact of an undesired event in terms of its severity and probability. (Reference FAA Order 8040.4). Note: Correct assessment of risk must include both the likelihood of a loss and the magnitude.	AIR SMS Operational Overview Document Risk Analysis Specification v7.0 10/11/06

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Risk	The composite of predicted severity and likelihood of the potential effect of a hazard in the worst credible system state. There are three types of risk: Initial — The severity and likelihood of a hazard when it is first identified and assessed; includes the effects of preexisting risk controls in the current environment. Current — The predicted severity and likelihood of a hazard at the current time. Residual — The remaining risk that exists after all risk control techniques have been implemented or exhausted and all risk controls have been verified.	AVS Safety Management System Doctrine
Risk	The composite of predicted severity and likelihood of the potential effect of a hazard.	JPDO SMS Standard v1 12/15/06
Risk	See safety risk also.	
Risk Analysis	The process whereby hazards are characterized for their likelihood and severity. Risk analysis looks at hazards to determine what can happen, when, and what consequences are expected. It is sometimes used interchangeably with Risk Assessment.	AIR SMS Operational Overview Document
Risk Analysis	The process whereby hazards are characterized for their likelihood and severity. Risk analysis looks at hazards to determine what can happen when. This can be either a quantitative or qualitative analysis. The inability to quantify and/or the lack of historical data on a particular hazard does not exclude the hazard from the need for analysis. Some type of a risk analysis matrix is normally used to determine the level of risk.	AVS Safety Management System Doctrine

Term, Acronym, Phrase	Definition	Source
Risk Assessment	The process by which the results of risk analysis are used to make decisions. The process of combining the impacts of risk elements discovered in risk analysis and comparing them against some acceptability criteria. Risk assessment can include the consolidation of risks into risk sets that can be jointly mitigated, combined, and then used in decision-making.	AVS Safety Management System Doctrine
Risk Assessment	A structured method for evaluating and providing a measure of the risk associated with a specific safety concern.	AIR SMS Operational Overview Document
Risk Control	Anything that mitigates risk. A risk control should directly map to a safety design requirement. All risk controls must be written in requirement language.	
Risk Management	Management activity ensuring that risk is identified and eliminated or controlled within established acceptable program risk guidelines.	Risk Analysis Specification v7.0 10/11/06
Risk Management (or safety risk management (SRM))	A management activity ensuring that risk is identified and eliminated or controlled within established program risk parameters. The process of making decisions where resources are allocated and safety actions are prioritized based on the assessed risk. (See FAA Order 8040.4. Safety Risk Management).	AIR SMS Operational Overview Document
S		
Safety (Safe)	The absence of unacceptable risk.	Risk Analysis Specification v7.0 10/11/06

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Safety	Freedom from those conditions that can cause harm. Absolute safety is not possible because complete freedom from all hazardous conditions is not possible. Therefore, safety is a relative term that implies a level of risk that is both perceived and accepted. (see FAA System Safety Handbook)	AIR SMS Operational Overview Document
Safety	Safety is the state in which the risk of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management.	AVS Safety Management System Doctrine
Safety Assurance	SMS process management functions that systematically provide confidence that safety objectives are met or exceeded.	AVS Safety Management System Doctrine
Safety Assurance	SMS process management functions that systematically provide confidence that organizational outputs meet or exceed safety requirements.	JPDO SMS Standard v1 12/15/06

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Safety Culture	An organization with a safety culture takes as an overriding priority that safety issues receive the attention warranted by their significance. It is evident when people recognize and act on their individual responsibility for safety, and actively support the organization's processes for managing safety. Some characteristics of a safety culture in AIR would be: • People at all levels understand their role and contribution to the safety oversight system, and respect the contribution of others as well. • People are alert to identify safety concerns and are willing to report them. • A system is in place to analyze reported concerns and take appropriate action. • People have confidence in the safety management system and work within it. • The culture can absorb benefits of learning/feedback, so that a safety escape does not equal chaos, but results in learning and improvement.	AIR SMS Operational Overview Document
Safety Culture	Safety culture is descriptive of organizations where each person involved in the organization's operations recognizes and acts on his or her individual responsibility for safety, and actively supports the organization's processes for managing safety. The outcome is that the organization's ability to manage safety continues to improve because decision-makers at all levels work to use their knowledge of safety risk to learn and adapt, thus improving the system's ability to support safety outcomes.	AVS Safety Management System Doctrine

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Safety Culture	The product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, the organization's management of safety. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures.	JPDO SMS Standard v1 12/15/06
Safety Management	The act of understanding and lowering risk, inherent in all human activity, to acceptable levels. Proactively identifying, assessing, and eliminating or controlling safety-related hazards to acceptable levels can achieve accident prevention. (Flight Safety Foundation, 2002 Q4)	AIR SMS Operational Overview Document
Safety Management	The act of understanding and making decisions and taking actions to lower risk, inherent in all human activity, to acceptable levels.	

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Safety Management System (SMS)	A disciplined and standardized approach for managing risks to safety. As with all management systems, a safety management system requires goal setting, planning, and measuring performance. A safety management system is woven into the fabric of an organization. It becomes part of the culture; the way people do their jobs. (Adapted from TCCA and CASA Australia SMS materials). SMS components typically include as a minimum: Safety risk management processes (see SRM and System Safety definitions) A process for proactive internal reporting of hazards A process for monitoring and improving the effectiveness of the SMS Documentation and control of the SMS objectives, processes and data Trained and educated people driving the SMS and its processes	AIR SMS Operational Overview Document
Safety Management System (SMS)	An integrated collection of processes, procedures, and programs that ensures a formalized and proactive approach to system safety through risk management. Risk analysis and assessment are required for all changes to identify safety impacts. The SMS is a closed-loop system ensuring all changes are documented and all problems or issues are tracked to conclusion. When properly implemented, an SMS establishes a safety philosophy or culture that permeates the entire organization in the monitoring and continuous improvement of safety of the operation.	AVS Safety Management System Doctrine

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Safety Management System (SMS)	The formal, top-down business-like approach to managing safety risk. It includes systematic procedures, practices, and policies for the management of safety (as described in this document, it includes Safety Risk Management, safety policy, safety assurance, and safety promotion).	JPDO SMS Standard v1 12/15/06
Safety Objective	Safety goals or desired outcomes, which are typically measurable.	JPDO SMS Standard v1 12/15/06
Safety Oversight	A function by means of which States ensure effective implementation of the safety related laws, regulations, policies, and procedures. Safety oversight also ensures the national aviation industry provides a safety level equal to or better than the acceptable level defined by the State.	
Safety Requirement	A safety condition or capability that must be met or passed by a system to satisfy a contract, standard, specification, or other formally imposed document or need.	JPDO SMS Standard v1 12/15/06
Safety Risk	The composite of predicted severity and likelihood of the potential effect of a hazard.	JPDO SMS Standard v1 12/15/06
Safety Risk Control	A characteristic of a system that reduces safety risk. Controls may include process design, equipment modification, work procedure, training, or protective device.	JPDO SMS Standard v1 12/15/06
Safety Risk Management (SRM)	A process within the SMS composed of describing the system, identifying hazards, and analyzing, assessing, and controlling the risk.	
Safety Risk Management (SRM)	A formal process within the SMS composed of describing the system, identifying the hazards, assessing the risk, analyzing the risk, and controlling the risk. The SRM process is embedded in the production/operational system; it is not a separate/distinct process.	JPDO SMS Standard v1 12/15/06

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Safety Standards	Regulations, policy and guidance that establish acceptable safety levels.	AIR SMS Operational Overview Document
Safety Value	Value is a function of the optimization of risk reduction, economic performance and impact of our oversight ability while considering the FAA's and Industry's capabilities. In this definition "value" is a measurement of what we do; as compared to what is it that we do that is valuable. Our value can be measured via the effectiveness of our system in supporting the reduction of safety risk to acceptable levels.	AIR SMS Operational Overview Document
Serious Injury	Any injury which: Requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; Results in a fracture of any bone (except simple fractures of fingers, toes, or nose); Causes severe hemorrhages, nerve, muscle, or tendon damage; Involves any internal organ; or Involves second or third degree burns, or any burns affecting more than 5 percent of the body surface.	AVS Safety Management System Doctrine & NTSB

Term, Acronym, Phrase	Definition	Source
Serious Injury	• Serious injuries include fatalities. • Serious and fatal injuries means any injury that: (1) Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received, (2) results in the fracture of any bone (except simple fractures of fingers, toes or nose), (3) involves lacerations that cause severe hemorrhages, nerve, muscle or tendon damage, (4) involves injury to any internal organ, or (5) involves second or third degree burns or any burns affecting more than five percent of the body surface, and (6) "Fatal injury" is defined as an injury that results in death within 30 days of the accident.	NTSB & AC39-8
Serious Injury	Level 4 risk guidelines are intended to cover exposures to the most severe of "serious injuries" (i.e., life-threatening injuries). Consequently, relaxation of these guidelines may be acceptable in cases where the associated "serious injuries" are clearly not life threatening (e.g., simple fractures). Injuries resulting from an emergency evacuation rather than from the event which caused the evacuation are not considered in evaluating the severity of the event. It is recognized that emergency evacuations by means of the slides can result in injuries without regard to the kind of event precipitating the evacuation.	AC39-8

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Severity	The consequence or impact of a hazard in terms of degree of loss or harm.	AVS Safety Management System Doctrine JPDO SMS Standard v1 12/15/06
Severity	The level of harm or loss of the outcome should the event occur. There may be multiple possible outcomes resulting from a given event.	Risk Analysis Specification v7.0 10/11/06
SMS Output	The result or product of an SMS process. In this context, it is the result of a process, which is intended to meet a requirement described in this Standard (e.g., results of safety risk analyses, safety audits, safety investigations, etc.).	JPDO SMS Standard v1 12/15/06
STC	Supplemental Type Certificate	
Substantial Damage	Damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, and damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered "substantial damage."	AVS Safety Management System Doctrine Risk Analysis Specification v7.0 10/11/06
Substitute Risk	Risk created as a consequence of safety risk control(s).	JPDO SMS Standard v1 12/15/06
SUP	Suspected Unapproved Part	

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Surveillance	The act of monitoring and evaluating an organization, product, or service in a systematic way to verify compliance with regulations; operation in accordance with their systems and methodologies; and that the desired outcome is achieved or product or service performance meets expectations.	AVS Safety Management System Doctrine
System	Collection of processes	
System	A collection of organized and arranged parts, components, factors or variables that interact together to function as a whole through feedback.	AIR SMS Operational Overview Document
System	A interdependent set or composite of procedures, processes, methods, or rules governing behavior	AIR SMS Operational Overview Document
System	An integrated set of constituent pieces combined in an operational or support environment to accomplish a defined objective. These pieces include people, equipment, information, procedures, facilities, services, and other support services, which interact.	AVS Safety Management System Doctrine
System	An integrated set of constituent elements that are combined in an operational or support environment to accomplish a defined objective. These elements include people, hardware, software, firmware, information, procedures, facilities, services, and other support facets.	JPDO SMS Standard v1 12/15/06

Term, Acronym, Phrase	Definition	Source
System Engineering	A discipline that concentrates on the design and application of the whole (system) as distinct from the parts. It involves looking at a problem in its entirety, taking into account all the facets and all the variables, and relating the social to the technical aspect. The translation of operational requirements into design, development, and implementation concepts and requirements in the lifecycle of a system.	AVS Safety Management System Doctrine
System Safety	The application of particular skills to the systematic, forward-looking identification and control of hazards throughout the life cycle of a project, program, or activity. The primary objective of System Safety, which is accident prevention, is achieved by focusing on the control of hazards associated with a system and/or product. Processes must include: The identification of hazards Analysis of hazards Assessment of risk Management of the risk Evaluation that actions adequately reduced the risk Measurement of the health of the system	AIR SMS Operational Overview Document
System Safety	The application of engineering and management principles, criteria, and techniques to optimize all aspects of safety within the constraints of operational effectiveness, time, and cost throughout all phases of the system lifecycle.	AVS Safety Management System Doctrine
System Safety Engineering	An engineering discipline requiring specialized professional knowledge and skills in applying scientific and engineering principles, criteria, and techniques to identify and eliminate hazards, in order to reduce the associated risk.	AVS Safety Management System Doctrine

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
System Safety Management	A management discipline that defines system safety program requirements and ensures the planning, implementation, and accomplishment of system safety tasks and activities are consistent with the overall program requirement.	AVS Safety Management System Doctrine
T		
TC	Type Certificate	
Test	To determine the presence, quality, or truth of something – asset, party, or system. (e.g., an asset meets performance characteristics, software meets functional requirements, designee has applicable skills, procedure yields acceptable results)	
Tool	Device that helps you perform the activity (the tool does not do anything)	AIR SMS Operational Overview Document
Top Management	The person or group of people that directs and controls an organization. Sometimes it is also referred to as senior management and may be the Chief Executive Officer, Board of Directors, or Administrator.	JPDO SMS Standard v1 12/15/06
TSO	Technical Standard Order	
Trigger	Initiates the event	AIR SMS Operational Overview Document
U		

APPENDIX C: AVS RAF TEAM ACRONYMS AND GLOSSARY

Term, Acronym, Phrase	Definition	Source
Unsafe Condition	The consequence of a failure or malfunction which if not corrected or prevented can reasonably be expected to result in one or more serious injuries or a fatal accident. An unsafe condition is not a function of probability. It is a function of the consequence (i.e.; the severity) of the causal factor(s). Hence, unsafe conditions (consequences) for a given scenario are constant. Their probability of occurring varies but that does not affect the fact that any given consequence is unsafe. This excludes In-flight shutdowns within acceptable reliability bounds which are dealt with by specific regulatory requirements applicable to the aircraft type designs. [E.g.; multi-engine aircraft have engine-out requirements and single engine aircraft have specific glide speed and crashworthiness requirements because of the chance of engine power loss. ETOPS aircraft have certain reliability requirements to maintain in order to be operated.]	
V		
W		
Work procedure	A set of defined steps that are meant to be performed or operated by an FAA party or other party of interest to the FAA.	AIR SMS Operational Overview Document
X		
Y		
Z		

APPENDIX D: COMMENTS TO FEDERAL REGISTER NOTICE & DISPOSITION

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
Honeywell	*Page 6,* *"Safety Concerns"*	June 16, 2003 – A Hawker 125-700 aircraft powered by Honeywell TFE731-3 turbofan engines experienced an uncontained failure of the first stage low pressure turbine disk. The investigation found that the root cause of the failure was an FAA-approved repair of the first stage low pressure turbine nozzle. The OEM repair requires that the total effective flow area of the nozzle be managed by adjusting each nozzle vane segment area utilizing a computer program to insure that no vibratory modes are induced onto downstream components. The FAA-approved repair did not require the management of the flow areas, resulting in a 2/rev vibration mode. This mode caused the first stage turbine disk to fail in High			**The FAA agrees** that there have been occasional failures and accidents caused by aftermarket parts just as there have been with TC/PC holder parts and repairs. **Action taken:** No change to report

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		Cycle Fatigue 107 hours after the engine was reinstalled on the aircraft following an overhaul. January 6, 1995 – A Beechcraft Duke aircraft crashed short of the Grant County Airport near Silver City, NM after a reported engine failure. The three occupants on board were fatally injured and the aircraft was destroyed. A causal factor of the crash was the failure of a Honeywell (Garrett) turbocharger. The investigation found that the turbocharger turbine main shaft failed in the area of an FAA-approved repair. The grind-plate-grind repair of the turbine journal bearing reduced the material properties of the main shaft where it was inertial-welded to the turbine rotor resulting in a Low Cycle Fatigue failure of the shaft. The OEM			

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		approved data does not allow any repairs to the main shaft journal bearings.			
Honeywell	*Page 21, Conclusion 2.*	Honeywell disagrees with the FAA position that "…repairs, however extensive, even though they may involve the fabrication of sub-elements of the part, are still considered a "repair" and not "fabrications"…". Honeywell contends that many repairs, sometimes referred to as "dime repairs" because only a dime sized piece of the original part is reused are in fact not a repair but a fabrication. These types of "repairs" should have a unique part number so that traceability can be established should it be required. Right now the burden falls on the OEM to research and determine the part linage.			**The FAA understands** the commenter's position. However, since TC/PC holders strongly objected to the recent FAA NPRM proposing to require marking new production parts, it is unlikely that an support could be garnered for a proposed rule to mark repaired, altered and fabricated parts, of which there are far more parts than new production. **Action taken:** No change to report

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
Honeywell	*Page 30, Conclusion 6.*	Honeywell agrees with the FAA Conclusion 6, but disagrees with their subsequent position regarding part marking. Honeywell contends that repaired parts need to have unique part number marking that would identify the part as being repaired and who performed the repair. This unique part marking does not require the data plate to be changed, but would allow for quick identification during investigations. Honeywell also contends that the FAA position on liability concerns is unfounded. In our litigious society the burden of proof will always fall on the OEM to show why a product defect is not their responsibility. If a component part is repaired or fabricated by a third party without using OEM			**The FAA understands** the commenter's position. However, since TC/PC holders strongly objected to the recent FAA NPRM proposing to require marking new production parts, it is unlikely that an support could be garnered for a proposed rule to mark repaired, altered and fabricated parts, of which there are far more parts than new production. The FAA agrees that the ideal situation would be to require all parts whether new, repaired, fabricated, or altered to be uniquely marked. If any commenters fell strongly they may wish to petition for rulemaking under 14 CFR Part 11. **Action taken:** No change to report

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		FAA-approved data, then the OEM has every right to distance itself from any claims brought on account of the part's failure to perform. Requiring the repaired or fabricated part to have its own unique part marking would allow the courts to fairly address liability concerns by allowing claims to be filed against the responsible party, and not arbitrarily against the OEM.			
Honeywell	*Page 33, Paragraph 1.*	Honeywell disagrees with this paragraph. It is within the OEM's prerogative to state that their Instructions for Continued Airworthiness are not valid if the product has non-TC/PC developed repairs, alterations, or fabricated parts installed. While the FAA may disagree with this statement it is wrong for the FAA to			**The FAA disagrees;** the TC/PC holder <u>does not</u> have the right to claim that the ICAs are invalid when the product is maintained in accordance with the CFRs and is using any parts, repairs or alterations approved or accepted by the FAA. **Action taken:** No change to report

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		mandate that OEMs must remove this guidance from their documents. The OEMs have no knowledge that the non-TC/PC developed repairs, alterations, or fabricated parts have been designed and tested in accordance with the same standards established by the FAA for the OEM and therefore the OEM cannot guarantee those parts are fit for use in their product. Additionally, the OEM will be held liable for product defects and can only defend itself for parts manufactured by the OEM. Removing statements regarding the suitability of non-TC/PC parts and repairs from their ICA could constitute a failure to warn and could open the OEM to additional litigation.			

