

**Aging Transport Systems
Rulemaking Advisory Committee**

ATSRAC Task 11:

**EAPAS Rulemaking Advisory
Harmonization Working Group**

Final Report to ATSRAC

**Prepared by the members of ASTRAC HWG 11
October 29, 2004**

Foreword

This report contains the interim recommendations of the Aging Transport Systems Rulemaking Advisory Committee (ATSRAC) EAPAS Rulemaking Advisory (ERA) Harmonization Working Group (known as HWG 11). The ERA HWG was formed by ATSRAC to address Task 11 which deals with developing alternatives to rulemaking, providing data to support the economic impact of the proposed rulemaking, and addressing public comments to the proposed rule. This report was submitted to ATSRAC at its conference call meeting, October 21, 2004.

Harmonization Working Group Members

The following members participated in the creation of this report:

Randy Pope – chair	Fed Ex
Johan Kala – previous co-chair	Continental Airlines
Martin Cheshire – previous co-chair	Virgin Atlantic Airlines
Fred Sobeck	FAA
Steve Slotte	FAA
Gill Palafox	Boeing
Vid Variakojis	Boeing
Jomar Rocha	Bombardier
Jeff Moon	Delta Air Lines
Joseph Spielmann	ASTAR Air Cargo
Kirk Thornburg	AirTran Airways
Jeff Becker	ABX
Greg Smith	ABX
Dave Tudor	CAA (UK)
Jerome Bruel	DGAC (France)
Dominique Chevant	Airbus
Jean-Luc Ballenghein	Airbus
Craig Vogelsang	FedEx
Sarah Knife	GEAC
Stefan Heutman	Lufthansa Technic
Gunter Friedrich	Lufthansa Training
Eli Cotti	NBAA
Chris Nichols	AirTran Airways

Tasking:

The FAA tasked ATSRAC with identifying recommendations to support the voluntary performance of the enhanced zonal analysis procedure (EZAP) on those supplemental type certificates (STC) not included in the proposed rulemaking currently being developed by the FAA. Additionally, ATSRAC was tasked with identifying electrical

wiring interconnection systems (EWIS) training requirements for different groups of people maintaining, inspecting, or interacting with EWIS on the airplane.

The exact tasks are provided below.

Task 11.1.1

Identify the minimum set of training requirements to changes recommended in the ATSRAC Task 8 Final Report in accordance with defined changes in Task 9 final report.

Task 11.1.2

Provide recommendations that will facilitate voluntary implementation of the remaining training recommendations in task 8 final report not implicitly mandated in task 11.1

Task 11.2

Development of adequate maintenance tasks for an air carrier may necessitate analysis of the wiring systems installed by the way of an STC. STC holders may not be required to provide the results of an EZAP analysis, or similar, on their STCs. Therefore, ATSRAC is requested to provide a recommendation that would facilitate development of appropriate maintenance tasks associated with STC installations and how an air carrier might implement them into its maintenance program. This task is to be completed by July 31, 2004.

To complete this task please consider the following items:

1. Identification of types or categories of STCs that would require additional or revised inspections or intervals as compared to those developed by the type design holder
2. Method to integrate STC related maintenance and inspection tasks with the TC holder developed tasks
3. Most appropriate means to include Passenger to Freighter Conversion STCs in accordance with the intent of the ATSRAC recommendations
4. Other items that ATSRAC determines necessary.

Recommendations:

For Tasks 11.1.1 and 11.1.2 the working group used the proposed advisory circulars produced by ATSRAC HWGs 8 and 9 on EWIS training and the EZAP analysis, respectively to produce a set of training requirements applicable to the various target groups. These target groups are the same as identified in AC 120-YY produced by HWG 8. Recommendations for Tasks 11.1.1 and 11.1.2 (recommendation numbers 1 and 2) are contained in Appendix A of this report.

For Task 11.2 the working group developed a simple flow diagram for operators and STC holders to follow when determining if an EZAP is necessary for an STC installed on an airplane that had a baseline EZAP performed by the airplane manufacturer. Because of previous compliance requirements for SFAR 88, operators already know what STCs are installed on their airplanes. Therefore the task is simplified because operators have data readily available that shows which STCs are installed on their airplanes. Recommendations for Task 11.2 (recommendation numbers 3 and 4) are contained in Appendix B of this report.

