DOCUMENT CHALLENGES IN REPAIR STATION ENVIROMENTS

Timothy Killion
Project Manager
tim.killion@goodrich.com

Jeff Bongard
Human Factors Specialist
jeff.bongard@goodrich.com

Goodrich Aviation Technical Services, Inc
Everett, Washington, USA

Abstract

This paper will present some of the daily challenges that face the repair station with respect to the way aircraft maintenance documentation plays a role in maintenance errors. Goodrich Aviation Technical Services (GATS) is one of the world's largest 3rd party maintenance providers. Our operations are comprised of a diversified customer base, which encompasses a large variation of aircraft types, configurations, and operating regulations. With this diversity, the daily operation is challenged with interpreting, segregating, and monitoring many very different maintenance programs.

GATS provides service for over 450 air transport aircraft a year and as a result, the effects of maintenance documentation ambiguities and errors can have a significant impact on our business. Important to our success is the ability to deliver a quality product on time, and at a value to the customer, while effectively managing documentation ambiguity and error. Effective interpretation of the various air carriers maintenance programs and the regulatory procedures that govern them are vital to this success.

No single maintenance program or repair station process alone can ensure the elimination of maintenance errors due to inadequate documentation. This paper shall provide examples of how maintenance documentation plays a contributing role in maintenance errors. Additionally, it will provide insight into the role that both FAR 145, and the regulations that govern the operators' Continuous Airworthiness Maintenance Programs contribute to these errors. This paper does not contain information from, or make inference to any actual airline customer or other 3rd party repair facility. Instead, it will generalize the issues and situations to illustrate how they relate to the occurrence of maintenance errors.

Background

The air carrier industry has long supported the outsourcing of aircraft maintenance to third party repair stations. As a repair station, it is Goodrich's responsibility to provide each of our customers with service and products that comply with their approved continuous airworthiness maintenance program. In addition, repair stations must meet and or exceed the customer's expectations of quality, span time, and cost while ensuring compliance with its own Repair Station Manual (RSM) and FAR 145.

At a glance, one might ask why should the repair station, which must follow the air carriers approved maintenance program, have any challenges with maintenance documentation? In looking at the air transport industry in general, the question points toward the end users ability to properly read, interpret, and execute written instructions or procedures. How this written information is developed and presented has a significant impact on the end user. In addition, the methods and structure by which maintenance and inspection personnel must document their maintenance actions play a significant role in maintenance documentation errors.

Continued Airworthiness Maintenance Programs

On average, 90% of Goodrich's business comes from U.S. Air Carriers. These air carriers provide the instructions and guidelines that the repair station must follow to ensure it complies with their continuous airworthiness maintenance programs. Each air carrier has its own General Procedures Manual (GPM), which embodies its continuous airworthiness maintenance program. This manual is continually revised to meet its regulatory and business requirements. Comparatively, air carriers have quite different business goals, strategies and corporate cultures, which are manifested in their procedures manuals, documentation, and related written information. Interpreting and putting into practice the air carrier's philosophy of how their aircraft maintenance should be carried out brings a special challenge to repair stations. Within the documentation are subtle clues implanted by document designers collectively conveying that air carrier's philosophy. These philosophies and the annotated language and terminology are well known to the carrier but, the repair station must seek out and understand these details to ensure compliance with the air carriers program intent. There are very few maintenance procedures that do not require some degree of interpretation. It is within these interpretations, or the air carriers assumptions that the third party repair station fully understands its culture that many errors occur.

As we further explore the differences in air carrier programs and requirements, it is important to note that the repair station must interpret and comply with not only its own RSM, but also that of the customer. As a certified repair station, Goodrich must adhere to FAR 145.2, which states in part "such repair station shall perform that work in accordance with the air carrier's or commercial operator's manual". This situation raises the question "when does the repair station use its manual, and when does it use the air carrier's?" The air carrier typically does not define how a repair station fits into their program. Should air carriers define this? At this point, current regulations do little to

help answer this question. Interpretation varies among regulators, and air carriers as to how the repair stations must function as a maintenance provider for the air carrier.

Air Carrier Documents

It's a well-known fact that how a document is designed can significantly increase the probability of the instructions being understood by the technician. When the air carrier's maintenance documents are used at a maintenance facility, it is critical that the airline and the repair station ensure there is consistent interpretation and that the intent of the task is clearly understood. Maintenance documentation and procedural instructions must be written as to remove the perceived necessity for verbal clarifications.