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
Honeywell	*Page 33, Conclusion 8.*	Honeywell disagrees with this conclusion. Honeywell actively participates in all investigations when requested by the FAA, NTSB and all foreign agencies. Typically the investigation is well underway before it is determined that an aftermarket part or repair may be involved. It has been Honeywell's observation that the missing parties during these types of investigations are routinely the aftermarket part repairer, fabricator, or STC holder. In addition, OEMs can only be responsible for tracking reliability data for parts manufactured by the OEM. Much of this data is considered proprietary and cannot be shared with competitor companies.			**The FAA agrees** that not all TC/PC holders lack objectivity when non-TC/PC holder parts are involved in a service event. **Action taken:** Report revised to acknowledge that fact

APPENDIX D: COMMENTS TO FEDERAL REGISTER NOTICE & DISPOSITION

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
Woodward Governor Company		Make a recommendation to define elementary processes	There is a emphasized concern on the decision making between major and minor repairs of critical components and the major/minor type design. However the committee appears to have omitted the repair/alteration requirement of determining its classification based on elementary operations and the definition of it. Discussions with the FAA have not been able to define the term of an elementary operation and it appears to be determined at the discretion of the applicant or FAA reviewer. In addition this definition may be valuable for defining guidelines in recommendation 5 when defining the quality control requirements.		**Agree** **Action taken:** Report revised in Conclusion 3 and Recommendation 6

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			In addition this may also then align with EASA and other agencies as this statement is not a prerequisite for determination of a major repair.		
FAA ANM-115	p.1, Heading "Key Issues"	It is mentioned in this section some stakeholders believe that significant safety risks currently exists and will get worse in the future. However, the text of the report mentions that the available data does not show that there is currently a safety issue and furthermore, the trend does not suggest an increase in risk. This seems to be a key point that should be understood as people read this report. Most of the stated concerns about safety appear to come from one set of stakeholders commenting on the technical abilities of			**Agree** **Action taken:** No change to report

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		the others. It is clear from the report that the FAA will need to exercise caution in discerning actual potential safety issues from those concerns driven from economic consideration. There does appear to be widespread perception by the stakeholders that the guidance provided by the FAA to industry is not adequate or consistent.			
FAA ANM-115	p.6, Heading "Safety Concerns"	The tone of the section, "Safety Concerns," seems to imply that there is a safety risk. However this seems inappropriate, based on the lack of data to support existing safety issues ("... the team did not find substantive evidence of failures or unsafe conditions arising from non-TC/PC holder developed data ... the general population of PMA parts and non-TC/PC holder repairs, alterations, has			**Agree,** The RAFT concluded that the present absence of substantive data indicating a system safety threat did not mean that the industries' concerns for safety were not warranted. There is a move by the aftermarket industry toward dealing with more complex and safety critical parts. That creates an increased risk of someone introducing a safety threat if designs and compliance are not carefully managed.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		increased substantively in past years particularly in the commercial aviation sector yet the occurrence of service difficulties and airworthiness directives on such parts for design or compliance shortfalls have not increased proportionately.") The concerns seem primarily based on the speculation that airplane designs are evolving such that future safety issues may arise.			**Action taken:** No change to report
FAA ANM-115	p.7, 1st full paragraph	This paragraph mischaracterizes the requirements. It implies that the repair or alteration does not need to be compliant with the applicable regulations.			**Agree** **Action taken:** Report revised to clarify
FAA ANM-115	p.7, 1st full paragraph	The term "recertification" seems inappropriate as it is used and does not seem to reflect options available such as the allowance in Section			**Agree** **Action taken:** Report revised to clarify

APPENDIX D: COMMENTS TO FEDERAL REGISTER NOTICE & DISPOSITION

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		21.303(c)(4) for "identically."			
FAA ANM-115	p.7, 1st full paragraph, last sentence	standard, however Section 21.303(c)(4) states: "Test reports and computations necessary to show ... unless the applicant shows that the design of the part is identical to the design of the part that is covered under the type certificate."			Understand the comment but FAA policy on the application of CFR 21.303 under FAA Order 8110.42 does not require a complete repeat of the direct compliance showing unless other test & computational methods are determined to be inadequate. **Action taken:** No change to report
FAA ANM-115	p.7, 2nd full paragraph, last sentence	Should say "certification" not "recertification" since the reference is to the design changes and affected structure. Recertification implies that the design changes were previously certified. "Recertification" would apply to existing hardware affected by the design change.			**Agree** **Action taken:** Report revised

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
FAA ANM-115	p.7, 3rd full paragraph, 3rd sentence	This statement does not accurately reflect the FAA's responsibility. The tone of these statements might imply that the FAA does not have sufficient involvement or is not living up to its responsibility. There is not data to support this implication. Similar to the FAA's responsibility relative to Type Certification regarding FAA involvement as described in FAA Order 8110.4, 2-5.a.: "**(1)** When a particular decision or event is critical to the safety of the product or to the determination of compliance, the FAA must be directly involved (as opposed to indirect FAA involvement by, for example, DERs). Project team members must build on their experience to identify critical issues. Some key issues that will always			Understand the concern about following orders but the FAA's discretionary function does not automatically dictate direct involvement to the extent or in the way implied by the commenter. The commenter also rightly so cites several inherently governmental functions that beyond the scope of discretion. Also, confusion exists about designees who do not have any discretionary authority like the FAA does. The understanding of FAA's discretionary functions, inherently governmental duties, and risk based oversight decision making is beyond the scope of this report. **Action taken:** Report revised to note that FAA's discretionary function is bounded by the FAA directives (Orders) that

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		require direct FAA involvement include rulemaking (such as for special conditions), ELOS determinations, development of issue papers, and compliance findings considered unusual or typically reserved for the FAA. While these items establish the minimum direct FAA involvement, additional critical safety findings must also be identified based on the safety impact or the complexity of the requirement or the method of compliance. Additional factors to consider in determining the areas of direct FAA involvement include the FAA's confidence in the applicant, the applicant's experience, the applicant's internal processes, and confidence in the designees. **(2)** Focusing FAA resources			govern how we do our business.

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		on the most critical areas maximizes the use of the delegation system while allowing for oversight and best use of the ACO's limited resources. FAA confidence in designees allows for full delegation for other than inherently governmental areas or new standards that are developing an experience base. Furthermore, confidence that the important safety areas are covered promotes greater delegation." Additional guidance/information regarding designee responsibility and FAA involvement is provided in FAA Order 8110.37 regarding "items requiring FAA approval," "items likely to be reserved for FAA approval," and "PMA design approvals."			

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
FAA ANM-115	p.7, 3rd full paragraph, 5th sentence	This statement is unnecessary, and implies a potential safety concern regarding basic airplane configuration and conformity. One aspect of the STC or PMA process is to check the AD status for the affected area of the airplane being changed. If there is an AD, that must be taken into consideration. In the case of a PMA, that may prevent a PMA from being issued. In the case of an STC, the applicant must address its means of addressing the unsafe condition (Section 21.21(b)(2).)			Agree with the second part of the comment re; ADs, STC and PMAs. The commenter's first statement is not understood. The report still seems to be appropriate as worded. **Action taken:** No change to report
FAA ANM-117	p.33, Conclusion 8	The investigation of service events should not be rigorous on behalf of the FAA. The FAA as having to ensure safety may have to err on the side of caution when determining the			**Agree;** However the regulations and past practices of FAA and NTSB have not always supported nor reinforced that view. **Action taken:** No change to report

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		appropriate corrective action. The investigation of events by the TC/PC holder and suppliers for parts should be a cooperative one so that corrective action evaluated and acted upon by the FAA addresses the root cause. One way for this to happen is for the owner / operator to take a predominant role in identifying a subject part of concern and possible root cause to facilitate the industry communication and FAA evaluation. This would be consistent with other recommendations.			
FAA ANM-115	p.37, 1st paragraph, 3rd sentence	The statement that the team's final recommendations was a solution that would have the "best impact on safety", seems inconsistent with the key position in the section "Safety Concerns" – that the team did not find data to			**Agree** **Action taken:** Report revised

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		suggest there is a safety concern, nor that there is a trend that the safety risk is increasing.			
FAA ANM-115	p.37, 1st paragraph, 5th bullet	"Requiring minimal rule changes and policy revisions most of which can be effected through current initiatives ... AVS SMS ..." It is not clear how this we can justify rule changes since there is no data to suggest a safety issue or potential for increased risk (i.e. what would the "benefit" of the rule be?).			**Agree** **Action taken:** Report revised to clarify
FAA ANM-105	p.40, Recommendation 4	The statement "retain the AC 43-18…requirements" implies ACs contain requirements, which is not true.			**Agree** **Action taken:** Revised report in several places to replace "requirements" with "guidance."

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FAA ANM-115	p.40, Recommendation 4	There have been other teams/efforts within the FAA that have already worked on the issue regarding classification of repairs (major/minor).			**Agree** **Action taken:** No change to report
FAA ANM-105	p.42, Recommendation 6, Prerequisites	Revise the wording: "…accomplish this prior to finalizing recommendation #2." to "…accomplish this prior to implementing recommendation #2."			**Agree** **Action taken:** Revised report
FAA ANM-117	p.46, Recommendation 11	Perhaps this is outside the scope of the recommendation but we should include guidance in the subject AC and associated Orders on the alteration or fabrication of parts that have been subject to airworthiness action. It makes sense to clearly lay out what is acceptable and what coordination etc. is needed for parts which fall into this category.			**Agree** **Action taken:** No change to report

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FAA ANM-115	p.46, Recommendation 12	It is not clear in the report that there is data justifying a safety concern to require a rule change to 21.3 and 21.4.			**Disagree in part;** the fact that FAA has on occasion written Airworthiness Directives to correct PMAs, repairs and alterations that were inadequately designed reflects that fact that entities other than the TC holder could potentially introduce design flaws. In those cases the TC holder should not be held responsible to develop a corrective redesign action if the FAA determines that someone else's design flaw has introduced an unsafe condition. The issue with CFR 21.4 is predominately around eliminating redundancy data required to be reported between aircraft TC holders, engine TC holders and that of owners/operators reporting under CFRs 121.374, 121.704 and 121.705 **Action taken:** No change to

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					report
FAA ANM-115	p. 47, Recommendation 13	It is not clear in the report that there is data justifying a safety concern to require a rule change to 21.99.			**Disagree;** the fact that FAA has on occasion written Airworthiness Directives to correct PMAs, repairs and alterations that were inadequately designed reflects that fact that entities other than the TC holder could potentially introduce design flaws. In those cases the TC holder should not be held responsible to develop a corrective redesign action if the FAA determines that someone else's design flaw has introduced an unsafe condition. **Action taken:** No change to report

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FAA ANM-115	p.47, Recommendation 14.	Clarify what the product/deliverable will be. The forms available to submit data from FAA engineering designees are limited (ref. Order 8110.37, FAA Form 8110-3, FAA Form 8100-9, etc.)			**Agree**; The intent was to not constrain the solution at this time until a team was formed to act on the recommendation. The objective was three fold. First, any FAA approvals that do not currently have a Form or a certificate issued, then an FAA Form would be required in the future. E.g.; today an ACO can issue a letter or e-mail approving a repair. In the future the ACO would have to issue the approval via new FAA Form X. Secondly, where practicable approval Forms should be combined. E.g.; Perhaps both the FAA ACO engineers and DERs would both use a Form 8110-3 for approvals in the future. Thirdly, the forms should be automated so they can be tracked and retrieve across the FAA system as needed.

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					Action taken: Report revised
FAA ANM-113/ FAA ANM-115/ FAA ANM-105	p.48, Recommendation 15	"Develop Advisory Circular guidance to require that all repairs and alterations need ICA assessments consistent with the AIR ICA Order 8110.54. " Advisory Circulars cannot REQUIRE anything. The requirements are in 14 CFR. Guidance, by definition, is not a requirement and should not be presented as such.			**Agree** **Action taken:** Report revised
FAA ANM-115	p.48, Recommendation 15	Should this recommendation also reference sections 25.1529, part 25 Appendix H, AC 25.1529, and part 26 rule for damage tolerance?			**Disagree**, the recommendation is generically applicable to all product types **Action taken:** No change to report

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FAA ANM-115	p.52, 2nd paragraph, 2nd sentence	Change the second sentence to read: "The AVS RAF Team will work with the AVS…"			**Agree** **Action taken:** Report revised
FAA ANM-115	General comment	The report and recommendations should provide some tie into SMS. It does not seem like these recommendations would get a high priority for resources through RBRT.			**Agree**; a number of the recommendations will be addressed as part of other existing broader rule and policy projects including SMS. **Action taken:** No change to report
FAA ANM-105 and FAA ANM-110		Multiple	Various Typos: o P. 7, 1st full paragraph, 2nd sentence: change "…using appropriate tests and analysis…" to "…using appropriate tests and analyses…" o P. 18 3rd paragraph under "STC Holders", 1st sentence: change "STC holders where…" to "STC holders were. o P. 24 3rd paragraph, 1st		**Agree** **Action taken:** Report revised

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			sentence: change "…and too what extent…" to "…and to what extent…" o P. 25 4th paragraph, last sentence: change "(ETOP)" to "(ETOPS)". o P. 28 2nd paragraph, 1st sentence: change "Directorates" to "Directorate". o P. 31, 1st paragraph, 3rd full sentence: change "…operator has the responsible…" to "…operator has the responsibility…" o P. 31, 1st paragraph, 6th full sentence: change "The products…" to "The product's…" o P. 31, 3rd paragraph, 1st sentence: add space between CFR and 45. o P. 34, 1st paragraph under Conclusion 9: add period after "policy" in		

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			the first sentence. o P. 34, 2nd paragraph under Conclusion 9, 3rd sentence: add end quotes at the end of the sentence. o P. 48, 2nd sentence under Objective heading: revise to read "…the AC should reinforce the…" o P. 50, 1st paragraph, 3rd sentence: "Emphasis" should be "Emphasize" o P. 52, 2nd sentence under Implementation Planning heading: revise to read "…to develop more detailed action plans…" (remove the "a"). o P. 53, last bullet: add "with" between "changes" and "industry". • P. A-1, 1st paragraph, 1st sentence: While the sentence says there are 7		

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			AIR and 3 AFS personnel, it appears there are only 2 AFS personnel listed in the table. Also, it says "plus two sponsors", but there appear to be three sponsors listed (AFS-301, ANE-100, and AIR-100).		
Bell Helicopter Textron	Page 6 Safety Concerns	The "confusion" around the basis for acceptable means highlights the issue that concerns our company. There is a general lack of awareness of the complexity of design, the assumption in a design, the assumptions used in a *Failure Mode and Effects Analysis* and analyses that supports the ICAs. If the non-OEM entity attempts to copy a part that this could create a safety concern. We agree that "discretionary authority" is not a well understood concept. The lack of understanding is exasperated by the lack of			**Agree**; An understanding of the product type design and consistency of applicants' compliance showings and FAA compliance findings is key to avoiding the introduction of unsafe conditions. **Action taken:** No change to report

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		standardization across FAA offices. What will be accepted by one office will not be by a second.			
Bell Helicopter Textron	Page 8 Liability Concern	The concerns of Bell are that the FAA is providing relief in one vein and not in another. From the report: "*The product does not "belong" to the manufacturer once ownership is passed.*" However, the FAA still looks to the company (TC Holder) to provide ICAs and other COS support. It cannot be both ways. The safety concern is that the product integrity is compromised by the introduction of parts, particularly critical parts that are not designed with the same robust approach of the TC/PC holder.			**Agree**; It is noteworthy that in most investigations the owner/operator, who is ultimately responsible for ensuring the aircraft's airworthiness, is rarely involved except for major accidents. In the past owners/operators and the FAA have expected the TC/PC holders to investigate service events and accidents. In today's environment when owners/operators are using a higher percentage of repairs, alterations and replacement parts that were not developed by the TC/PC holder, the owners/operators need to become more active in leading investigations and engaging the responsible non-TC/PC holders when aftermarket repairs and

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					parts are involved. **Action taken:** Report revised in "Liability" section Page 8 and in Conclusion 8.
Bell Helicopter Textron	Page 9 Economic Concerns	The tenor of this section is biased toward the large repair stations with an emphasis on Part 25 airplanes and large high-bypass turbofan engines. This is a very small section of the greater repair station clientele. Whether an OEM owns repair stations misses the focus of the economic impact. Small repair stations, especially those with special class ratings are the backbone of the industry. The statement: "The FAA understands the economic needs of all the stakeholders . . . ". If that were the case then Rulemaking would not require the benefit of an economic analysis. To that end, some of the policy			**Agree** **Action taken:** Added focus on regulatory basis and safety substantiation to that section.

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		recommendations enunciated in the recommendations will require Rulemaking. Bell Helicopter and other industry members caution the FAA to carefully keep policy and guidance contained to the current codified Federal Aviation Regulations.			
Bell Helicopter Textron	Page 12 Aircraft Owners/ Operators (Air Carriers and General Aviation)	We would agree that lack of standardization in the application of rules and policy is the biggest problem. The fact that Flight Standards District Office's and Manufacturing Inspection District Offices can have desperate interpretation creates cost for OEMs and wastes resources with no safety benefit. The difference in delegation interpretation is another area of cost for industry. There is an indirect safety benefit. Costs			**Agree,** the RAF Team also recognizes that non-standardization not only across Aircraft Certification but also between AIR and AFS has been a significant contributor to past difficulties. The FAA also recognizes that industry has additional burdens to meet EPA, OSHA, DDTC and other regulatory requirements beside what FAA requires. That creates a daunting task for industry. **Action taken:** Report revised

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		of repeating or meeting FAA "demands" moves resources from specific safety programs to "no value-added" work.			to note these issues
Bell Helicopter Textron	Page 13	The holding back of ICAs comment is a weak argument. When repairs compromise the integrity of the design and the inherent safety that is embedded, it is in the public's best interest and the owner/operator for TC/PC to not authorize a repair. As is stated in the report, the repairs must meet the design requirements of the 14 CFR.			**The intent** of that section is not for when a TC holder, based on an objective risk assessment, states in the ICA that a part should not be repaired. Some TC holders have removed existing repairs from the ICA or not put new repairs in the ICA but still send customers to a repair station that they, the TC holder, own where the repair is available. That practice is not illegal, but it is merely a statement that owners/operators do not like that practice since it limits their flexibility and perhaps the best cost of obtaining a repair. **Action taken:** No change to report

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Bell Helicopter Textron	Page 14	The question of warranty or customer support begs a different question. At what point does the embedded new parts/PMA compromise the Type Design of the product? This question speaks to the interpretation of 14 CFR part 43.13 to return a product to "equal to or better . . ." design standard. The point being that the design standard is only understood by the OEM not the PMA holder. As an example, the EC-120 chapter 5 limitations contain a statement that says all repairs not called out in the repair manual must be coordinated with Eurocopter Customer Service. The NTSB Administrative Law Judge agreed in an Emergency Revocation Order for the Standard.			**The FAA understands** the concern but the FAA regulations require that no repair an appreciable effect on the type design and that no alteration may have an appreciable effect on the type design unless it is approved via an STC. The RAF Team is not familiar with the cited case. However, such a broad unsubstantiated statement in the limitations section of the ICAs is inappropriate and there is no regulatory basis to require or adhere to it. Only the Regulatory Authority (i.e.; FAA in the U.S.) can establish limitations and conditions and not the TC holder. Be aware that an NTSB judge's ruling in the specific context of one appeal case does not constitute a general rule or policy change on behalf of the

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					entire FAA. **Action taken:** No change to the report
Bell Helicopter Textron	Page 21 Conclusion 2	The statement: "The AVS RAF Team concluded that it is not within the FAA's authority to regulate industries economic decision except where they would have an unacceptable adverse effect on safety." is troubling. The earlier elements on TC/PC holders owning repair stations, PMA, etc., (pages 15-16) shows that the FAA did discount the business relationship and subsidiary relationships and further ignores the financial liability that the TC/PC holder assumes. A PMA company could easily declare financial insolvency, close operations, abandon the PMA's and reopen with a new name. The same would not hold true for a TC holder.			**The FAA disagrees**. There have been instances of abandon TCs and STCs. Also, keep in mind that in the U.S. regulatory system, regardless of the existence or viability of a TC, STC, PMA or repair holder the owner/operator is always responsible for the continued airworthiness of the aircraft. FAA understands that the financial liability of a major TC holder may be substantially greater than a PMA holder. That liability is a business decision that any TC holder decides they will take on when they apply for a TC of a complete product rather than a part. **Action taken:** No change to the report