Acronyms:

AC – Advisory Circular
ATSRAC – Aging Transport Systems Rulemaking Advisory Committee
DET – Detailed Inspection
EAPAS – Enhanced Airworthiness Program for Airplane Systems
ERA – EAPAS Rulemaking Advisory
ESDS – Electrostatic Discharge Sensitive
EWIS – Electrical Wiring Interconnection System
EZAP – Enhanced Zonal Analysis Procedure
FOD – Foreign Object Debris
GVI – General Visual Inspection
HWG – Harmonization Working Group
ICA – Instructions for Continued Airworthiness
LRU – Line Replaceable Unit
MRO – Maintenance, Repair and Overhaul
OEM – Original Equipment Manufacturer (includes Type Certificate Holder or Type Design Holder in this report)
SDI – Special Detailed Inspection
SFAR – Special Federal Aviation Regulation
STC – Supplemental Type Certificate

Appendix A

HWG 11 Recommendations to Address Tasks 11.1.1 and 11.1.2

Recommendation for Task 11.1.1

HWG 11 Recommendation 1

Appendix A to AC 120 - YY, Electrical Wiring Interconnect Systems Minimum Initial Training Program, produced by ATSRAC HWG 8, recommends a minimum set of training requirements as well as the individuals who should receive EWIS specific training. HWG 11 reviewed those suggested minimum training requirements and developed the following chart to identify the minimum set of training requirements for personnel performing maintenance and inspection (Target Groups 1 and 2) on EWIS.

Federal Aviation Regulation § 121.375 requires that any person performing a maintenance action on an airplane be properly trained to perform those actions. Therefore, these training requirements should be identified as the minimum set of training requirements for personnel performing maintenance and inspection on aircraft EWIS (Target Groups 1 and 2) in any advisory material produce by the FAA to support the current EAPAS rulemaking effort..

Target group 1: Personnel performing EWIS maintenance

Target Group 2: Personnel performing maintenance inspections on EWIS

TARGET GROUP	1	2
A – INTRODUCTION		
Demonstrate the safe handling of airplane electrical systems, Line Replaceable Units (LRU's), tooling, troubleshooting procedures, and electrical measurement.		
1. Safety practices	X	X
2. Electrostatic Discharge Sensitive (ESDS) Device handling and protection	X	X
3. Tools, special tools and equipment	X	
4. Verify calibration/certification of instruments, tools, and equipment	X	
5. Required wiring checks using the Troubleshooting Procedures and Charts	X	
6. Measurement and troubleshooting using meters.	X	
7. LRU replacement general practices	X	X
B – WIRING PRACTICES DOCUMENTATION		
Know the construction and navigation of the applicable airplane wiring system overhaul or wiring practices manual	1	2
8. Standard Wiring Practice Manual structure/overview	X	X
9. Chapter cross-reference Index	X	X
10. Important Data and Tables	X	X
11. Wiring Diagram Manual	X	X

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 Recommendations for Tasks 11.1.1 and 11.1.2
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TARGET GROUP	1	2
12. Other Documentation as applicable	X	X
C – INSPECTION		
Know the different types of inspections, human factors in inspections, zonal areas and typical damages	1	2
13. General Visual Inspection (GVI), Detailed Inspection (DET), Special Detailed Inspection (SDI), and Zonal Inspection	X	X
14. Human factors in inspection		X
15. Zonal areas of inspection		X
16. Wiring system damage	X	X
D – HOUSEKEEPING:		
Know the contamination sources, materials, cleaning and protection procedures	1	2
17. Airplane external contamination sources	X	X
18. Airplane internal contamination sources	X	X
19. Other contamination sources	X	X
20. Contamination protection planning	X	
21. Protection during airplane maintenance and repair	X	
22. Cleaning processes	X	
E – WIRE:		
Demonstrate the correct identification of different wire types, their inspection criteria, and damage tolerance, repair and preventative maintenance procedures	1	2
23. Identification, type and construction	X	X
24. Insulation damage limits	X	X
25. Inspection criteria and standards of wire and wire bundles		X
26. Wire bundle installation practices	X	X
27. Typical damage and areas found (airplane specific)	X	X
28. Maintenance and repair procedures	X	X
29. Sleeving	X	X
30. Unused wires-termination and storage	X	X
31. Electrical bonding and grounds	X	X
F – CONNECTIVE DEVICES:		
Know the procedures to identify, inspect and find the correct repair for typical types of connectors found on the technician's airplane.	1	2
32. General types and identification	X	X
33. Cautions and protections	X	X
34. Visual inspection procedures	X	X
35. Typical damage found	X	X
36. Repair procedures	X	X
G – CONNECTIVE DEVICE REPAIR:		
Demonstrate the procedures to replacement of all parts for	1	2