Program issues such as computerized maintenance programs, OEM vs. air carrier customized maintenance manuals, and tailor-made routine maintenance documents increase the probability for misinterpretation and resulting documentation errors. Airline document designers often make assumptions that the end user possesses knowledge or terminology common to the airline culture, but in reality, the end user may not. This is due largely to differences in knowledge, experience and culture of the workforces between the air carrier and repair station.

In the repair station environment, the technician is exposed to wide variations in the format and detail of documents that accomplish similar or like tasks. Often the repair station is given a document to accomplish a particular maintenance action or modification, but the document contains no ready method for signing off the performed maintenance actions or, a mere list of modification requirements is all that is provided. In either case, the repair station must generate supporting documents to ensure compliance and for appropriately documenting all maintenance actions. Conversely, the maintenance or modification documents may contain very detailed information with positive compliance sign-off's for each level of maintenance action. The more detail the better undoubtedly, but the information must be written and arranged with the end user in mind. How information is arranged within a document is a significant issue for the maintenance technician. It can greatly increase the chance for human error not only in the handling of the document, but also in accomplishing the work. The following list provides a small sampling of issues that the repair station must understand and overcome as part of its daily operations.

- Document and Program variations:
  - FAR 121 air carrier customer:
    - Complexity and method that is required for documenting maintenance actions
    - Specialized identification and coding of maintenance actions
    - Inspection requirement variations
    - Identification of Required Inspection Items (RII)
    - Determining Major Repair and Alteration thresholds
    - Repair or modification parts identification
    - Alterations/prototype aircraft – Instructions for continued airworthiness (IFCAW) may not be integrated into the air carrier manual
    - Methods for acceptance/procurement of aircraft parts

- Non-air carrier – FAR 91 customer:
  - Not required to have a GPM – uses repair station manual and procedures
  - Alterations / prototype aircraft – Instructions for continued airworthiness (IFLCW) may not be consistent with the maintenance program
- Foreign air carrier customer:
  - No FAA oversight - Foreign Airworthiness Authority oversight
  - Carrier must provide written processes, procedures

The following table provides a sample of the program variations that the repair station may encounter as part of daily routine operations

		Carrier A	**Carrier B**	**Carrier C**
Program Element	**Required Inspection Items (RII)List**	A list arranged by 10 specific maintenance operations, and the applicable components.	A list that contains 29 specific items, arranged by ATA	A list arranged by component, and the 23 specific maintenance operations to the component.
	Major Repair/Alteration Determination Criteria	Criteria in the form of a 6 step Yes-No decision tree	Criteria in the form of an 11 step Yes-No decision tree	Criteria in the form of multiple decision trees depending on repair/alteration application
	Service Difficulty Reporting	Not required for repair stations to report	Employs Service Difficulty reporting	Employs both Operational Difficulty Report and Service Difficulty Report

Regulatory Issues

Ensuring that documents satisfy regulatory requirements is the primary and most difficult challenge the repair station faces. Directly or in-directly, the repair station must satisfy the requirements of:

- The customers regulatory agency
- The repair station regulatory agency
- The FAA Aircraft Certification Offices that issue airworthiness, modification, and repair approvals
- FAA designee's (DAR, DER, DMIR)
- The repair station PMI and air carrier CMO
- The aircraft manufacturers regulatory agency that initially approves maintenance programs for new model aircraft.

Each of these entities has their own agenda and unique set of expectations, which may have different views of program compliance. This is another way of saying that interpretation of the regulations varies between persons, agencies, and geographic location. As an example, it is very frustrating for the repair station when one regulatory representative or designee determines a particular action to be in compliance, and then, at a later date, another questions its compliance.

Conclusion

As an industry we must look to the end user, the maintenance technician, to ensure that our safety goals and error reduction plans succeed. The technician must be provided with the proper tools and processes to assure the highest level of quality and flight safety. We must continue to challenge the technician to participate in processes intended to assure that the end result suits not only the compliance needs, but also that of the user. We the managers and designers must find ourselves looking more to the experience of the technicians to identify and formulate the best solutions.

Recently, Goodrich has taken on this challenge by recruiting some of our best technicians to participate in a project that is directly related to their daily responsibilities. These technicians have revised/rewritten a routine heavy maintenance program for an airline. This project focused on compliance, error reduction, and user friendliness. The objective: To minimize documentation ambiguities and enhance their usability so that it is easier for the technician to “do things the right way.”

We must never forget that no one comes to work to do the wrong thing, so why should the caliber of tools provided to him or her be of any lesser quality. To further support this process, we encourage the air carriers to partner with the repair stations in developing joint continuous improvement strategies such as error management, continuous training, and reliability improvement programs.