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Bell Helicopter Textron	Page 23 Conclusion 2	Bell Helicopter agrees that either rulemaking or policy is needed to clarify the extent and engineering substantiation of minor and major repairs. It is not enough to use: If it is not a major repair then it is a minor repair. The delineation of this must be sufficient to insure standardization. It must also clarify what repair(s) cross the threshold into an STC.			**Agree** **Action taken:** No change to the report
Bell Helicopter Textron	Page 24 Conclusion 3	Bell Helicopter agrees that "Non TC/PC holders . . . " are not being held to the same level compliance. This can and will be further exasperated by ODA designation to non OEM's. Bell Helicopter is also concerned the inadequate design data issue will continue to grow with the additional growth of the repair/overhaul business.			**The FAA agrees** with the concerns. Lacking any direct knowledge of the TC holder's proprietary/intellectual data, the FAA as well as non-TC/PC holder applicants must make all the necessary comparative analysis and tests to substantiate that a repaired part or fabricated replacement part is at least equal to the original part with respect to airworthiness. That is what

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		The linkage from AC 120-77 to normal category aircraft is tenuous at best. There is in this case an inordinate attention to large transport category aircraft. The fallacy is the most large transport aircraft are covered by an operating rule maintenance program that is thorough. This is not the situation with normal category aircraft. Bell Helicopter agrees that rulemaking and AC guidance material are required to define major/minor repair definitions. And, such guidance should define the qualifications and regulatory currency (14 CFR 1-59) for persons approving or designing repairs/overhauls. In may instances foreign regulatory agencies routinely request the OEM's concurrence to both minor and major changes to our type designs either done by			the current regulations require. This may not be an easy task. Some applicants may not be up to that task and their applications should be rejected. In the case of major changes to the type design or when adequate data is not evident, full certification re-testing by non-TC/PC holder applicants will be necessary. **Action taken:** No change to the report

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		repair stations or the STC process. There is a general lack of awareness of the complexity of design, the assumption in a design, the assumptions used in a *Failure Mode and Effects Analysis* and analyses that supports the ICAs. If the non-OEM entity attempts to copy this that could create a safety concern. How does the FAA propose to insure that the integrity of the Type Design is not compromised? Unless the FAA is completely familiar with the Type Design, the FAA is not able to insure there is not compromise of the safety level inherent in the already-approved design.			
Bell Helicopter Textron	Page 27	Bell Helicopter agrees that the two biggest concerns are data approval integrity and quality control of the repair/overhaul.			**Agree** **Action taken:** No change to the report

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Bell Helicopter Textron	Page 29 Conclusion 5	Bell Helicopter is not completely in agreement that the particular FAA office's awareness of or familiarity with an OEM should be discounted. If this were the case, why was PMA on rotating high energy parts retained by the Engines and Propeller Directorate? This element should be considered on a case-by-case basis.			**Agree;** the FAA's Directorate system was designed to assume that any ACO could adequately service an applicant. Experience has shown that to not be the case due to staffing limitations and lack of product knowledge and access to type design data. However, even FAA offices that oversee a TC holder can lose their "corporate knowledge" on a product because of staff turn-over. The FAA is currently developing a staffing skills management process and a risk based resource targeting methodology to help alleviate those concerns. **Action taken:** No change to the report
Bell Helicopter Textron	Page 32 Conclusion 7	The "need" for ICA's for repairs/PMA is recognized. The bigger issue to be dealt with is how to handle the already exiting parts/repairs			**Agree,** The FAA is currently working on repair specifications management policy although that will only be one part of the

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		without ICA's.			solution. **Action taken:** No change to the report
Bell Helicopter Textron	Page 33 Conclusion 8	This is a false and misleading conclusion. The issue may be more accurately framed as does this OEM have any responsibility when the service difficulty is directly linked to a repair or PMA part? The FAA is obliged to oversight the repair station or PMA company. The FAA logic also fails in that it is probably more appropriate for the owner/operator to pursue the repair station or PMA company.			**The FAA agrees** that not all TC/PC holders lack objectivity when non-TC/PC holder parts are involved in a service event. The ultimate obligation of the owner/operator is also a valid point. **Action taken:** Report revised to acknowledge that fact
Bell Helicopter Textron	Page 34 Conclusion 9	The underlined statement referring to approval methodology and level of certitude is troublesome. The OEM had to show compliance the pertinent elements of 14 CFR parts 1-59. This should also hold for a repair holder or PMA.			**FAA disagrees**. The current regulatory basis assumes that because the original TC/PC holder part already complies and conforms; and thus it can be used as a basis for comparative test and analysis. Only where that comparative approach can

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					not be validated, would the FAA require direct compliance testing. Major alterations on the other hand would be more likely to require direct compliance showing because of differences in design from the TC/PC holder parts. **Action taken:** No change to the report
Bell Helicopter Textron	Page36 Conclusion 10	This issue is the integrity of intellectual property. It is also an issue of sunk cost the TC holder has via it's investment. If the FAA is convinced of this position then complete an economic impact as required for an NPRM.			**The FAA understands** the cost a TC holder expends to develop a complete product. However, the FAA will not preclude an owner/operator from repairing or altering their aircraft in the most cost effective manner, if they can do it safely and in compliance with applicable standards, just to protect a TC holder's aftermarket business. **Action taken:** No change to the report

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Bell Helicopter Textron	Page 38	Bell Helicopter agrees that rulemaking is required to define a critical part.		Recommendation 2	**Action taken:** No change to the report
Bell Helicopter Textron	Page 40	The FAA has too narrowly considered in the *"Boundaries & Conditions"* the content of AC 120-77. We agree that it needs revision and the next revision should have a distinction between Transport Category (Parts 25 & 29) and Normal Category (Parts 23 & 27). This is implicit in that there is a different level of certitude between Transport and Normal Categories.		Recommendation 4	**Agree** **Action taken:** Report changed to emphasize that point.
Bell Helicopter Textron	Page 41	Bell Helicopter believes that rulemaking within Part 43 will be required to clarify the intent of major/minor. We agree that best practices will need further guidance but that the distinction will also need rulemaking language.		Recommendation 6	FAA will take that under consideration during that project work **Action taken:** No change to the report

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Bell Helicopter Textron	Page 42	In the Boundaries & Considerations, Bell Helicopter is dubious of the "industry" reference. This element should be considered very carefully and any input to a Rulemaking and guidance effort from "industry" should be weighed with an eye toward the protection of intellectual property.			**Agree** **Action taken:** No change to the report
Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)	Page 10 Stakeholder Analysis	It is not helpful to have such a generic statement as "…*that cause them to lose sight of what their primary regulatory responsibilities are*." This may also be factually untrue for most of the stakeholders.	Most stakeholders are well aware of their regulatory responsibilities	Delete this sentence from the report	**Agree**, The intent of the report is to indicate that some stakeholders did not understand the regulatory obligations of other stakeholders thus adding confusion to the diverse views. **Action taken:** Revised report

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ESG	Pages 21 and 22 Conclusions 2 and 3	It is accepted that it is difficult to establish the extent of a repair or fabrication before it is necessary to obtain a PMA but assessment of the design changes introduced by a repair and their effect on the airworthiness of the product should be made.	Experience has shown that repaired parts may have been substantially remanufactured and may be significantly different to the original design	Adequate oversight of the extent of repairs and the categorization of repair vs. alteration vs. change to type design must be ensured. Clear definition of the criteria for major/minor categorization within this structure is essential.	**Agree**, The report recommends addressing Major-Minor determination best practices and assessing repair data submittals for whether or not they are truly a repair versus an alteration or a type design change. That will necessitate clarifying whether the action is a repair versus an alteration under CFR 1.1 and 43 versus a major change to the product's type design under CFR 21. **Action taken:** No change to report
ESG	Page 26 Conclusion 4	ESG strongly encourage consistency between the FAA and EASA definitions of Critical Parts and the recognition of the importance of influencing parts	The importance of parts which influence the critical characteristics of Critical Parts is already recognized in CS-E and the concept is included in draft AC 33-70 – Y	Harmonization wherever possible between EASA and FAA regulations.	**Agree**, on the need for harmonization. However, Draft AC 33.70-Y does not define critical other than to imply that Life Limited parts are critical. That is consistent with the current CFR Part 45.14 which identifies critical components as those subject to an

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					Airworthiness Limitation. There are other parts that would be defined as critical under EASA CS-E that in the U.S. system would not have an Airworthiness Limitation placed on them. EASA has defined critical parts by regulation (Specification) but the FAA has not except for helicopters (CFRs 27 & 29.602). EASA's CS-E requires all critical parts to be life limited whereas FAA rules say Life Limited parts are critical but not all critical parts have to be Life Limited as they do in the E.U. Part of an adequate safety assessment for approval or acceptance of any repair or alteration whether major or minor must be assessing the impact not only on the part but also on the rest of the product (aircraft, engine or propeller). **Action taken:** Report revised

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					to recognize influencing parts and need for safety assessments in Rec. 3.
ESG	Page 33 Conclusion 8	These generic comments may unfairly represent the position of some stakeholders. TC holders will always try to carry out an objective investigation of service events. However, once it has been established that the cause of an event is due to the failure of a non-TCH part, for liability reasons they may choose not to continue the investigation other than to establish whether there were any unforeseen problems with TCH parts. EASA AMC to CS-E 515(6)(a) contains recommended wording to be included in the appropriate section of the Airworthiness Limitations Section (ALS) of the ICA.	EASA approved wording is considered as objective	Delete Conclusion 8 from the RAF Team report	**The FAA agrees** that not all TC/PC holders lack objectivity when non-TC/PC holder parts are involved in a service event. Conclusion 8 will however be retained. It reflects one of the principle reasons that the RAF Team was formed because of certain numerous allegations by certain TC/PC holders. The vast majority of the allegations were unfounded and data/information presented by TC holders was occasionally incomplete or skewed to support their arguments. Certain TC holders were not simply stopping their investigation and turning it over to the authorities when they discovered a part that was not manufactured or repaired by someone else.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					Regarding AMC CS-515; it states in part: "For Engine Critical Parts and parts that influence Engine Critical Parts, any repair, modification or maintenance procedures not approved by the Type Certificate holder, or its licensees, or any substitution of such parts not supplied by the Type Certificate holder, or its licensees, may materially affect these limits." That statement is actually in error. The FAA's position is that any repair, modification, maintenance procedures or any substitution of influencing parts, <u>even if developed by the Type Certificate holder, shall not appreciably affect</u> those Airworthiness Limitations. If there is any appreciable affect then the Airworthiness Limitations must be amended by an amendment

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					to the TC or an STC. **Action taken:** Report revised to acknowledge the fact that lack of objectivity during investigations is not a universal characterization of all TC holders.
ESG	Page 37-38 Recommendation 1	For engine parts, ESG supports maintaining the current regulatory and policy structure with improvements allowing a more consistent regulation that addresses, with the same rigorous manner, approval of: – Fabrication of parts during maintenance of higher level assemblies and subassemblies, which do not constitute a major change to the type design. – Fabrication of Owner Produced Parts, which do not constitute a major change to the type design.	If any time during a fabrication, repair, alteration, or PMA, a material or a material process is changed, that could have an appreciable effect on the structural strength, reliability, or other characteristics (like life) affecting the airworthiness of the product, it should be considered as a change in type design, and approved in an appropriate way. Current regulation contains some terms and definitions which are difficult to understand such as the difference between alteration and change in type design, and major alteration or major	Add to recommendation 1, page 37 – 38: Maintain the current regulatory and policy structure which permits: (…) – STC of major changes to the type design regardless of criticality, but Improve it for engine parts in order to address all the different ways in which a change in type design can be introduced. This will allow approval of design changes to be approved in the same consistent way.	**Agree with the recommended change** to the report and the conclusion that major alterations under CFRs 1.1 and 43 need to have a comparable rigorous compliance assessment. **However**, **FAA disagrees** with the conclusion that all major alterations under CFRs 1.1 and 43 would qualify as major changes to the type design under CFR 21 thus requiring an STC. **Action taken:** Report revised although this does not address the full intent of the commenter's point. The FAA is taking steps to assess during the approval process

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		– Repairs of parts, which do not constitute a major change to the type design – Alteration of parts under 14 CFR 43, Maintenance, preventative maintenance, rebuilding, and alteration, regardless of criticality to any extent which does not constitute a major change to the type design – PMA of parts regardless of criticality which do not constitute a major change to the type design – STC of major changes to the type design regardless of criticality. All these physical actions to parts should be considered as changes in type design, as defined in CFR 21, classified minor or major, as defined in CFR 21.93, and approved in a same consistent manner.	repair and major change in type design. For example, as defined in CFR 1.1, *Major alteration* means an alteration (…) *(1) That might appreciably affect weight, balance, structural strength, performance, Powerplant operation, flight characteristics, or other qualities affecting airworthiness (…)* As defined in CFR 21.93, *a "minor change" is one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the product. All other changes are "major changes"* By these definitions, a major alteration or a major change in type design seems to have same effect on the product and should be approved in the same rigorous and		whether certain major repairs and major alterations are really major type design changes and thus should require an STC. Policy is being developed on the determination of major/minor under CFRs 21.93 and 21.113. Also, best practices guidance is being develop for major/minor determination under CFRs 1.1 and 43.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			consistent way.		
ESG	Page 38-39 Recommendation 2	ESG support a simpler, clearer and more efficient regulation that defines that all repairs, alterations and fabrications of any extent for critical parts are automatically defined as major repairs or major alterations as appropriate and thus require FAA approved data.	ESG consider that criteria to define the desired outcomes quoted in page 38 to evaluate the effectiveness of recommendations regarding major/minor determination and development of acceptable data for critical parts would be very difficult to define. On an other point, when taking the example of an engine disk as a critical part, 99% of disk areas are critical areas and some process on remaining area could damage a critical area (like electro -marking or electro-machining), if not done properly. So ESG consider that it would be simpler, clearer, safer and more efficient if all repairs, alterations and fabrications of any extent for critical parts are	Delete following words from recommendation 2: *"As the other AVS RAF team recommendations regarding major/minor determination and development of acceptable data for critical parts are being implemented periodic evaluations of their effectiveness should be conducted. If the desired outcomes are not adequate then"* Add to § Product / Deliverable: Ensure consistency of major/minor definition for repair, alteration and change in type design. Change § Boundaries & Considerations by : "Ensure consistency between major/minor under CFR 43 and major/minor type design changes under CFR 21.	**FAA agrees with the conclusion** that the vast majority of work done on a very critical part such as a turbine disk would be major. **However**, criticality is a relative term and all critical parts are not equally sensitive. The impact of such a regulatory shift to any and all repairs being major for certain parts, and whether there is a valid safety benefit to do that, requires a more in-depth objective evaluation than was conducted by the RAFT. **Action taken:** The FAA will be reconsidering the issue of making all repair and alteration actions on certain parts major when we are developing guidance on major/minor determination with the assistance of

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			automatically defined as major repairs or major alterations as appropriate and thus require FAA approved data.		industry stakeholders.
ESG	Page 39 Recommendation 3	ESG support clarification of guidance on what constitutes a "Critical Part". For that, ESG support maintaining alignment with EASA harmonization effort, and consider that definition of EASA CS-E 15 and CSE 515 (Engine Critical Part) and CFR 33-70 (Engine life-limited parts) are very close. However, ESG consider that EASA CS-E 15 is simpler and clearer. ESG propose that Influencing parts be identified, not as a new category of part, but as parts for which changes are to be carefully studied for their potential influence on Critical parts. ESG propose that Influencing	FAA regulations contain several definitions of words "Critical part": §33.70, AC 33.4-2, AC 43- 18, Order 8110.42B, etc. A simple, and clear definition such as the EASA definition would be more easily understood by industry which would help safety. As there are many more parts and components that can significantly degrade safety margins or create unsafe conditions if not managed appropriately, ESG proposes that Influencing parts be identified, not as a new category of part, but as parts for which changes are to be carefully studied for their potential influence on	Add to § Boundaries & Considerations: Don't create new or extra unnecessary category(s) of parts, but take into account influencing parts as mentioned in CFR 33.70 and draft AC 33.70-Y.	**Agree**, Part of an adequate safety assessment for approval or acceptance of any repair or alteration whether major or minor must be assessing the extent of its on not only the part but also on the rest of the product (aircraft, engine or propeller). **Action taken:** Report revised

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		parts be identified, not as a new category of part, but as parts for which changes are to be carefully studied for their potential influence on Critical parts.	Critical Parts. Such influencing parts are considered in draft AC 33- 70 –Y and are already addressed in AMC to CSE 515(3)(h)		
ESG	Page 40 Recommendation 4	ESG support a clarification of the differences between repairs, alterations and change to type design. If this clarification is consistent with current regulation, especially CFR 21, ESG support requiring all major repair, major alteration, fabrication and PMA submittals for design data approval be evaluated for whether or not they are a.) Properly classified as a repair or alteration and b.) A major or minor change to the type design in accordance with 14 CFRs 21.113, Requirement of supplemental type certificate, and 21.93, Classification changes in type design.	ESG consider that regulation will be simpler, clearer, and more consistent if all repairs and alteration are considered as type design changes per CFR 21.93 Under this consistent point of view, ESG consider its own repairs as design changes and get approvals in the same manner.	Add to § Boundaries & Considerations: Clarify definition of repairs, alterations, fabrication, and design changes for more consistency and clear distinction.	**Agree** **Action taken:** Report revised

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
ESG	Page 41 Recommendation 5	ESG support this recommendation for a more consistent regulation. ESG does not know what the "*new 14 CFR* *21 phase 1 FAA project*" is, and would like to have information on it to better comment this recommendation.	Under EASA design approval rules, ESG has the same quality control procedures for repairs and new parts.		**14 CFR 21 Phase I** is the recent rulemaking changes to the production requirements. CFR 21 Phase II which has not yet started will be changes to the engineering requirements. This will accomplish a common quality system approach for PMA but not repairs. **Action taken:** Report revised to eliminate reference to Phase 1 which is just an FAA internal name for our most recent CFR 21 rulemaking project. Another CFR 21 rule change is already being planned which is referred to as Part 21 Phase 2.
ESG	Page 41-42 Recommendation 6	ESG support this recommendation. ESG propose to participate in the working group on best practices.	ESG consider that regulation will be simpler, clearer, and more consistent if all repairs and alteration are considered as type design changes per CFR 21.93. Under this consistent point of view, ESG consider its own repairs as	Change § Boundaries & Considerations: For more consistency, clarify definition of major/minor repair or alteration determined under 14 CFRs 1.1, Definitions and abbreviations, and 43, Maintenance, preventative	**Agree** **Action taken:** Report revised.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			design changes and get approvals as a same manner.	maintenance, rebuilding, and alteration, versus major/minor type design changes under 14 CFR 21, Certification procedures for products and parts.	
ESG	Page 42-43 Recommendation 7	ESG support the recommendation for better skilled people in charge of approval control and major/ minor type design change evaluation assistance.			**Agree** **Action taken:** No change to report
ESG	Page 43-44 Recommendation 8	ESG support the improvement of marking requirements, especially to identify the approval holder. ESG supports the use of part numbers different to those of the TCH P/N	As Owners / operators are responsible for the configuration of their product in service, a marking requirement clearly identifying the approval holder would help them to bear this responsibility. Use of part numbers different to the TCH part number will avoid any confusion in part definition, function, and maintainability.	Change § "Product/Deliverable: *14 CFR 43 AC guidance on part identification for all repairs, alterations, fabricated parts and owner produced parts mirroring the existing guidance in AC 43_18, Fabrication of aircraft parts by maintenance personnel"* by adding at the end "except the original manufacturer's part number which must be removed to avoid any confusion"	**Disagree**, The U.S. regulatory system permits retaining the original type design part number unless a major alteration is accomplished which affects the installation compatibility or in the case of a PMA part. The FAA does agree on the need for supplemental marking as a means to trace who performed maintenance on parts. **Action taken:** No change to report