typical types of connectors found on the technician's airplane.	TARGET GROUP	1	2
37. Circular Connectors		X	
38. Rectangular Connectors		X	
39. Terminal Blocks-Modular		X	
40. Terminal Blocks- Non-modular		X	
41. Grounding Modules		X	
42. Pressure Seals		X	

NOTE: For Target Group 2, items A3, A4, A6 are not recommended as mandatory, but as new inspection tooling becomes available it may be appropriate to require tooling training. In addition, these items would be valuable for voluntary training for inspector awareness.

Recommendation for Task 11.1.2

HWG 11 Recommendation 2

HWG11 acknowledges the recommendations for a minimum set of training for Targeted Groups 3 through 8. Since there are no existing regulatory requirements to train Target Groups 3 through 8, the members of HWG 11 recommend that training be made available to Targeted Groups 3 through 8 through voluntary measures. The members believe that training the individuals in these groups would greatly enhance the knowledge of the importance of EWIS safety in the overall safe operation of aircraft. Although not all targeted groups are directly involved in the maintenance of EWIS, they have the potential to have an adverse impact on EWIS. This can occur through inadvertent contact with EWIS during aircraft cleaning or by individuals performing unrelated maintenance that could impact the integrity of EWIS. Mechanics leaving drill shavings on wire bundles is one example of how this could occur. Some Target groups prepare paperwork that can guide mechanics in their work to insure proper attention to EWIS issues

A recommended minimum set of training is outlined later in this Appendix. Operators/organizations will want to voluntarily provide this training as appropriate for their organization.

There are many benefits in insuring that personnel that work in the aircraft environment or control the work of others are trained to protect the EWIS system. Safety, Reliability, Availability and Cost are all impacted by the condition of the aircraft EWIS.

A well trained workforce leads to a safe work environment. This environment:

- Raises awareness to readily detect and report obvious or potential EWIS maintenance issues
- Avoids unintended damage to EWIS by all work groups as they go about their business

- Allows Engineers and Planners to use newly obtained EWIS knowledge to improve documentation for house keeping and cautionary notes
- Creates a positive perception of the organization, internally and externally
- Insures that airworthiness and safety are positive images of the airline or maintenance organization
- Helps the organization to focus on continuous improvement rather than mere compliance

Tools for an operator/maintenance organization EWIS training/familiarization might include:

- Industry and corporate recognition programs for outstanding EWIS maintenance or training practices
- An EWIS awareness multimedia program like videos, posters. This could raise the EWIS the level of the FOD awareness.
- Management emphasis at all levels – Regulatory, Operator, MRO

Target groups are defined as follows:

- Target group 3: Personnel performing electrical/avionic engineering on in service aircraft
- Target group 4: Personnel performing general maintenance/inspections not involving electrical wiring interconnection systems maintenance. (LRU change is not considered wire maintenance)
- Target group 5: Personnel performing other engineering or planning work on in service aircraft
- Target group 6: Other service staff with duties in proximity to electrical wiring interconnection systems.
- Target group 7: Flight Deck Crew
- Target group 8: Cabin Crew