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ESG	Page 44 and 45 : Recommendation 9 Objective Boundaries & Considerations:	ESG supports the development and deployment of repair, alteration and PMA compliance guidance templates for applicants to use when developing data packages for approvals for aircraft engines types. In particular these templates must include checking that engine system effects caused by repaired, altered, or PMA parts on other engine parts are addressed to show compliance with CFR33 AIRWORTHINESS STANDARDS AIRCRAFT ENGINES requirements. These templates must obviously address life limited parts, but also influencing parts , as defined in draft AC No: 33.70-Y	Experience has shown that uncontrolled engine system effects can affect life limited part life. Accurate substantiation that engine system level effects are addressed by repairs, alterations or PMA applicants is necessary to maintain a high level of integrity and reliability for engines which incorporate repaired, altered or PMA parts. CFR 33.70 requires that the applicant will establish the integrity of each engine life-limited part by an engineering plan (…), including effects of influencing parts. These templates should therefore address not only critical parts but also influencing parts:	Add influencing parts to following paragraph: "Objective: Improve the scope and consistency of the data that supports showing of compliance for repairs, alterations and PMA to manage the integrity of data approvals for major repair, major alteration and PMA of critical parts and influencing parts. Focus is on managing the integrity of data for major repair, major alteration and PMA of critical parts and influencing parts.	**Agree** **Action taken:** Report revised

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ESG	Page 45: RECOMMENDATION 10	ESG supports the revision of AC 120-77, "*Maintenance and Alteration Data*" to standardize and extend the applicability to all maintenance providers and product types and to incorporate other pertinent input related to the other AVS RAF team recommendations. This revision must be linked to the other recommendations of this report covering more clear and precise definitions of words "repair", and "alteration", more precise guidance for "major" classification, and compliance data templates..	AC 120-77 should be consistent with other recommendations in this report, and associated comments made by ESG. As experience showed that some repairs were in fact alterations, and that "major" was not understood in the same manner by all the industry, definition and guidance should be clarified in this AC, consistently with all related CFR.	Add reference to "major" classification guidance to following paragraph: Boundaries & Considerations: Consider reference to CFR and AC defining « major », and taking into account other related recommendations of this report (2, 4 and 6) Clearly define the difference between a repair and an alteration.	**Agree** **Action taken:** Report revised
ESG	Page 46: recommendation 11	ESG supports that FAA will continue the implementation of COS programmes and SMS with PMA holders, repair stations, and air carriers with the assistance of MARPA and ARSA for all			**Agree** **Action taken:** No change to report

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		product types. A wider communication on these programs should be welcome.			
ESG	Page 47: recommendation 12	ESG supports the revision of 14 CFR 21.3, Reporting of malfunctions, failures, and defects, to be applicable to any design, production, fabrication or maintenance approval holders that for failures malfunctions or defects introduced by their respective design or their performance of manufacturing, fabrication or maintenance work. ESG also supports the revision of 14 CFR 21.4, ETOPS reporting requirements to ensure alignment and eliminate redundancy of reporting requirements. It would be useful to clarify what is meant by "*elimination of redundancy of reporting requirements*".	Equity and standardization of reporting requirements should be ensured across all approval holders for their respective products and parts. Experience has shown that inappropriate or improperly done repairs and alterations can cause malfunctions, failures, and defects.		**Agree** **Action taken:** Report revised to clarify the CFR 21.4 redundancy issue in the conclusions and recommendations sections.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
ESG	Page 47: recommendation 13	ESG supports revision of 14 CFR 21.99, Required design changes, to make the requirement applicable to all design and data approval holders. It is necessary to clarify what is meant by "*phase II Part 21*".	Standardization of requirements for developing safety related corrective actions across all approval holders, for their respective products and parts, should be ensured. Experience has shown that inappropriate or improperly done repairs and alterations could require design change.		**Agree**; **However**, the commenter should be aware that 14 CFR 21.99 is not intended to address the situation where the design is adequate but a repair or alteration is "improperly performed" by an owner/operator or maintenance provider. It is aimed a design shortfalls. **Action taken:** Report revised eliminate ref to Phase II
ESG	Page 48 and 49: recommendation 15	ESG supports Development of Advisory Circular guidance to require that all repairs and alterations need ICA assessments consistent with the AIR ICA Order 8110.54. This AC must recognize that TCH has the right to state in its ICA that the TCH has no data to validate airworthiness limitations and technical data for Life Limited Parts operated in conjunction with	A Type Certificate Holder publishes and periodically updates Instructions for Continued Airworthiness for TCH Life Limited Parts in accordance with 14 CFR 33.4 (FAA) and CS-E (EASA). All technical documentation and information contained in TCH ICAs for Life Limited Parts, including assembly and disassembly, cleaning, inspection methods and limits, repair methods and	FAA should add in the boundaries and considerations paragraph what are the warnings or restriction that TC/PC holder place in the ICA which are not strictly related to maintaining the airworthiness of the product. Add that the FAA understands, as it is stated in SAIB NE-08-40, that "the TC/PC holder has no knowledge or data about the	**Agree** **Action taken:** Report revised

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		non-TCH attaching parts, and that the TCH does not endorse their use. FAA should define what are the non-airworthiness information.	limits, operational limits, life limits and the like are predicated on the use of TCH attaching hardware. TCH ICAs apply to TCH Life Limited Parts operated in TCH approved configurations. For this reason, a TCH does not have the technical capability to provide technical advice or continued airworthiness support for TCH Life Limited Parts operated in conjunction with non-TCH attaching parts. This is fully consistent with recommended wording to be included in the appropriate section of the Airworthiness Limitations Section (ALS) of the ICA, which is contained in EASA AMC to CS-E 515(6)(a).	PMA and STC parts installed in the product and, therefore, can only assess the airworthiness and systems effects of their parts installed in the product", for a TCH known configuration.	

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Industria de Turbo Propulsores S.A. (ITP)		ITP's comments were identical to the Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)			**Disposition of all comments is the same as for ESG**
MTU		MTU's comments were identical to the Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)			**Disposition of all comments is the same as for ESG**
TURBOMECA		Turbomeca's comments were identical to the Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)			**Disposition of all comments is the same as for ESG**
Volvo Aero		Volvo Aero's comments were identical to the Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)			**Disposition of all comments is the same as for ESG**
Snecma		Snecma's comments were identical to the Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)			**Disposition of all comments is the same as for ESG**

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Pratt & Whitney	Page 21 Conclusion 2			P & W strongly recommends Conclusion 2 be included verbatim via revision to AC 43-18 under the added definition Repair.	**Agree** **Action taken:** Revised report to note in recommendation
Pratt & Whitney	Page 37	Fabrication of parts during maintenance of higher level assemblies and subassemblies. Fabrication of Owner Produced Parts. Repairs to parts of any extent that restores it, short of 100% fabrication, which the applicant determines is more economic than purchasing or fabricating a complete new part. Altering parts under 14 CFR 43, Maintenance, Preventive Maintenance, Rebuilding, and Alteration, regardless of criticality to any extent which does not constitute a major change to the type design. PMA of parts regardless of criticality which do not constitute a major change to the type design. STC of major changes		P & W concurs with Recommendation 1. Maintain the current regulatory policy structure which permits.	**Agree** **Action taken:** No change to report

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		to the type design regardless of criticality.			
Pratt & Whitney	Page 30 Conclusion 6	P&W does not agree with the Conclusion 6 that part marking is not a safety concern. P&W recommends that FAA advisory material be revised to allow maintenance providers to, as illustrated I the example below, strike out the "as-received" part number and replace it with the "up-changed" Design Approval Holder part number that actually reflects the true configuration of an altered part modified using FAA approved technical and substantiation data outside the Design Approval Holder's (DAH) ICA. If this is not done, the actual configuration of the part will be misrepresented, based on the			**Agree** with the commenter's concern that altered parts where the installation compatibility has been affected should be marked in order to ensure that a wrong, incompatible part is not installed. That would not be the case for repaired parts, including fabricated parts pursuant to higher level maintenance since those scenarios are required by regulation to return a product to its original or properly altered condition and thus should <u>not</u> be altered to a configuration that is incompatible with the product that it is being installed in to. **Action taken:** No change to

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		number physically placed on a part. Should there be an Airworthiness Directive (AD) on the "up-changed" part; the "misrepresented" part would not be identified in the applicability section of the AD. Therefore, this would be a safety of flight concern. Also, unless there is clear guidance and policy for marking altered parts, they may be considered as SUPs. Additional supplemental markings should also be required for traceability purposes to distinguish a part that was repaired or altered using a third party's FAA approved technical and substantiation data from a part maintained in accordance with the DAH's ICA. This approach is consistent with the logic employed in AC 43-18 and is not contrary to the regulations.			the report.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		Example: As received DAH Part Number-1944M64G02 Post repair or alteration F+DAH part number (up-changed part number) would appear as follows 1944M64G02 2033M64G02 (TWP 07XX123) This approach embodies the same logic as the part marking requirements defined in AC 43-18. It provides reference to the entity performing the maintenance, it distinguishes the part from a part repaired or altered in accordance with the DAH ICA by crossing out the old part number, and it maintains reference to the original part number. The same language utilized with the respect to marking critical parts in AC 43-18 could be utilized within this proposed methodology. The			

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		up-changed part number and the engine build configuration would indicate the actual configuration of parts.			
HEICO	All	The RAFT Study is a very thorough and objective report. After a detailed review, it is clear that this report represents a fact based and unbiased view of the current state of the commercial aviation industry. The FAA has very accurately defined the overall views and regulatory/industry facts about aftermarket parts and repairs. The wording, structure and organization of the study make it very "user friendly" to owner/operators and MROs.	The study accurately assesses the adequacy of current and pending regulations, policy, guidance and past practices for obtaining approval for non-TC/PC holder developed replacement parts and repairs. The accuracy and depth of information in this study has provided very helpful guidance to airlines and MROs by clearly stating the useful applications of the current regulations and policies as these "customers" are insuring continued airworthiness for their aircraft and engines.	HEICO recommends to AVS that the RAFT study report remain as drafted in the final version V7. This is an objective, well written and well organized document.	**The FAA appreciates** the commenter's view. Certain changes where appropriate based on consideration of all stakeholder's comments will be made to the report but the overall context will remain intact. **Action taken:** no changes made specific to this comment
HEICO	All	HEICO will support the FAA and provide any appropriate assistance in	Cooperation between MARPA and the FAA has proven to be effective and	MARPA and HEICO will maintain ongoing contact with the various FAA offices	**Action taken:** No change to report

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		implementing the recommendations in the study related to clarification, efficiency and standardization of applicable rules and	has produced helpful guidance material for the FAA and the industry. HEICO will continue to support MARPA in these safety improvement efforts.	and recommends that the FAA contact MARPA or HEICO anytime as appropriate for support of the FAA business performance plans.	
HEICO	Page 4 , paragraph 2	The sentence "Fabrication of aircraft parts by maintenance personnel" appears twice at the beginning of the paragraph.	Typo	Correct typo	**Agree** **Action taken:** changed report
HEICO	Page 24 In the Conclusion 3 block	Remove the word "***as***" from the last sentence in Conclusion 3.	Typo	Correct typo	**Agree** **Action taken:** changed report
HEICO	Page 24, paragraph 2, first sentence	We believe the word "***regulatory***" should be "***regulation***" in the context of the sentence.	Typo	Correct typo	**Agree** **Action taken:** changed report
HEICO	Page 33, Paragraph 1, 10th line on page	We believe the word "to" is missing and the sentence should read "The owner operator can choose ***to*** do exactly what …..	Typo	Correct typo	**Agree** **Action taken:** changed report

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HEICO	Page 36, paragraph 1, 5th line on page	We believe the word "than" is missing and the sentence should read ".objective investigations and reporting rather ***than*** fighting over…"	Typo	Correct typo	**Agree** **Action taken:** changed report
HEICO	Page 37, paragraph 1, 2nd line on page	The sentence is written ".test and analysis to ***should*** equivalency…". The word "***should"*** should be replaced with the word "***show"*** to correct context of sentence.	Typo	Correct typo	**Agree** **Action taken:** changed report
HEICO	Page 55, Paragraph 3, Paragraph 5,	***"His***" report… should be changed to "***This***" report….. Paragraph 5, 6th sentence, the word "*decides*" should be "***decided***".	Typo	Correct typo	**Agree** **Action taken:** changed report
Mark E.J.	Page B-18	The study cites "acceptable level of safety" at least 15	Acceptable level of safety is achieved at issuance of type	Delete every instance of the term "an acceptable level of	**Agree**

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
Fay Airworthy		times, but does not define it.	certificate, where aircraft engines have demonstrated compliance with §33.75 Safety Analysis, transport category airplanes have demonstrated compliance with §§25.571 and 25.1309, and all other type certificated products have demonstrated compliance with similar safety requirements in their respective airworthiness standards in 14 CFR. The requirement of transport category Maintenance Review Boards is to develop initial scheduled maintenance and inspection requirements for inclusion in the ICA as the means to maintain the level of safety demonstrated when the FAA approved the product's type certificate. This defines "in condition for safe operation," a component part of the definition of airworthy.	safety", and replace with "continued airworthiness" with following exceptions: Item 1, substitute as above, and delete the rest of the sentence after airworthiness; Item 2, delete "a common acceptable level of safety" and insert "continued airworthiness" in its place.	**Action taken:** changed report

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Mark E.J. Fay Airworthy	Page C-24			Second row, middle column, delete "to acceptable levels" in both sentences. Third row, middle column, delete "to acceptable levels.	**FAA agrees conceptually** but those are direct quotes from the referenced documents. **Action taken:** No change to report
Mark E.J. Fay Airworthy	Page C-26			Third row, middle column, delete "the acceptable level defined," and insert "that to which the product was certified to" in its place.	**FAA agrees conceptually** but those are direct quotes from the referenced documents. **Action taken:** No change to report
Mark E.J. Fay Airworthy	Page C-27			Second row, middle column, delete "our system in supporting the reduction of safety risk to acceptable levels," and insert "maintaining the continued airworthiness of the product" in its place.	**FAA agrees conceptually** but those are direct quotes from the referenced documents. **Action taken:** No change to report
Mark E.J. Fay Airworthy		The study, beginning bottom of page 10 states, "This diversification has caused TC/PC holders to lose sight of the different regulations and obligations they must meet as a TC/PC holder versus a repair station certificate	There are no differences in the requirements for production of a type certificated product, or its repair, alteration, or for the manufacture of a PMA or STC part. They all are required to be airworthy.	Strike the sentence.	**Agree**, The intent of the report is to indicate that some stakeholders did not understand the regulatory obligations of other stakeholders thus adding confusion to the diverse views. FAA agrees that

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		holder, PMA holder or as a leasing company owner of aircraft.	Airworthy is defined by; Title 49 USC §44704(d), which states, in part, "The Administrator shall issue an airworthiness certificate when the Administrator finds that the aircraft conforms to its type certificate and, after inspection, is in condition for safe operation." Type certificate is defined by §21.41 "Each type certificate is considered to include the type design, the operating limitations, the certificate data sheet, the applicable regulations of this subchapter with which the Administrator records compliance, and any other conditions or limitations prescribed for the product in this subchapter." Type design, operating limitations, and certificate data sheet are defined following. Applicable regulations, and other		ultimately the goal of all is to be "airworthy." However, the regulations and policy governing how to get to that end airworthy state is different for TC versus repair versus PMA. **Action taken:** Revised report to clarify

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			conditions or limitations prescribed are self-evident. §2131 "The type design consists of- a) The drawings and specifications, and a listing of those drawings and specifications, necessary to define the configuration and the design features of the product shown to comply with the requirements of that part of this subchapter applicable to the product. b) Information on dimensions, materials, and processes necessary to define the structural strength of the product; c) The Airworthiness Limitations section of the Instructions for Continued Airworthiness as		

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			required by parts 23, 25, 26, 27, 29, 31, 33 and 35 of this subchapter, or as otherwise required by the Administrator; and as specified in the applicable airworthiness criteria for special classes of aircraft defined in §21.17(b); and d) For primary category aircraft, if desired, a special inspection and preventive maintenance program designed to be accomplished by an appropriately rated and trained pilot-owner. e) Any other data necessary to allow, by comparison, the determination of the airworthiness, noise characteristics, fuel venting, and exhaust emissions (where		

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			applicable) of later products of the same type." Operating limitations are found in subpart G for Airworthiness Standards Parts 23, 25, 27, 29, which include the requirement for ICA, and in §§33.7 and 35.5 §§33.4 and 35.4 are the requirements for ICA for aircraft engines and propellers, respectively. Each type certificated product's type certificate includes the certificate data sheet. "The TCDS is a formal description of the aircraft, engine or propeller. It lists limitations and information required for type certification including airspeed limits, weight limits, thrust limitations, etc." (Ref http://rgl.faa.gov/RegulatoryandGuidanceLibrary/rgMakeModel.nsf/mainFrame?OpenF		

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			rameset) §91.7(a) "No person may operate a civil aircraft unless it is in an airworthy condition." §§91.405(a) and 91.409 require aircraft to undergo periodic inspections to determine their continued airworthiness. §1.1 Maintenance means inspection, overhaul, repair, preservation, and the replacement of parts, but excludes preventive maintenance. 14 CFR Part 43 prescribes rules governing the maintenance, preventive maintenance, rebuilding, and alteration of any aircraft having a U.S. airworthiness certificate. Specifically, §43.13(a) and §43.13(b) require data, equipment, tools, and performance of the maintenance, preventive maintenance, rebuilding, and		

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			alteration be done in such a manner that the condition with regard to aerodynamic function, structural strength, resistance to vibration and deterioration and any other factors affecting airworthiness. Every repair and alteration whether minor or major, affects airworthiness since airworthiness is conformance to the type certificate and in condition for safe operation. Until and unless there are better ways to determine minor or major, every repair and alteration, especially part fabrication, must at minimum perform the same FMEA/FMECA as required for original type certification in accordance with the type certificated product's certification basis.		

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Mark E. J. Fay Airworthy		"Level playing field" is cited at least three times as something all stakeholders want. There is no logical argument against all affected parties wanting a "level playing field."	Airworthiness is a condition required whether a product is a newly delivered product or has been in service for many years after being newly manufactured. The product, by law, must conform to its type certificate, and, be in condition for safe operation. Until all repairs, modifications, alterations, and other maintenance ensure that the product is airworthy in the legal definition of the term, we are all at risk, and there is no possibility of achieving a "level playing field."	Enforce the current regulations which require all civil aircraft to be airworthy for every flight, and the "playing field" will be "level."	**Agree**, consistency and standardization of applying requirements is a primary goal of the RAF Team's recommendations. **Action taken:** No change to report
Mark E. J. Fay Airworthy		Defining airworthiness as defined in the law underlying civil aviation in the United States is a first, necessary step in improving safety of flight while simplifying the labyrinthine interpretations extant in the	USC 49 §44704(d) is the source of "airworthy." Everyone involved in civil aviation needs to know and understand airworthiness, and that airworthiness is not a vague, undefined, notional concept but is the fundamental requirement for	Revise 14 CFR Part 1 to add Airworthiness, to wit: a) For a product, means conforms to its type certificate and is in condition for safe operation; b) For a part,	**Agree** with the commenter's intent. Airworthy is already inherent in the regulations and policy that lead to the FAA's issuance of a Certificate of Airworthiness for the aircraft. At the component part level the commenter is correct that the

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		current regulatory realm.	all civil aircraft, and is clearly defined in law.	component, subassembly, appliance, etc. which is part of a product, means conforms to its type design and is in condition for safe installation and safe operation when installed in a type certificated product.	results of a repair, alteration, fabrication, or PMA is that they conform to their approved design and be safe for operation in the product. The FAA will clarify that point in the recommended rule and policy changes resulting from the RAF Team's recommendations. **Action taken:** No change to the report
Argo-Tech Corp/Eaton Aerospace Buss		Argo-Tech believes it is unreasonable to expect safety will not to be affected if original design criteria are not used for the development and approval of alternative configurations of the fuel pumps we design and manufacture. To avoid difficulties with alternative configurations a thorough understanding of these design criteria is required. The design criteria used in product development are			**Action taken:** No change to report

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		based on years of research and decades of field experience. These criteria are applied during product development to insure reliable system performance. We note that these criteria and potential interaction with other parts is a prime concern of all type certificate holders during evaluation of any design criteria and hardware interaction will subordinate safety aspects of any design.			
Chromalloy Gas Turbine LLC	Page 29 Conclusion 5			History has shown that is **not** always the case.	**Agree** **Action taken:** Report revised
MCAMI	Page 38 Recommendation 2			MCAMI has significant concerns about the Report's Recommendation #2, which proposes to eliminate current major-minor repair language in 14CFR 43 and instead declare that all repairs and	**Agree** that the impact could be significant which is why the FAA will undertake other actions and evaluate their effectiveness before deciding whether or not to under take Recommendation 2 through

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				alterations of any extent to critical parts be classified as "major." This would inevitably lead to a vastly increased workload on already-limited FAA and FAA designee resources, which in turn would greatly increase the developmental timeline for any such repairs, as well as divert FAA and FAA designee attention away from other, more safety-critical tasks. It would also result in absurd situations such as having extremely simple and basic repairs/alterations like snap diameter skim cuts, removal of or insertion of snap-fit metering plugs, reapplication of anti-seize compound, or even re-identification of critical part P/Ns, all being declared as "major". These results would greatly increase the economic burden on lease companies	rulemaking. Neither the RAFT nor industry could find definitive data to substantiate concerns that the impact would be significant if the FAA required all repairs, alterations and fabrications of certain critical parts to be major. One operator stated that they developed 40 minor repairs to engine disks in a particular year. Forty additional repairs to be FAA approved for one air carrier in the scheme of a years worth of maintenance is not a large number. That operator's concern was not an added workload, because either way they have to develop the data. They were concerned about the substantial extra time it takes to get an approval processed through the FAA system. **Action taken:** No change to

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				and operators, without any corresponding increase in safety. MCAMI would like to request the Report's Recommendation #2 be removed, and to have the sole recommendation on this issue be Recommendation #6, which MCAMI believes is a more collaborative and appropriate method to improve the current major-minor decision-making process. With the regard to the fourth bullet item of the preamble in the Report's Recommendations section ("Improve the credibility and global acceptability of FAA approved repairs, alterations, fabrication, and PMA approvals"), MCAMI would like to request further details as to what the FAA's planned actions are in this regard. We agree with the Report stating that a major	the report

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				concern of independent Lease Companies (such as MCAMI) is the difficulty of transferring aircraft containing non-TC/PC holder parts/alterations/repairs between different regulatory jurisdiction who have widely varying views and acceptance of non-TC/PC holder parts, alterations, and repairs. Specifically, MCAMI would like to suggest the following: A) That the FAA consider adopting a 'two-track' approach to harmonization with other regulatory authorities, concentrating first on non-critical parts whose failure would not hazard the aircraft, and leaving the much more technically difficult (not to mention economically and politically charged)	

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				issue of non-TC/PC holder manufacture, alteration, and repair of critical parts "off to the side" until some later date. B) That, if the FAA wishes to consult with the stakeholders on this harmonization issue (and MCAMI recommends that this does happen), that the FAA consult with working groups of <u>both</u> owner/operators and aircraft leasing companies, instead of only the first group. Aircraft leasing companies own more than 30% of today's worldwide large commercial aircraft, and this percentage is forecast to increase to 40% or even higher over the next few years.	

APPENDIX D: COMMENTS TO FEDERAL REGISTER NOTICE & DISPOSITION

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Rolls-Royce plc		Rolls-Royce' comments were identical to the Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)			**Disposition of all comments is the same as for ESG**
AVIO		AVIO's comments were identical to the Aerospace and Defense (ASD) Industries Association of Europe; Engine Sectoral Group (ESG)			**Disposition of all comments is the same as for ESG**
Ben Granatek, FAA DER		Agree with report. Typo in CFR reference under "Liability" section, should FAR 45.16 be FAR 45.14 and/or 45.15?			**Agree** **Action taken:** Report revised
Southwest Turbine Inc.		We need a workable definition of "critical" engine part, and hopefully this will be one that EASA can use as well. My preference would be to narrowly define critical as those parts with airworthiness limitations based on fatigue life. Another thought is to have the TC holders publish a critical parts list for each product as is the			**Agree** **Action taken:** Report revised under Conclusion 4 to note the current confusion and inconsistency of the term "Critical Part."

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		case with rotorcraft, but given the competitive positions articulated in the Report, I am concerned that in the engine world this would devolve into yet another vehicle to stifle competition through unfair advantage.			
Southwest Turbine Inc.		We need to stay away from the highly subjective term "complex" as there is no easy way to define this, and as the Report pointed out, no compelling safety concern to justify a new category of parts.			**Agree** **Action taken:** No change to report
Southwest Turbine Inc.		The existing and proposed templates from ANE110 relative to turbine engine repairs and PMA parts need to be reviewed in light of the position articulated in the Report that a complete re-certification effort and line-by-line compliance finding with 14 CFR 33 is generally not required or justified for these submittals. The templates should then be re-written by someone other than			**Partly agree** **Action taken:** The templates will be re-evaluated as the ACs are further developed. The reference to the applicable CFR paragraphs in the templates does not mean that a repair or PMA has to be re-certified to each applicable paragraph. It

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		representatives of the TC holders. I don't have a problem with the template concept, just the present form.			only means that the repair or PMA should be assessed with respect to each applicable CFR paragraph to ensure that the original compliance to the product Certification Basis is maintained or rather is not invalidated by the design of the repair or replacement part. No change to the report.
Southwest Turbine Inc.		Provide language for designees similar to that found in 14 CFR 21.93 for TC holders to authorize and guide evaluation of minor design changes incorporated during repairs or alterations. The language of 21.93 is good, although this needs to be included in 14 CFR 43 (or other appropriate guidance) so it can apply to repairs and alterations.			**Agree** **Action taken:** No change to report. The FAA is currently developing guidance on determining major-minor type design changes under CFR 21.93.
Southwest Turbine Inc.		The major/minor designation is still problematic for minor repairs and minor alterations. In			**Disagree** **Action taken:** No change

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		the repair arena, our experience has been that even though we have FAA-accepted procedures in our repair station quality control manual to designate and perform minor repairs (using previously-*approved* data), the path of least resistance is to designate all repairs as "major" and approve the data on Form 8110-3. This takes the approval responsibility off the Flight Standards inspector, and although this may not be "right", it prevents disputes with inspectors and moves commerce forward which is ultimately the goal. This procedure became an issue when EASA reared its anti-competitive head and started questioning all FAA-DER approvals of major repairs. Since EASA is supposedly now accepting DER major repairs for other than critical parts, this may not be an issue any longer except where we disagree with			to report. The commenter seems to be leaning towards calling everything major merely to avoid disagreements. One concern to note in the comment is the implication that FAA Inspectors approve or accept data for minor repairs. That is not true. If a repair station or owner/operator, or other appropriately rated person determines that a repair is minor and that they are using methods, techniques and practices acceptable to the Administrator; that should be sufficient. A qualified person need only make a reasonable judgment in the context of the CFR and the work to be performed that the FAA would find it

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		EASA on what is critical hence the importance of the critical definition. The practical reality in our world (where getting along with Flight Standards is essential) is that it's much easier to just designate all repairs as "major".			acceptable. The FAA should not be "accepting" or "approving" minors before hand. If the FAA disagrees with a call after-the-fact then it is the duty of the FAA to prove that in the judgment of a reasonable qualified person it would not be judged minor and acceptable. Granted disagreements may arise but there are several avenues to resolve and appeal such disagreements. Certificate holders should not always concede to FAA opinion without due process or the balance will always remain slanted toward everything being called major.

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Southwest Turbine Inc.		In the alteration arena, we perform a number of repairs where the component may be altered to another approved design configuration using data specified in the approved repair process specification. I have classified as minor those alterations incorporated during the course of repair where a component is altered from one approved design to a configuration equivalent to another approved design provided any design changes can be substantiated as minor (currently using the definition of minor in Part 21.93 for lack of any other guidance). This is the "best practice" that has developed between our project ACO and FAA engineering advisors, and it would be helpful for designees if this were stated as policy.			**FAA disagrees with using "repairs" to "alter" parts and with automatically calling an alteration minor just because it is accomplished concurrently with a repair.** Alteration and repair are two different things. If the alteration how-to instructions are defined in the product specifications (e.g.; the manufacturer's ICA or a service bulletin, etc.) then it is automatically minor (see CFR 1.1) However, if the alteration is NOT in the product specifications then you must assess major/minor in accordance with CFR 1.1 Major Alteration Paragraphs 1. & 2. One should also note that

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					there is an "OR" qualifier between those two paragraphs. It is inappropriate to call all alterations accomplished concurrently with a repair "minor" just because some different altered end state part defined by the TC holder exists, especially when you have to independently develop the instructions on "how" to perform the alteration if the TC/PC holder has not provided those instructions to you in the product specifications. **Action taken: No change to report but FAA intends to clarify these areas in future policy.**

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Southwest Turbine Inc.		Finally, although it is implied, we would suggest clearly articulating the position that installation of a component part with a minor alteration as defined above does not constitute an alteration of the engine (product). The one time we attempted to obtain an EASA major repair approval (with two strikes against us; 1) the part was destined for a Euro state-of-design engine, and 2) the request was well before the current policy accepting DER major repairs), I actually had an EASA representative quoting draft ANE110 policy (that was still out for comment at the time) tell me that an STC would be required to install our repaired part in an engine because we incorporated a major design change (we added a diffusion coating applied to a previously uncoated area of nickel super alloy material that usually requires a coating for durability			**Disagree;** alterations should not be misrepresented as repairs. The repair and alteration even though applied to the same part must both be addressed separately in the determination of major-minor and the data and the records of work performed. It seems that EASA had a different view of the alteration being major even though the commenter called it minor. Whether or not the alteration was truly minor or it warranted an STC is another issue that will require a more detailed review. Be aware that Bilateral agreements with other countries may require things to be classified or done differently than they would in the U.S.

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		to address severe hot corrosion that was occurring due to the lack of coating in the original design), and that EASA would not recognize comparative analysis using reverse engineering as a basis for showing compliance with certification requirements. But that's a story for another day.			**Action taken:** No change to report. FAA is planning to develop guidance that will clarify the difference between major-minor under CFR 1.1 and 43 versus type design changes under CFR 21.93.
Mark Palajac		From my perspective providing an airworthiness certificate for an aircraft should be about the quality and reliability of the product, not who built how much of it. These latter concerns should be reserved for the certificate allowing [owners] to maintain their aircraft. …. I believe the focus should be on the airworthiness of the aircraft, not on who put it together. I also believe that the FAA should spend a bit more effort in ensuring that builders don't fraudulently represent their content so they can maintain it. I understand the FAA's concern			**Agree**, that is the key desired outcome of all the issues surrounding repair, alteration, fabrication and PMA i.e.; to maintain the airworthiness of the aircraft in service. **Action taken:** No change to report

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		over maintenance but not on the original determination of airworthiness.			
Robert J. Jones		One of the questions that was asked several times at the EAA Convention was **"what is fabrication".** The answer to this question is important because the how the FAA decides to answer that question will have a huge impact on the light aircraft industry. This question went unanswered at the EAA Convention. It is clear that the FAA wants their new rules passed, and then they will decide what fabrication is later. I think that if I mined some aluminum, smelted it, added the proper alloys, rolled it into a sheet, then cut a part for an aircraft out of it the FAA would agree that I had fabricated it. On the other hand I could buy an aluminum rib for an aircraft wing from some kit plane manufacturer that was stamped out by a big press. I would still			**Agree that the terminology can be confusing.** FAA unfortunately has promulgated various policy and guidance that has created context specific definitions which often are different. Although many of the same processes and practices are used in manufacturing, repairs, alterations, and fabrication of parts; the context of when, where and under what CFR the work is being performed affects one's understanding of the terminology. Fabrication in the context of this report is related to the fabrication

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		have to straighten the curve left in it from being stamped out with some fluting pliers. Then I would have to sand smooth all the edges, final ream all the rivet holes to size, de-bur all the holes, dimple the holes for flush rivets and then I would finally have it ready to rivet in place. That will probably not be interpreted as fabrication….			of parts in conjunction with, and that are consumed in, performing higher level maintenance under CFR 43. That is unfortunately different than how the term fabrication for home-build and the 51% rule is used, and how it is used regarding PMA parts. **Action taken:** No change to report. However, FAA will be attempting to clarify those points in future policy and guidance.
MARPA		Report Conclusion 8 states: "TC/PC holders and their suppliers are not objectively investigating service events nor accurately representing all the facts when aftermarket repairs or parts are involved. They have also represented a very few random isolated events on aftermarket parts as implying			**Action taken:** No change to report.

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		there is a systemic breakdown in FAA compliance oversight and the non-TC/PC holder industry's capability." This has long been a complaint of MARPA. Last summer, we sent a letter to [a major TC holder], pointing out that they appear to be misrepresenting certain facts to the detriment of the entire industry. Although they did not concur with our conclusion, we have noticed that recent [TC holder's] advertisements appear to have eschewed some of the factual inaccuracies that we had noticed in earlier [TC holder] advertisements. MARPA has presented to the FAA evidence of one case where a PMA part was being blamed for a failure – the air carrier contacted the engine OEM but the engine OEM failed to provide notice to the PMA manufacturer for many months. Such a failure			

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		to communicate basic allegations undercuts our joint efforts to strive toward safety and predictive response. We hope that by casting attention on this issue, the FAA's Report may eliminate some of the inaccuracies and lack of objectivity merely by demonstrating that the government and industry are aware of the lack of objectivity, and that they find it unacceptable (mitigating bad-acting through industry shame). We would like to praise the FAA for their efforts to bring this issue to light.			
MARPA		Report Conclusion 10 states: A major driver of the debate between TC/PC holders and non-TC/PC holders over the integrity of repairs and replacement parts is the economic business competition between them. That is not likely to change despite any actions taken by the FAA. Regardless, the FAA will take the			**Action taken:** No change to report.

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		necessary steps to ensure safety, compliance, and standardization shortfalls are corrected. Too often, it seems that some parties have tried to cloud the economic issues and tried to cast economic issues as if they were safety issues when they are not. This past practice is dangerous in that it threatens to divert oversight resources from genuine safety issues, and re-focus those resources on non-safety issues because of a perception that is not mirrored in reality. We have always known that the FAA was not being fooled, but the fact that the FAA is willing to recognize this issue in a written report is gratifying to the industry. We would like to praise the FAA for their efforts to remind the industry that sometimes TC/PC holders raise safety allegations with little or no foundation in an effort to promote their own economic concerns.			

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		We do respectfully dissent from the FAA's claim that the matter "is not likely to change despite any actions taken by the FAA." We think that you give the FAA's published Reports far too little credit for their ability to motivate the industry merely by "showing us the way." While the FAA may be unable to put a halt to all economic arguments cast in the guise of safety allegations, we feel that merely by raising this issue to the public, we hope that the public will better recognize such behavior, and will object to it. The FAA's voice in this regard, and the FAA's willingness to raise the issue, should do some good even without further action by the FAA.			
FedEx		FedEx generally agrees with the team's findings. While post-production repairs, alterations, and alternative parts production activities are not blemish-free, this post production work is			**Agree** **Action taken:** No change to report.

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		invaluable and the safety benefits far outweigh the impact of the very small number of problems encountered over the years. Enhancements to voice and data recorders, Enhanced Ground Proximity Warning Systems, aircraft wheels, tires and brakes, and a host of other safety improvements were accelerated into the world fleet primarily through these post-production activities.			
FedEx		We strongly agree that fewer distinctions are better than more distinctions of: major/minor, 'critical', 'critical safety', 'special emphasis', etc. By trying to emphasize one facet or feature at a time, the industry loses its focus that <u>all</u> areas of the airplane and its operation require the utmost attention to detail.			**Agree** **Action taken:** No change to report.

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FedEx	**Comments on Recommendations 2 and 3:**	To better align with the principal in the report, the number of categories should be minimized and the list should refer to critical parts or category parts, but not both. As a comment, the aviation community generally does not have a substantial problem developing or obtaining FAA-approved data. The issues arise with "special" approvals reserved to individuals, entities, or processes outside the typical Part 21, Part 43, and related methods. By reducing categories and striving for an "approved data is approved data" equal footing, much confusion can be eliminated from the processes.			**Agree** **Action taken:** Revised Boundary Conditions of Recs. 2 & 3 to strengthen that thought.
FedEx	**Comments on Recommendations 4:**	These major/minor issues were well documented in the published-then-withdrawn FAA orders 8110.45 and 8110.46. While they were clear and clearly aligned with the			**FAA agrees** that there are major alterations under CFR 1.1 that are not major changes to the type design and can thus be approved without the

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		regulations, they did not generally align with the then-prevailing opinions on the 'critical,', 'critical safety', etc. culture as described above. In particular, the regulations are clear that not all 'major alterations' are 'major changes in type design.' However, in practice the list of examples has dwindled to the point where there seem to be few distinctions. This is well demonstrated by evaluating the information that was NOT transferred to the FAA Inspectors Handbook when the Orders were withdrawn with the explanation that the content was moving to the Handbook. While 14 CFR Part 121 and similar operators have the ability to accomplish major alterations in this manner, a process alternative to a full STC effort may be appropriate for			need for an STC. **Action taken:** The FAA in follow-on action will be clarifying major-minor under CFR 1.1 and major-minor under CFR 21.93 as well as their relationship. The FAA will revisit the referenced orders during the renewed effort to develop guidance for major-minor repair and alteration under CFR 1.1.

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		non-operators. This may help solve some of the open issues in recommendations 9 and 14 on data approvals as well. The ODA activity is well suited to help solve this issue.			
FedEx	**Comments on Recommendations 4:**	In addition to guidance on "improperly done" and "appreciable affect", please add the "manufacturer's specification" language from the major alterations description to the list for clarification.			**Agree** **Action taken:** FAA has identified these and other related terms such as "elementary operations," "accepted practices," and "current'" which are in need of clear agreement on their meaning.
Northwest Airlines		NWA agrees with the general direction the FAA is heading to improve the process and documentation of major repairs and/or alterations as they pertain to engines. The report is well balanced identifying the concerns of the major stakeholders in the development of repairs and/or alterations.			**Action taken:** No change to report.

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Northwest Airlines		In the RAFT report under "Recommendation #2" the FAA identified a product deliverable: "Rulemaking to CFR Part 1.1 re-defining major alteration and major repair as including **any** repair, alteration and fabrication of a critical part" NWA does not agree with this approach. We believe that better proposals for a rewrite of this regulation already exist (e.g.; ARAC Major/Minor WG Technical Report). If the FAA feels they must proceed with this approach, NWA requests the FAA take into account the following: 1) Agree to this approach if the critical parts lists are defined in the regulations, orders and advisory circulars. The definition of critical parts varies from FAA office to FAA office and within the published FAA documents. There is a concern by NWA with either approach:			The FAA would like to avoid such rulemaking if we can reach a consensus with industry on acceptable guidance for determining major-minor in a more consistent way. Clarification of critical is also needed and should be harmonized internationally. If agreeable guidance for these two objectives can be achieved then rulemaking should be unnecessary. The goal is not to create a new higher standard of safety but rather to facilitate a more standardized application of the determinations of major-minor to ensure that the existing standard of airworthiness of the

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		Without a critical parts list in the regulations, orders or advisory material, operators or other entities must rely on the Type Certificate Holders (TCH) to share such a list, and the TCH may be unrealistically conservative so as to stifle competitive repair development; a codified list will be universally accepted if developed per item 2, but may not get updated as often as technological developments might dictate. 2) All the stakeholders agree that all repairs to critical parts are major. 3) TCH clearly identify in applicable manuals what the "Major" Repairs are going forward and retroactively. 4) TCH provide categorization of alterations as major and/or minor when issuing maintenance documents for alterations 5) Principle maintenance			product is maintained over time. **Action taken:** no change to report.

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		providers will report all major repairs and alterations on Class 1 & Class 2 Products down to individual parts to allow end user(s) to properly document major repairs and alterations as required by regulations. 6) End users/Operators recognize the increased reporting requirements that the new process will require. 7) FAA will staff appropriately to accommodate and quickly respond to the increased number of approvals and that will be requested by the stakeholders.			
UPS	For the most part, United Parcel Service Co. (UPS) agrees with the recommendations. However, recommenda	The main concern …pertains to classifying repairs currently contained within Manufacturer's Maintenance Manuals. It seems that there are some within the FAA who believe this will be an appropriate approach. UPS does not agree with this approach for several reasons. First, requiring	Requiring classification of repairs currently contained within Manufacturer's Maintenance Manuals does not improve safety. The repairs within the manuals went through an accepted and approved process in order to be included within the manuals. Additional		The FAA agrees that it is unnecessary and is not required by the CFR to re-classify repairs that are in the Product's ICA developed pursuant to the product's respective airworthiness requirements and distributed under 14

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	tion #2 pertaining to major/minor determination does cause significant concern.	classification of repairs currently contained within Manufacturer's Maintenance Manuals will not improve safety and is duplicating a process that was previously accomplished. Second, to track, classify and record repairs currently contained within the Manufacturer's Maintenance Manuals will cause an administrative burden that can not be satisfied. Third, if an administrative process can be developed, the cost to produce an engine from a repair vendor will increase substantially due to increased staffing. Finally, the engine shop turn times will increase substantially, causing airlines to increase the number of spare engines. This will significantly increase engine capital expenditures.	reviews and evaluations of each repair contained within the manuals will only result in a duplicate process. If a repair is deemed to be major, additional paperwork will then be required to document and keep record of the major repair. This evaluation, classification and documentation of major repairs contained within the manuals will provide only another level of bureaucracy providing no improved safety benefit. The administrative burden created by such a requirement cannot be satisfied. As engines enter the shop for repair, they are completely disassembled with parts routed to different cleaning, inspection and repair shops within and outside the		CFR 21.50. The objective of recommendation #2 is with respect to classifying repairs that are not in the ICAs (i.e.; repairs which are developed outside of the manufacturer's process for developing and distributing ICAs.) 14 CFR 43.13 states that a person performing maintenance "shall use" the ICA so it is a moot point whether to classify or reclassify repairs or alterations contained in the ICA which have already undergone an FAA accepted revision process agreed between the FAA and the TC holder. As noted by the commenter, the repairs, and indeed all content of the ICAs and revisions thereto must conform to the airworthiness

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			engine facility. To accurately identify when and what exact repair is being accomplished according to Manufacturer's Maintenance Manuals is an impossible task requiring real time coordination between all shops within and outside the engine facility. If an identification method can be developed, work will then stop until an engineering major/minor determination can be made. In the very unlikely event that an administrative process can be developed, the cost to produce and engine from a repair vendor will increase substantially. The cost increase [of having to reclassify, approve and report repairs already in the ICA] occurs due to the requirement to determine the classification and if		requirements for the product under which the ICAs are provided (e.g.; 14 CFR 33.4 and Appendix A for engines) Therefore ICAs are already deemed acceptable to the administrator under CFR 43.13 without further showing. The FAA oversees the manufacture's process for revising and distributing ICAs to ensure their acceptability for use under 14 CFR 43. The FAA agrees that any re-classification or re-substantiation of the ICAs by users would be redundant, would be an unnecessary burden, and adds no safety benefit. **Action taken:** Recommendation #2

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			major obtain FAA approval. The engine repair facilities utilize FAA DERs to accomplish this approval. The engine facilities, engine facility sub-contractors and airlines are currently staffed to review only deviations from the manufacturer's Maintenance Manuals. … additional DER staffing will be required to accomplish the additional approvals. This additional staffing will be required within the engine facilities, the engine facility sub-contractors and the airlines. This increase staffing will increase cost substantially. The engine turn times will increase substantially if repairs contained within Manufacturer's Maintenance Manuals require classification. Each repair will require the repair process to stop for		revised to clarify that it does not apply to repairs, alterations, and fabrications that are already included in the ICA and to alterations included in the product's specifications as cited in 14 CFR 1.1.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			evaluation. The repair will require re-evaluation and coordination with the airline to determine classification because the 121 carrier is responsible for classification. … Once the engine turn times increase, the airlines will be forced to spend millions of dollars to increase spare engine levels or park aircraft due to lack of available engines. Requiring classification of repairs currently contained within Manufacturer's Maintenance Manuals does not improve safety. The repairs within the manuals went through an accepted and approved process in order to be included within the manuals. Additional reviews and evaluations of each repair contained within the manuals will only result in a duplicate process. If a repair is		

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			deemed to be major, additional paperwork will then be required to document and keep record of the major repair. This evaluation, classification and documentation of major repairs contained within the manuals will provide only another level of bureaucracy providing no improved safety benefit. The administrative burden created by such a requirement cannot be satisfied. As engines enter the shop for repair, they are completely disassembled with parts routed to different cleaning, inspection and repair shops within and outside the engine facility. To accurately identify when and what exact repair is being accomplished according to Manufacturer's		

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			Maintenance Manuals is an impossible task requiring real time coordination between all shops within and outside the engine facility. If an identification method can be developed, work will then stop until an engineering major/minor determination can be made. In the very unlikely event that an administrative process can be developed, the cost to produce and engine from a repair vendor will increase substantially. The cost increase [of having to reclassify, approve and report repairs already in the ICA] occurs due to the requirement to determine the classification and if major obtain FAA approval. The engine repair facilities utilize FAA DERs to accomplish this approval. The engine facilities, engine		

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			facility sub-contractors and airlines are currently staffed to review only deviations from the manufacturer's Maintenance Manuals. … additional DER staffing will be required to accomplish the additional approvals. This additional staffing will be required within the engine facilities, the engine facility sub-contractors and the airlines. This increase staffing will increase cost substantially. The engine turn times will increase substantially if repairs contained within Manufacturer's Maintenance Manuals require classification. Each repair will require the repair process to stop for evaluation. The repair will require re-evaluation and coordination with the airline to determine classification because the		

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
			121 carrier is responsible for classification. … Once the engine turn times increase, the airlines will be forced to spend millions of dollars to increase spare engine levels or park aircraft due to lack of available engines.		
FAA AFS		Several locations where the term maintenance is used it may be confusing whether you are referring to all maintenance or just repairs.		Change "maintenance" to "repair" wherever the intent was actually just repair.	**Agree** **Action taken:** Report revised
Note: The following comments from General Electric (GE) included substantial broad commentary as well as comments to specific sections of the RAFT Report. In order to give the input fair consideration and ensure the context is maintained the FAA has included the entire GE submittal at the end of this section rather than attempt to extract or interpret excerpts for disposition out of context. A summary of the FAA's changes to the report and responses to the specific comments on the recommendations is included in the table below. Inclusion of the entire submittal does not indicate RAFT agreement or disagreement with the commentary other than as specifically dispositioned in the following table.					
GE, Charles Blankenship		We were surprised with the RAF conclusion that there has not been evidence of unsafe conditions arising from PMA parts and non-TCH repairs. GE and others have shared with the FAA several cases where this material resulted in unsafe conditions. Since 2007, there has			The RAFT did not conclude that there was no evidence of PMAs or non-TCH repairs introducing unsafe conditions. FAA agrees there have been ADs written for accidents and safety problems

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		been an AD and two SAIB's on GE/CFM engines arising from replacement parts. These and other operational events provide "leading indicators" which should not be ignored, as modified part and repair providers focus on more complex parts. We think a rigorous analysis of data, taking into account the total level of fleet experience and part criticality, would yield a different RAF conclusion.			caused by non-TC/PC holder products and services. The RAFT concluded that those instances are limited and do not indicate a systemic breakdown in the aftermarket industries capabilities nor the FAA's oversight processes. There was no substantive evidence that failures of non-TC/PC holder repairs and replacement parts were any more prevalent than those of the TC/PC holders'. Regarding PMAs, it was also noted that some PMA failures have occurred because the PMA holder had unknowingly replicated a design flaw that existed in the TC holder's parts. In the PMA approval process,

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					it is not the responsibility of the PMA holder or the FAA to search out and fix deficiencies in the TC/PC holder's design. **Action taken:** The report "Safety Concerns" section was reworded to clarify this.
GE, Charles Blankenship		Our view of FAR 21.50(b) is that it clearly states that holders of a design approval, "shall furnish" Instructions for Continued Airworthiness. ICAs furnished by GE include disclaimers stating that the limits apply to GE parts. Were PMA holders to furnish their own ICAs, which we believe is the stated intent of the regulations, there would not be the "confusion" resulting from our statements that the RAF report references. We think requiring every design approval holder to furnish its own ICAs is clearly the best approach.			The FAA agrees that any design approval holder of a PMA, repair or alteration must furnish a supplement to the ICA when their design has a difference that is not adequately addressed in the existing product ICAs. If the ICA assessment required prior to FAA approval determines that the existing ICA is adequate and compatible with repair, alteration or a PMA part; then the

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					FAA's position is that the original product ICA are equally applicable to the PMA part or the repaired or altered part regardless of any disclaimers to the contrary made by the TC /PC holder. **Action taken:** No change to report
GE, Charles Blankenship		We anticipated the RAF team would focus on compliance with the regulations, with a goal toward insuring FAA policies related to non-TCH material are consistent with them. Unfortunately, the report often highlights commercial reasons as a basis to discount technical and safety concerns raised by TC holders. GE recommends that such commercial references be removed from the report, as they are inconsistent with the goals and tasks of the RAF team.			**The FAA respectfully disagrees.** The context of the global business competitive environment was viewed as a key factor in understanding the needs and positions of all of the stakeholders. The FAA accepts that there are legitimate safety concerns on both sides of the issue. All stakeholders unanimously agreed on the need to protect

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
					safety and regulatory compliance. The FAA RAF Team felt it was necessary to provide that context so everyone understood where the FAA's charter did and did not permit the FAA to take regulatory or policy action on the issues that were raised by all stakeholders. **Action taken:** No change to report.
GE	**Recommendation 1** -	as worded, is not an actionable recommendation.	• The current rules may define the "current regulatory structure and policy," and the industry is working within this "structure." However, the current structure, which is based on the premise that individual non-TCH parts (repairs, alterations, fabrications, and PMA/STC) are replaceable with TC	GE suggests it be deleted, and its discussion be added to the Recommendation summary on page 37.	**Agree** that it is more of a conclusion than an action. **Action taken:** Moved the content to the discussion at the beginning of the conclusion section. The numbering of the remaining recommendations was not changed in order to avoid confusion when people refer to

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			defined parts and repairs **without limit** throughout the engine system, is not sufficient to maintain compliance and safety. Low technology parts with primarily independent functions have been successfully replaced in engines in the past. But data is beginning to show that individual part validation and COS for highly interdependent, complex and advanced technology parts on commercial gas turbine engines are not providing the product level validation and COS required by 14 CFR. • GE does not support part alteration or fabrication regardless of		recommendations by numbers.

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			criticality because of the safety need for part integration compliance demonstration. RAF recommendations 2, 3, 4 and 6 associated with defining clear major/minor definitions, including evaluation of type design change(s), highlight the need for "change to the current regulatory structure." • GE does not agree with repairs to any extent short of 100% fabrication.20 The complexities with this subject discussed in the RAF report do not change the fundamental fact that repair of an existing part via maintenance is totally different from manufacturing a		

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			replacement part.		
GE	**Recommendation 2 –**	GE supports revising §1.1 to specifically define any repair, alteration, or fabrication of a critical part as a major repair or major alteration. However, the very nature of critical parts requires that this action be addressed now, rather than revisited following "period evaluations" of the effectiveness of other initiatives recommended by the RAF report. GE also recommends that life limited parts be specifically mentioned as a subset of critical parts, since their existence is widespread and there are type certification and maintenance regulations that specifically address life limited parts. In the interim, GE believes the present definitions in 14 CFR Part 1 enable the FAA to quickly			**There was substantial disagreement on the need for rulemaking to mandate that all repairs of critical parts be classified as major.** Several stakeholders identified past repairs to critical or life limited parts that were clearly minor, some of which had been supported by TC holders. FAA disagrees that the current CFR provides adequate basis to issue policy or guidance rather than rulemaking. **Action taken:** No change to the report. FAA will reconsider the comment in light of our follow on

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		issue guidance that defines the repair, alteration, or fabrication of critical parts to be a major repair or major alteration. The phrase "or other qualities affecting airworthiness" in both definitions provides a regulatory basis for such guidance.			work regarding RAF issues.
GE	**Recommendation 3** -	**GE supports Recommendation 3**, but suggests that it be expanded. The result would provide guidance on what constitutes a Critical Part and to align that definition with the EASA harmonization effort.	The FAA's objective to define a "single high level criteria" for critical parts is a start. But, in parallel, each of the 4 individual AIR Directorates should begin defining critical part criteria for their products. Progress within each Directorate will provide valuable clarification for that branch of aviation. A good place to begin is any part or component, whose individual failure or malfunction, or the related failure or malfunction of another affected part or component, could trigger reporting under §21.3.	The definition should be based on impact to the product, not on individual part descriptions. Consistent with Recommendation 2 revision to §1.1, a critical part definition should be added to the appropriate section(s) of 14 CFR. Due to the complexity with creating a standard critical part definition, GE recommends the FAA revise the appropriate sections(s) of 14 CFR for commercial gas turbine engines independent of other aviation products.	**Agree with the need to gain clarity on what parts are critical** especially if FAA continues to use it as a discriminating definition in policy that affects regulatory compliance determinations. However, the FAA has yet to determine whether or not that should be codified in a rule. **Action taken:** No change to the report.

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			While GE agrees that unnecessary categories of parts should be avoided, the importance of "influencing parts" needs to be addressed and clarified within the regulatory structure, particularly for parts that influence life limited and critical parts in gas turbine engines. This clarification is needed to assure all DAHs and repair providers show compliance to the airworthiness requirements applicable to the product are met with their part installed. GE recommends that influencing parts be included in Recommendation 9 (data package templates).		
GE	**Recommendation 4 –**	GE supports the recommendation to better define what constitutes a major or minor change to the type design, in accordance with §21.93. The			**FAA agrees that there needs to be consistency** in how the ACOs apply the determination of major-minor type

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		FAA Aircraft Certification Service's current practice is that any part that can not be conformed to an approved original type design, or properly approved change to a type design, constitutes a change to the type design which must be addressed in accordance with subpart D of 14 CFR Part 21. That practice should form the basis of any new FAA guidance material. Aircraft Certification Offices (ACO) frequently provide TCHs with a list of those parts, components, or appliances that may not be approved under the process defined in §21.93. ACOs also define specific airworthiness standards for which any compliance activity, regardless of the type design change, must be accomplished in accordance with §21.97. Both of these FAA practices define what the ACO considers to be a major change to the type design for a particular product. Those			design change. **Action taken:** No change to report.

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		definitions of a major change should also be applied to any activity to modify the type design by other than the TC holder, such as alterations and design approvals. This practice by the ACO community should be considered when defining what constitutes a major or minor change to a type design. Regardless of how these terms are eventually defined, they should be applied the same way to TC holders, STC applicants and holders, alterations, and any repairs that FAA policy defines as a change to the type design.			
GE	**Recommendation 6 –**	GE concurs with the intent to gain as much input from industry as possible before the FAA clarifies what constitutes a major or minor repair or alteration. In the end what constitutes major or minor should be based on regulatory intent and not just industry practice.			**FAA agrees that any industry best practices** of determining major-minor repair and alteration need to meet regulatory objectives. FAA also agrees with the need to clarify the relationship of major-minor determinations within CFRs 1.1, 43, and

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		The recommendation discusses the need to avoid confusion between major/minor as it relates to repairs/alterations and major/minor type design changes within 14 CFR Part 21. There is evidence that confusion already exists. For example, under 14 CFR Part 43 the classification of something as major or minor not only relates to the product, part, or appliance but to who may execute an approval for return to service. Under 14 CFR Part 21 a major or minor change is only related to the type certificate and in most cases just to the type design. GE recommends that all activities to define major or minor with respect to 14 CFR Part 21 and 14 CFR Part 43 be accomplished as a single effort, co-chaired by AIR-100 and AFS-300, so that the existing confusion can be cleared up.			21.93 **Action taken:** No change to report

APPENDIX D: COMMENTS TO FEDERAL REGISTER NOTICE & DISPOSITION

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
GE	**Recommendation 8 -**	**GE supports Recommendation 8** to provide guidance on part identification for all repairs, alterations, fabricated parts, and owner produced parts. We also support reconsideration of rulemaking on part identification. • The RAF's preliminary report acknowledged that, "Part marking is a significant issue … but not a notable safety concern yet." • Part numbers, serial numbers and all part marking elements are used by industry for more functions than identification of an approved part for installation into a product. Industry liability, COS management, incident reporting, and incident investigation rely on knowing the DAH for specific parts. • GE has significant experience with STC/PMA parts and repairs being mis-			**At this time the FAA can not comment on the pending rulemaking** regarding production part marking. FAA does agree on the importance of part marking for determining installation eligibility, configuration management, accident/incident investigation and managing continued operational safety. **Action taken:** No change to report.

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		marked to the extent that it's impossible to determine whether the part qualifies for installation. • GE agrees that recent FAA proposed rulemaking on production part identification and the revised 14 CFR Part 45 should have the goal to identify a part marking rule proposal that encompasses both production and repair/fabrication parts. The objective should be the easy identification of the DAH for all parts, recognizing that there will be some small parts that utilize bag or tag marking.			
GE	**Recommendation 9 -**	GE supports the development of templates to be used by applicants when developing data packages for all types of approvals. The objective of consistency should be with respect to full compliance with the regulations, and not consistency with how that			**FAA agrees but should note** that the commenter's words "…full compliance with the regulations…" should not mean that the means of showing compliance must be identical to that which

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		compliance must be demonstrated. The templates should address part functionality, system effect assessments up to and including the product.			was done for the original TC. **Action taken:** No change to report.
GE	**Recommendation 10 -**	GE supports this recommendation.			**Agree** **Action taken:** No change to report.
GE	**Recommendation 11 -**	**GE conditionally supports Recommendation 11**, which encourages industry initiatives to provide guidance on COS management via SMS. • Given that there is no SMS rule in existence, SMS implementation at this point would be voluntary by industry. We do not support the imposition of SMS requirements without a regulation that requires and defines SMS.			**Agree** **Action taken:** No change to report.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		• GE support is predicated on requiring COS plans that address individual parts, and the system interactions inherent in today's high technology gas turbine engines.			
GE	**Recommendation 12 –**	GE supports revising §21.3 to include reporting requirements for any design, production, fabrication or maintenance approval holder, by adding a requirement for those that have performed fabrication or maintenance activities on a product. GE also supports further clarity as to the reporting requirements in §21.4, ETOPS reporting. The present requirement refers to type certificate holders only. If an airplane-engine combination approved for ETOPS undergoes a type design change, especially one that is major, and an in-service event related to that type design change triggers a reporting, tracking, or resolution			**Agree** **Action taken:** No change to report.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		per this section, the requirements of this section should apply to the design approval holder responsible for the change. This makes it consistent with the reporting requirements in §21.3 for failures, malfunctions, and defects, which applies to a PMA or TSO authorization as well as a TC holder.			
GE	**Recommendation 13 –**	GE concurs with this recommendation to change the applicability of §21.99 to include all design and data approval holders. The change to §21.99 should include system level responsibility. Experience has shown that failure modes can be different between TCH and non-TCH parts, including different system level failure modes. Therefore, all design approval holders need to assess the potential system impact for a part failure, within the bounds of the "unsafe condition" referred to in §21.99(a)(1) or the			**Agree** **Action taken:** No change to report.

Company & Group	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
		definition of what "will contribute to the safety of the product" in §21.99(b). Section 21.99 correctly refers to the safety of the product, as it is impossible to demonstrate the safety of any individual part. This is consistent with draft AC33XX that is in review, and it should be reflected in the rule.			
GE	**Recommendation 15 –**	GE supports the need for more clarity with respect to the requirements in §21.50(b) for ICAs. The appropriateness of any changes to an existing AC should be measured with respect to the regulations, and not just an existing AC. §21.50(b) presently applies to all design approval holders and requires the preparation of an ICA applicable to that design approval. This is aligned with the basic regulatory premise that the person who makes the change is responsible for the impact that change may have on the part, appliance or product,			**The comment regarding the FAA** defining what types of non-airworthiness related information are appropriate in the ICA is not solely related to how factual the words may be. The concern is that the ICAs are intended to be actionable information and instruction on how to maintain the airworthiness of the product. Statements should be avoided that restrict a user's ability

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		including any maintenance impact. As previously stated, a showing of compliance under §21.50(b) requires the creation of an ICA by every design approval holder, even if that ICA is the same as what the original design approval holder provided. **GE does not support the FAA's position in Recommendation 15** regarding TCH statements in ICAs and manuals. SAIB NE-08-40 clearly states "the TCH has no data or knowledge about the PMA and STC parts installed in the product." The TCH's statements are within the regulations, as long as they remain factual, and related to TCH parts and the product.19			to apply the ICA as they and the FAA see fit under the CFR. Such inappropriate wording may include warranty restrictions, commercial restrictions, or claims of proprietary data. It would also be inappropriate to directly or indirectly imply that the ICA are not applicable to parts that were repaired or fabricated by non-TC/PC holders when the FAA approval of those has determined otherwise. **Action taken:** No change to report.

GE Aviation Response and Comments to:

Aviation Safety, (AVS) Repair, Alteration and Fabrication (RAF) Study
(August 6, 2008)

October 6, 2008

APPENDIX D: GENERAL ELECTRIC COMMENTS TO FEDERAL REGISTER NOTICE

INTRODUCTION

GE Aviation1 submits these comments in response to the Federal Aviation Administration's (FAA) RAF report published August 6, 2008. GE commends Aviation Safety, Aircraft Certification, and Flight Standards' leadership for beginning to address these important issues, and the hard work of the RAF team. GE supports most of the Recommendations.2 However, GE also takes exception to several conclusions and RAF commentary, which we discuss in this response.

In addition to implementing RAF Recommendations, the FAA's ongoing diligence in requiring compliance to existing regulations, and improving guidance for STC/PMA parts, alterations, fabrications, and repairs (hereafter, "STC/PMA parts and repairs"), 3 is absolutely necessary to maintain the same level of safety the FAA and industry has come to achieve. Especially now, as the RAF concluded, that these parts are growing in rate and complexity, are applied to more safety critical and complex parts, and are incorporated into higher technology products with less margin for variation.

For turbine engines and their critical parts especially, compliance testing and service history demonstrates that changes to parts must be addressed by considering the interaction of accumulated design changes and maintenance on the whole system, since the loads on engine parts and overall engine behavior within the certificated flight envelope can only be understood by assessing the engine/product as a whole system. Therefore, GE suggests AVS initiate further analysis of how the regulations account for the system effects that design variation introduces into turbine engines as a whole product (and not just the effects on individual components), since the RAF appears not to have addressed that issue.

RAF Conclusions Regarding Safety of Existing PMA/Repair Rules and GE's Proactive Safety Concern

For several years Engine TCH's have demonstrated that the FAA's rules – or their implementation - governing STC/PMA parts and repairs allow considerable variation to the type design without a commensurate demonstration of the impact that variation has on the safety and compliance of the product. We disagree with the RAF conclusion that there has not been any evidence of unsafe conditions arising from STC/PMA parts and repairs. GE was directly involved with, and has shared with

1 The General Electric Company holds 15 Type Certificates for turbine engines and is a partner in companies that hold an additional 10 Type Certificates for turbine engines.
2 GE's comments pertaining to the RAF's specific Recommendations begin on page 11.
3 For ease of reading, GE will use "STC/PMA parts and repairs" or "design changes and repairs" as shorthand in this response to refer collectively to the various design approvals (e.g. STC and PMA) and maintenance (repair, fabrications and alteration) activities developed without original type design data. These design changes introduce variation to a part or to the product type design as a whole. Licensed PMA is not included in this shorthand category because the design of licensed PMA has been approved as part of the type design.

the FAA and operators, several cases where STC/PMA parts and repairs in GE and CFM4 engines resulted in unsafe conditions. In the last year alone there has been an Airworthiness Directive and two SAIBs issued on GE or CFM engines arising from the use of PMA parts. GE is also aware of multiple in-flight shut downs, loss of thrust control, and air turnback events on GE and CFM engines that were caused by STC/PMA parts and repairs. The 2002 Certification Process Study highlighted the inherent safety risks of variation introduced by aftermarket providers who make assumptions about type design, and GE is aware of two fatal helicopter crashes that related to failed PMA parts.

The RAF's conclusion that TCH safety concerns are "unfounded" fails to recognize the lack of in-service history for STC/PMA parts and repairs compared to the vast, documented service history of TCH parts and repairs. STC/PMA parts and repair design changes on critical engine parts are in their infancy, and there is no reliable baseline of in-service history to validate the RAF's conclusion. The RAF report does not describe its review of the in-service performance and reliability of STC/PMA parts and repairs, nor does it list the failure history of these parts. GE is unclear if the RAF evaluated whether the failures were timely and accurately reported as required by the regulations, or appreciates the impact of the potential safety hazards in the future. In GE's view, the data provides a leading indicator of the potential safety and operational challenges to come as multiple design approval holders (DAH), with independent and isolated data, introduce variation to the type design without a cumulative analysis of airworthiness impact on the product. The few present day unsafe conditions with STC/PMA parts and repairs may not be a valid predictor of the future.

RAF Commentary Regarding TCH Motivations

The RAF appears to have the perception that TCH's are "against" STC/PMA parts and repairs as a whole. GE is not aware of any TCH's that claim STC/PMA parts and repairs, as a class, are unairworthy or do not meet the minimum standards that the FAA has required of them. GE has never placed value judgment or "accused" PMA part and repair providers, as a class, of being incapable or unqualified to fabricate parts. In fact, GE has participated in and led efforts by the FAA and AIA focused on improving guidance for PMA holders.

The data GE shares with the FAA and industry is always fact-based, rooted in our own technology and safety culture, and is intended to raise the awareness of operators and industry regarding GE's compliance and airworthiness concerns. The FAA and industry have always relied on the sharing of information and data to promote improvement in the regulations, and we see these issues as no different. GE's position and comments regarding STC/PMA parts and repairs is motivated by its proactive concern regarding the safety of GE products and the flying public.

4 CFM International, S.A. is a joint venture company between GE and Snecma. CFM holds 8 Type Certificates for CFM engines.

Economics and business competition have no role to play in aviation safety and compliance with airworthiness requirements, nor in GE's view do they have a place in FAA regulatory analysis.5

RAF Conclusions Regarding Incident and Event Reporting

The Report suggests on page 17 that TC/PC holders have misrepresented events being caused by PMA parts or have not informed PMA holders "in a timely manner" of service events related to PMA parts. Conclusion 8 also accuses TC/PC holders of not objectively investigating or reporting facts of an investigation when STC/PMA parts and repairs are involved. GE objects to these sweeping and generalized accusations about TCH's. GE reports every reportable incident on a GE engine in accordance with regulations and long-standing GE policies, which includes reporting in-service difficulties beyond the minimum criteria of §21.3. For every reported event, GE investigates the root cause of the condition to the fullest extent of our technical capability. In some cases, GE has contacted PMA holders to share GE's field experience. GE shares the FAA's goal to have timely reporting and rigorous and objective investigations, and has furthered such goals through decades of safety leadership.

However, the Report correctly states that the TCH is not responsible under 14 CFR for any changes made by others to the products the TCH delivered, and the FAA has acknowledged that TCH's have no knowledge of changes and modifications to those products made by someone else. FAA regulations require that all DAHs are responsible for monitoring and understanding their parts in-service performance and history, and report any events related to that in-service performance. The FAA should reinforce that the same responsibility applies to maintenance providers. GE has and will continue to report to the FAA and operators in-service events that are caused by STC/PMA parts and repairs in GE engines. In many of those cases, the PMA or repair provider is not aware of the event caused by their part. The Report erroneously implies that a TCH has the added responsibility to notify a PMA holder of in-service events on its parts, but TCH's are not responsible for ensuring compliance for all industry participants. In that regard, the FAA and the operator have the obligation to ensure that notice of any service problems are provided to the proper DAH or repair provider, who should be responsible for timely reporting and full investigation, since they are the only ones who fully understand their design change and have data that was used to show compliance to the airworthiness standards.

5 The RAF spends several pages providing commentary about TCH motivations, economics, business competition, and editorializing about what TCH's want or need if they own maintenance facilities, leasing companies, etc. The assessment of Alternatives also imputes certain assumptions and motivations to TCH's that are wrong. The FAA's mission is to regulate Aviation safety, 49 U.S.C. §44701 et seq. The FAA reinforces the notion of being "overly collaborative" with industry when it appears to be influenced by business motivations over safety. GE requests that all statements pertaining to business issues, economics, motivations, or TCH assumptions (e.g. page 2 para. 3, page 9 para.1 & 2, page 10 para 1, page 11 para 1, page 14 para 2, page 16 last paragraph, page 19 para 1, page 33 para 1, page 36 conclusion 10, Alternatives) be removed from the final RAF report.

SPECIFIC COMMENTS AND REGULATORY PRINCIPLES

GE's specific comments to the RAF report are based on three basic FAA safety and regulatory principles, for which Aircraft Certification and Flight Standards have shared responsibilities:

- Compliance and FAA Oversight
- Instructions for Continued Airworthiness (ICAs) and Operator Responsibility for Continued Operational Safety and Airworthiness
- Airworthiness and its Relation to Type Design

Compliance and FAA Oversight

The RAF has properly framed the basic compliance responsibility that, "the TC/PC holders, STC holders and FAA PMA holders have the responsibility to design and manufacture aircraft, engines, propellers, and parts that comply with applicable airworthiness requirements, conform to the approved design data, and which are safe for operation **before** they sell them to owners/operators." We believe the same principle also applies to fabrications, repairs and alterations conducted in the course of maintenance.6

As GE understands the regulations, all DAHs must perform tests and analysis to show compliance with the applicable airworthiness standards for the product.7 Maintenance and alterations must also continue to comply with the type certification basis of the product, which also requires a showing of compliance. The overarching regulatory concept embodied in the regulations is that the applicant must "show," and that showing must be by way of test reports, analysis and computations. A showing of compliance may not be a simple statement that something complies, or that another person has already shown compliance for a similar situation.

The Report discusses a concept the FAA calls "comparable level of certitude,"8 which indicates that the FAA is not requiring the same method of showing compliance by everyone and that the FAA's objective when making approvals is only to achieve a "common acceptable level of safety." FAA regulations and policy have always focused on compliance, not just on a subjective determination of safety.

6 As outlined in our introductory comments, this regulatory premise alone may be insufficient to ensure the continuing airworthiness of an engine over time, as a whole product. Aggregate changes to a type design over time, and their cumulative effect on the interactions of the product, are not being fully evaluated by the various individual DAHs and repair providers.
7 E.g. §§21.21 (Type Certificate), 21.115 (Supplemental Type Certificate), 21.303 (PMA).
8 The report does not contain a definition of what is meant by "comparable level of certitude" and it is not a term found in any 14 CFR regulations that GE is aware of. If this is a standard to which the FAA is holding applicants, it should be defined in the regulations and described more precisely for the public and industry.

Safety considerations are what drive the need for regulations and policy, but certificates and approvals must be issued on the basis of compliance with the regulations. We assume that the FAA does not intend to relieve PMA parts and repair providers of their obligation to show compliance, and GE urges the FAA to ensure that the applicant's' showing is consistent with the regulatory requirements.

The RAF acknowledges that there have been STC/PMA parts and repairs that did not have a clearly documented showing of compliance. Any discovery by the FAA of an insufficient showing of compliance should lead to an FAA request for proper compliance demonstrations from the responsible person. If that insufficient showing of compliance has been found to be unsafe, then the FAA has the additional responsibility of mandating corrective action.

GE understands the FAA's discretionary authority regarding the exercise of its technical judgment, and the fact that the showing of compliance to FAA regulations rests with design/repair providers and operators. However, there is no statutory or regulatory discretion granted to the FAA to relieve applicants of their responsibility to show compliance. The FAA must always be sure its findings are preceded by a sufficient "showing" by the applicant that meets the regulations.9

Instructions for Continued Airworthiness (ICAs) and Owner/Operator Responsibility for Continued Operational Safety (COS)

- ICAs

The FAA's policy that allows STC/PMA parts and repairs providers to apply the TCH's ICAs to STC/PMA parts and repairs is a significant issue. The problems related to compliance, ongoing continued airworthiness of products, and the safety of allowing operators to apply technical data developed for one design (e.g. the TCH design) to a different design (e.g. PMA or repairs) has not been sufficiently addressed or evaluated by operators and the FAA.

GE believes the FAA practice of allowing other DAHs to apply TCH ICAs to their parts is contrary to the requirements of §21.50(b), and is one area where the FAA has not required PMA applicants to demonstrate compliance. For years, FAA Orders and Policy have essentially permitted applicants to "state or show" that the original ICAs published by the TCH apply to the applicants' part or repair (e.g. Order 8110.54 and 8110.42C). However, the ICA regulation, §21.50(b) mandates that all DAH's must

9 As the RAF points out, the FAA does not require full product re-certification by TCH's of new parts or repairs the TCH introduces in order to show compliance. However, this conclusion does not address the fact that the TCH has extensive data from initial product certification, type design data, and comprehensive field experience to assist in its technical substantiation for any redesigned parts or repairs – data which is not available to independent design and repair providers. The TCH performs assessments of a design change or repair's impact to the overall airworthiness of a product. This should be acknowledged in the final RAF report, and any suggestion that TCH's expect a different standard for TCHs versus other DAHs should be eliminated from the report.

"furnish" ICAs for their design:

> (b) The holder of a **design approval**, including either the type certificate or supplemental type certificate…, **shall furnish** at least one set of complete Instructions for Continued Airworthiness, to the owner of each type aircraft, aircraft engine, or propeller upon its delivery….10

The PMA regulation, §21.303, makes clear that the applicant must "provide test reports and computations necessary to show that the part meets the airworthiness requirements of the … regulations applicable to the product on which the part is to be installed." For engines, the airworthiness standards for the product are set forth in 14 CFR Part 33, and §33.4 mandates that the applicant "prepare" ICA. When §21.50(b) and §33.4 are read together, and consistently with the regulatory premise of DAH responsibility, the regulations require any DAH for a part to prepare and provide an ICA, even if the FAA or applicant claims that the design approval does not alter what is in the original ICA. A statement indicating the "appropriateness" of using an existing ICA to a new design does not comply with the requirement for a document, and GE does not believe it is sufficient for the FAA to make a statement that it has determined that the TCH ICA are applicable for other approvals.11

The original proposal for §21.50(b) addressed only type certificate holders12 but was changed to make it applicable to all design approval holders (which includes PMA and changes to type design introduced via major repairs or alterations). GE assumes this change was deliberately made because the FAA intends that all DAHs, regardless of their category, be held to a similar standard of showing compliance to airworthiness requirements. The PMA and ICA Order, however, appear to allow a PMA part or repair provider to do nothing more than "assess" and "state" that the TCH ICA applies to their design, relieving the PMA providers of their regulatory responsibility in this regard.

The requirement to prepare and furnish ICAs by each DAH makes sense because there is no safety or technical rationale for accepting ICAs developed for one part to be applied to another part. More importantly, from a safety perspective, when a TCH makes a change to its ICAs, there is no regulated process that ensures those changes are evaluated for their impact to every other approved PMA part or repair introduced in the product previously, nor subsequently. And there is no process by which the PMA provider "shows" that the TCH changes to the ICAs apply to the DAH's

10 Part 43 does not require an "application" for a repair or alteration and therefore the requirement to furnish an ICA does not appear to apply to a repair provider directly. However, the FAA acknowledgement that fabrications, repairs and alterations can introduce changes to type design suggests that the regulatory intent is the same for all design and maintenance changes. The impact on the existing ICA must be defined and assessed by the repair provider, and repair providers should also be required to furnish ICAs for their fabrication or alteration that is outside the type design.
11 The only exception to this would be PMA by license, which by definition is already included in the TCH ICA and part of the TCH type design.
12 Docket 14779, No. 75-31.

part. 13 This issue is magnified as increasing numbers of DAHs introduce modifications to products over time. This is a significant gap in the technical and safety baseline underlying the FAA-accepted ICA practice of adopting TCH ICAs for other DAHs. The only rationale the RAF discusses for this practice appears to be to ease the compliance burden on PMA DAHs, or to ease recordkeeping for operators, neither of which should supercede a safety and regulatory requirement.

It is this safety and compliance focus that has caused TCHs to include statements of applicability in their ICAs. It is a TCH's responsibility to define the applicability of its ICA documents in a clear manner. The ICA provided by a TCH are technically based on the assumption that all parts of a product are those defined within the TCH's original design configuration (or altered via TCH compliance data), and need only address the TCH's type design configuration. It is also necessary for clarity to state the fact that the TCH has not evaluated the applicability of its ICA to any design approvals or repairs not shown by the TCH to comply with FAA requirements. The FAA acknowledged in SAIB 08-40 that the TCH is not able, nor required, to assess the applicability of its ICA to other than the type design of its type certificate.

Statements of applicability do not invalidate the ICAs, but merely provide operators clear and complete information regarding the technical basis for the ICA, and how the operators should use the ICA. Any "confusion" about these statements stems from the absence of ICAs for PMA parts, not from the statements TCH's have provided. GE disagrees with the RAF suggestion that TCH's should remove legitimate and technically based statements of applicability in TCH-developed ICAs.

By properly enforcing §21.50(b), owners/operators of products will have a better understanding of what instructions they should be complying with and who they should consult with in fulfilling their continued operational safety responsibilities. Requiring all DAH's and repair providers to prepare and provide an ICA for their parts would go a long way to eliminate confusion about which data applies to which parts, it would standardize requirements for approval and compliance among various data holders, it would eliminate the concerns related to TCH statements regarding ICA applicability, and it would improve the global acceptance of aircraft because of the clarity in records, configuration, and ICAs.

13 For example, the TCH may change its ICAs to extend a permissible certain crack limit in a turbine blade, based on extensive data learned through field events and type design analysis. How and whether such change applies to a PMA replacement blade approved by test and computation, which may be different from the TCH blade, is unknown to both the TCH and PMA Holder. Yet the current FAA policy and industry practice is to apply the changed ICAs to the PMA blade without any commensurate showing of compliance to §33.4 by the PMA DAH.

- COS and Owner/Operator Responsibility

An overriding theme throughout the RAF report, supported by existing FAA regulations, is that the owner/operator is ultimately responsible for ensuring the continuing airworthiness of their aircraft through the original certificate and any subsequent changes introduced to the aircraft over time. In contrast, the report simultaneously acknowledges that TCH's have historically played a large role in supporting owners/operators in executing that ultimate COS responsibility, even though the TCH's post-certification regulatory obligations are limited to §§21.3, 21.4, 21.49, 21.50(b), and 21.99. Operators have relied extensively on TCHs for technical and field support, airworthiness recommendations, and safety risk analysis (among many other things) well beyond what the TCH is required to provide by the regulations. TCH's were historically capable of providing this comprehensive level of COS support because they understood both the original type design and modifications made to the products, which were standardized across the fleet. This level of TCH COS support has benefited the industry as a whole.

However, the RAF conclusions about the adequacy of the existing regulatory regime, DAH responsibilities, and COS requirements means that the FAA, and more importantly operators, must accept that TCH's must play a more limited role in COS support in the future. As products are modified into unique configurations, with design changes, parts, and repairs about which the TCH has no data, the TCH cannot evaluate the effects of such changes on type design, airworthiness, or continuing operational safety. It is inappropriate for the FAA or operators to suggest that the TCH can, or should, provide comprehensive technical support for unknown configurations. In practice, this means that operators will have a substantially higher burden to meet their COS responsibilities for the continued airworthiness and compliance of the products it operates (e.g. §121.363).

The FAA will have to retrain its workforce and emphasize to operators that: this responsibility includes understanding which parts are operating in their products; the total cumulative compliance and airworthiness of all design or maintenance changes introduced to the product by those parts; who the responsible part fabricator is; and the respective responsibility of that part or repair provider to monitor, report, and correct its in-service failures. GE anticipates this responsibility will become much more complicated for operators as STC approvals form the basis for major design changes introduced into an engine. STC designs, like PMA and repairs, are evaluated presuming the design change is made on an as-certified (unmodified) product. In reality, in most cases the product has been altered or modified – often substantially – over time through various DAH and maintenance providers. STCs are clear on their face that the installer must determine that the STC design, combined with any other previously approved modifications, create no adverse effect on the product's airworthiness. It will be virtually impossible for operators or maintenance providers to make these determinations without the original compliance and other modification data for the product.

Given that operators will be assuming more duties related to their COS responsibilities, there are several areas in the regulations that must be improved for the operators to be able to meet this increasing COS responsibility. Part marking and maintenance document retention are two readily apparent areas. The RAF acknowledges that there is no regulatory basis that requires marking of any parts other than life-limited parts, PMA parts and TSO parts. There is no requirement for manufacturers and fabricators of parts to track PMA parts or to have a tracking system. The CFR only requires maintenance and configuration records be kept for 1 to 2 years. These minimum requirements are insufficient to ensure configuration control throughout the useful life of the product (especially as products transfer between operators).14

The operator is the only one who is in a position to identify the status of their products' configuration. And for any in-service events that arise, operators' complete and timely reporting to the appropriate DAH is essential for corrective action and safety evaluations. But without the FAA requiring more specificity regarding part numbering, part and repair tracking, configuration control, ICA furnished by different approval holders, and longer record keeping, it is unclear how any operator can meet its COS responsibilities for ensuring the cumulative airworthiness of products whose type design is modified over time via STC/PMA parts and repairs.

Airworthiness and its Relation to Type Design

The concept of airworthiness begins with the need to establish an approved type design and then demonstrate that a product conforms to that type design and is in a condition for safe operation throughout its operating life. §21.31 defines the type design to include "the drawings, and a listing of those drawings and specifications, necessary to define the configuration and the design features of the product shown to comply with the requirements of the subchapter applicable to the product." The "configuration" of the product is essential when defining the type design. When the configuration to the product changes (e.g. through STC/PMA parts and repairs), the type design has also changed.

Subpart D of 14 CFR Part 21 addresses changes to type certificates, which includes changes to the type design (e.g. §21.93 and §21.95). This subpart applies to changes to type design, regardless of what process is used to make those changes (i.e. design or maintenance). For example, the PMA regulation §21.303 applies to both "replacement" and "modification" parts. Although the regulations do not specify the difference between the two, any parts approved that do not conform to the TCH design should be considered "modifications". If a PMA is issued for a part that is not identical in all respects to the part certified in the existing type design (including

14 Engines, for example, may stay with an operator from anywhere between 1 to 10 years, and will operate in civil aviation for up to 30 years. The CFR requirements to keep maintenance and configuration documentation for only 1 to 2 years does not correlate to this reality.

materials and process specifications)15 then it logically follows that the installation of that PMA part constitutes a change to the type design for the product, and there must be a determination whether the change is major or minor under 14 CFR Part 21.

The Report discussion on Page 7 seems to imply that repairs, alterations, and fabrications, have the objective of replicating "an equivalent part with respect to the airworthiness of the product." But maintenance activity, just like PMA parts, may change the type design of a product. GE is unaware of any regulatory requirement that either must result in an "equivalent" part. The primary focus of any change to a product, whether by design or via maintenance, should be its continued compliance with the type certification basis of that product. It is confusing to refer to that process as "equivalent airworthiness".16

GE agrees with the FAA that it would be rare for a minor repair/alteration or minor design change to an existing type design to require a repeat of all the original type certification testing or analysis. GE believes, however, that STC/PMA parts and repairs may still constitute a change to type design of the product, and must be properly approved or accepted by the FAA, only after a proper applicant showing, in a consistent manner.17 That showing by a subsequent DAH, repair providers, and owner/operators must be a holistic approach to the airworthiness of their modifications on the product, not just the piece part. What one provider may think is a "minor" change to one part evaluated in isolation may not be the case when a holistic or cumulative evaluation as to the effect on the whole product is made. This is particularly applicable to those parts that are critical to operating safety of engines, where even "minor" changes can impact overall product safety.

GE supports the RAF's discussion of the need to provide more guidance and focus on what constitutes a critical part, and we agree that the guidance should be a "risk based performance criterion or categorization" and not a list. The criticality of parts is dependent on the specific product and the specific application. It is essential for that risk-based performance approach to consider not just the compliance and safety risk to an individual part, but the risk associated with the influences such parts introduce directly or indirectly, and how they impact the product as a whole.

15 The only case where true identicality can be established is in PMA by license or by identicality using TCH design data.

16 For example, 14 CFR Part 43 requires a determination of major or minor with respect to repairs and alterations, but it appears that the FAA requires a different determination of major or minor if there is any change to the type design (§21.93). In addition, the FAA states on Page 7 that: "The repair, alteration, or fabrication of a replacement part is therefore intended to return the product to its original or properly altered condition. In those instances within the scope of maintenance work under 14 CFR Part 43, there should not be changes to a product substantive enough to be a change to its type design. If there were a change in design then it would be alteration, not maintenance, and if it was substantive enough it may require an STC and more expansive compliance showing."

17 The FAA has taken a very literal approach to what constitutes a type design, or a change to it, during the initial type certification and production compliance processes. Things as minor as a radius change to a part are found to be changes to a type design, and are characterized as an escape to the production system. There must be consistency in the definition of a type design throughout a product's useful life to ensure continued airworthiness and safety.

Specific Comments on RAF Recommendations 1-15 18

GE supports Recommendations 2 through 15 in general (with some exceptions to Deliverables or Considerations) as defined by the RAF team. The following discussion provides GE's rationale applicable to these recommendations. It focuses on clarifying roles and responsibilities related to compliance, continued operational safety, and airworthiness.

GE supports Recommendations 12, 13 and 15, which are focused on the responsibilities for all Design Data Holders associated with Continued Operational Safety (COS).

- **Recommendation 12** – GE supports revising §21.3 to include reporting requirements for any design, production, fabrication or maintenance approval holder, by adding a requirement for those that have performed fabrication or maintenance activities on a product. GE also supports further clarity as to the reporting requirements in §21.4, ETOPS reporting. The present requirement refers to type certificate holders only. If an airplane-engine combination approved for ETOPS undergoes a type design change, especially one that is major, and an inservice event related to that type design change triggers a reporting, tracking, or resolution per this section, the requirements of this section should apply to the design approval holder responsible for the change. This makes it consistent with the reporting requirements in §21.3 for failures, malfunctions, and defects, which applies to a PMA or TSO authorization as well as a TC holder.

- **Recommendation 13** – GE concurs with this recommendation to change the applicability of §21.99 to include all design and data approval holders. The change to §21.99 should include system level responsibility. Experience has shown that failure modes can be different between TCH and non-TCH parts, including different system level failure modes. Therefore, all design approval holders need to assess the potential system impact for a part failure, within the bounds of the "unsafe condition" referred to in §21.99(a)(1) or the definition of what "will contribute to the safety of the product" in §21.99(b). Section 21.99 correctly refers to the safety of the product, as it is impossible to demonstrate the safety of any individual part. This is consistent with draft AC33XX that is in review, and it should be reflected in the rule.

- **Recommendation 15** – GE supports the need for more clarity with respect to the requirements in §21.50(b) for ICAs. The appropriateness of any changes to an existing AC should be measured with respect to the regulations and not just an existing AC. §21.50(b) presently applies to all design approval holders and requires the preparation of an ICA applicable to that design approval. This is aligned with the basic regulatory premise that the person who makes the change

18 Recommendations and supporting material (Product/Deliverable, Objective, Boundaries & Considerations) documented in pages 37-51, Aviation Safety, (AVS) Repair, Alteration and Fabrication (RAF) Study dated August 6, 2008.

is responsible for the impact that change may have on the part, appliance or product, including any maintenance impact. As previously stated, a showing of compliance under §21.50(b) requires the creation of an ICA by every design approval holder, even if that ICA is the same as what the original design approval holder provided.

GE does not support the FAA's position in Recommendation 15 regarding TCH statements in ICAs and manuals. SAIB NE-08-40 clearly states "the TCH has no data or knowledge about the PMA and STC parts installed in the product." The TCH's statements are within the regulations, as long as they remain factual, and related to TCH parts and the product.19

GE supports Recommendations 2, 4 and 6, and recommends that clarification and guidance for major/minor determination under 14 CFR Part 21 and 14 CFR Part 43 be integrated into one project.

- **Recommendation 2** – GE supports revising §1.1 to specifically define any repair, alteration, or fabrication of a critical part as a major repair or major alteration. However, the very nature of critical parts requires that this action be addressed now, rather than revisited following "period evaluations" of the effectiveness of other initiatives recommended by the RAF report. GE also recommends that life limited parts be specifically mentioned as a subset of critical parts, since their existence is widespread and there are type certification and maintenance regulations that specifically address life limited parts.

  In the interim, GE believes the present definitions in 14 CFR Part 1 enable the FAA to quickly issue guidance that defines the repair, alteration, or fabrication of critical parts to be a major repair or major alteration. The phrase "or other qualities affecting airworthiness" in both definitions provides a regulatory basis for such guidance.

- **Recommendation 4** – GE supports the recommendation to better define what constitutes a major or minor change to the type design, in accordance with §21.93. The FAA Aircraft Certification Service's current practice is that any part that can not be conformed to an approved original type design, or properly approved change to a type design, constitutes a change to the type design which must be addressed in accordance with subpart D of 14 CFR Part 21. That practice should form the basis of any new FAA guidance material.

19 GE does not support Conclusion 7 and recommends it be rewritten. Proper use of ICAs is a significant compliance and safety concern. Compliance with STC and PMA rules require the applicant prepare and furnish ICAs. The rules are incomplete relative to maintenance ICA requirements. FAA policy that permits assessments of ICAs is inconsistent with the rules. FAA Policy on this subject should be realigned with the rules, and gaps in the rules for maintenance providers should be addressed via advisory material and rulemaking.

Aircraft Certification Offices (ACO) frequently provide TCHs with a list of those parts, components, or appliances that may not be approved under the process defined in §21.93. ACOs also define specific airworthiness standards for which any compliance activity, regardless of the type design change, must be accomplished in accordance with §21.97. Both of these FAA practices define what the ACO considers to be a major change to the type design for a particular product. Those definitions of a major change should also be applied to any activity to modify the type design by other than the TC holder, such as alterations and design approvals. This practice by the ACO community should be considered when defining what constitutes a major or minor change to a type design. Regardless of how these terms are eventually defined, they should be applied the same way to TC holders, STC applicants and holders, alterations, and any repairs that FAA policy defines as a change to the type design.

- Recommendation 6 – GE concurs with the intent to gain as much input from industry as possible before the FAA clarifies what constitutes a major or minor repair or alteration. In the end what constitutes major or minor should be based on regulatory intent and not just industry practice.

  The recommendation discusses the need to avoid confusion between major/minor as it relates to repairs/alterations and major/minor type design changes within 14 CFR Part 21. There is evidence that confusion already exists. For example, under 14 CFR Part 43 the classification of something as major or minor not only relates to the product, part, or appliance but to who may execute an approval for return to service. Under 14 CFR Part 21 a major or minor change is only related to the type certificate and in most cases just to the type design. GE recommends that all activities to define major or minor with respect to 14 CFR Part 21 and 14 CFR Part 43 be accomplished as a single effort, co-chaired by AIR-100 and AFS-300, so that the existing confusion can be cleared up.

GE supports Recommendation 3, but suggests that it be expanded. The result would provide guidance on what constitutes a Critical Part and to align that definition with the EASA harmonization effort.

- The FAA's objective to define a "single high level criteria" for critical parts is a start. But, in parallel, each of the 4 individual AIR Directorates should begin defining critical part criteria for their products. Progress within each Directorate will provide valuable clarification for that branch of aviation. A good place to begin is any part or component, whose individual failure or malfunction, or the related failure or malfunction of another affected part or component, could trigger reporting under §21.3. The definition should be based on impact to the product, not on individual part descriptions. Consistent with Recommendation 2 revision to §1.1, a critical part definition should be added to the appropriate section(s) of 14 CFR. Due to the complexity with creating a standard critical part definition, GE recommends

the FAA revise the appropriate sections(s) of 14 CFR for commercial gas turbine engines independent of other aviation products.

- While GE agrees that unnecessary categories of parts should be avoided, the importance of "influencing parts" needs to be addressed and clarified within the regulatory structure, particularly for parts that influence life limited and critical parts in gas turbine engines. This clarification is needed to assure all DAHs and repair providers show compliance to the airworthiness requirements applicable to the product are met with their part installed. GE recommends that influencing parts be included in Recommendation 9 (data package templates).

GE supports Recommendation 8 to provide guidance on part identification for all repairs, alterations, fabricated parts, and owner produced parts. We also support reconsideration of rulemaking on part identification.

- The RAF's preliminary report acknowledged that, "Part marking is a significant issue … but not a notable safety concern yet."

- Part numbers, serial numbers and all part marking elements are used by industry for more functions than identification of an approved part for installation into a product. Industry liability, COS management, incident reporting, and incident investigation rely on knowing the DAH for specific parts.

- GE has significant experience with STC/PMA parts and repairs being mismarked to the extent that it's impossible to determine whether the part qualifies for installation.

- GE agrees that recent FAA proposed rulemaking on production part identification and the revised 14 CFR Part 45 should have the goal to identify a part marking rule proposal that encompasses both production and repair/fabrication parts. The objective should be the easy identification of the DAH for all parts, recognizing that there will be some small parts that utilize bag or tag marking.

GE supports Recommendations 9 and 10 to develop and deploy repair, alteration and PMA compliance guidance templates along with advisory material (revise AC120- 77).

- Recommendation 9 – GE supports the development of templates to be used by applicants when developing data packages for all types of approvals. The objective of consistency should be with respect to full compliance with the regulations, and not consistency with how that compliance must be demonstrated. The templates should address part functionality, system effect assessments up to and including the product.

- Recommendation 10 – GE supports this recommendation.

GE conditionally supports Recommendation 11, which encourages industry initiatives to provide guidance on COS management via SMS.

- Given that there is no SMS rule in existence, SMS implementation at this point would be voluntary by industry. We do not support the imposition of SMS requirements without a regulation that requires and defines SMS.

- GE support is predicated on requiring COS plans that address individual parts, and the system interactions inherent in today's high technology gas turbine engines.

Recommendation 1, as worded, is not an actionable recommendation. GE suggests it be deleted, and its discussion be added to the Recommendation summary on page 37.

- The current rules may define the "current regulatory structure and policy," and the industry is working within this "structure." However, the current structure, which is based on the premise that individual non-TCH parts (repairs, alterations, fabrications, and PMA/STC) are replaceable with TC defined parts and repairs **without limit** throughout the engine system, is not sufficient to maintain compliance and safety. Low technology parts with primarily independent functions have been successfully replaced in engines in the past. But data is beginning to show that individual part validation and COS for highly interdependent, complex and advanced technology parts on commercial gas turbine engines are not providing the product level validation and COS required by 14 CFR.

- GE does not support part alteration or fabrication regardless of criticality because of the safety need for part integration compliance demonstration. RAF recommendations 2, 3, 4 and 6 associated with defining clear major/minor definitions, including evaluation of type design change(s), highlight the need for "change to the current regulatory structure."

- GE does not agree with repairs to any extent short of 100% fabrication.20 The complexities with this subject discussed in the RAF report do not change the fundamental fact that repair of an existing part via maintenance is totally different from manufacturing a replacement part.

20 GE disagrees with Conclusion 2. The concern is not primarily the percentage of the part being repaired or fabricated. Repairs are going beyond restoration of wear or damage. Parts with 100% new material, only preserving the TC part number and serial number, are not "restored," they are replacement parts. In addition, modifications (additional & different features, changed cooling characteristics, weight differences) require an assessment of the part's function in the system and the impact on the applicable airworthiness standards for the product. The RAF clearly states on page 7, that the compliance focus is on **what effect the work performed will have on the product.** GE recommends policy and advisory material used for showing repair and fabrication impact on the product be reviewed, and integrated as appropriate with the major/minor clarification recommendations sited earlier in this report. Conclusion 2 should be rewritten accordingly.

end