Target Groups	3	4	5	6	7	8
A – INTRODUCTION						
Demonstrate the safe handling of airplane electrical systems, Line Replaceable Units (LRU's), tooling, troubleshooting procedures, and electrical measurement.						
1. Safety practices		X		X	X	X
2. Electrostatic Discharge Sensitive (ESDS) Device handling and protection		X				
7. LRU replacement general practices		X				
B – WIRING PRACTICES DOCUMENTATION						
Know the construction and navigation of the applicable airplane wiring system overhaul or wiring practices manual						
8. Standard Wiring Practice Manual structure/overview	X					
9. Chapter cross-reference Index	X					
10. Important Data and Tables	X					
11. Wiring Diagram Manual	X					
12. Other Documentation as applicable	X					
C – INSPECTION						
Know the different types of inspections, human factors in inspections, zonal areas and typical damages						
13. General Visual Inspection (GVI), Detailed Inspection (DET), Special Detailed Inspection (SDI), and Zonal Inspection		X	X			
14. Human factors in inspection			X			
15. Zonal areas of inspection			X			
16. Wiring system damage		X	X	low level	low level	low level
D – HOUSEKEEPING:						
Know the contamination sources, materials, cleaning and protection procedures						
17. Airplane external contamination sources		X		X	X	X
18. Airplane internal contamination sources		X		X	X	X
19. Other contamination sources		X		X	X	X
20. Contamination protection planning	X	X	X			
21. Protection during airplane maintenance and repair	X	X	X			
22. Cleaning processes	X	X	X	X		
E – WIRE:						
	3	4	5	6	7	8

Target Groups	3	4	5	6	7	8
Demonstrate the correct identification of different wire types, their inspection criteria, and damage tolerance, repair and preventative maintenance procedures						
23. Identification, type and construction	X					
24. Insulation damage limits	X					
25. Inspection criteria and standards of wire and wire bundles	X					
26. Wire bundle installation practices	X					
27. Typical damage and areas found (airplane specific)	X	X	X	Low level	Low level	Low level
28. Maintenance and repair procedures	X					
29. Sleeving	X					
30. Unused wires-termination and storage	X					
31. Electrical bonding and grounds	X	X Bond	X			
F – CONNECTIVE DEVICES: Know the procedures to identify, inspect and find the correct repair for typical types of connectors found on the technician's airplane.	3	4	5	6	7	8
32. General types and identification	X					
33. Cautions and protections	X					
34. Visual inspection procedures	X					
35. Typical damage found	X					
36. Repair procedures	X					

Appendix B

HWG 11 Recommendations to Address Task 11.2

Summary

The FAA is expected to issue new regulatory requirements that will require holders of type certificates to develop Electrical Wiring Interconnection System (EWIS) related instructions for continued airworthiness (ICA) based on the application of an enhanced zonal analysis procedure (EZAP). However, the FAA has indicated that there will not be a parallel requirement for performing an EZAP on existing supplemental type certificates (STC) to those type designs. Supplemental type certificates that affect or modify wiring could impact the EWIS ICA developed by the type certificate holder.

HWG 11 Recommendation 3

During the July 2004 ATSRAC meeting the committee rejected HWG 11 Recommendation 3. The ATSRAC members asked that HWG 11 members develop a list of STC types that should be reviewed for their impact to EWIS maintenance tasks developed by the airplane manufacturer using the EZAP process. Since the FAA will be asking for voluntary compliance to this task, the committee believed that identifying the types of STCs would reduced the workload on the STC holders, and thus have a greater chance of success. Although the members of HWG 11 believe that their original recommendation is more comprehensive in nature and a good way to determine potential impact to the manufacturer developed EWIS maintenance tasks, the HWG has develop a list of STCs as requested by the ATSRAC. The members of HWG 11 have retained their original recommendation in this report and ask that the ATSRAC committee endorse its use for those STC holders who want to complete a more comprehensive review of their STCs impact to the EZAP derived EWIS maintenance tasks.

Below are the types of STCs HWG 11 recommends be reviewed for their impact to the EWIS maintenance tasks developed by the airplane manufacturers:

- 1) In-flight entertainment systems
- 2) Digital flight data recorder systems
- 3) Powered cargo handling systems
- 4) Galley and lavatory modifications that include power wiring redistribution

Many types of STCs were considered by HWG11 in creating this list. However, the four types listed were chosen because they were subject to a combination of the following conditions that made them stand out as most likely to benefit from an EZAP analysis:

- STC adds substantial wiring in some cases to areas that may have had a low wiring density prior to the STC
- STC adds wiring that is located in a uniquely harsh environment
- The modification involves high power wiring that is in a hostile environment.

Original HWG 11 Recommendation 3:

Airplane operators and STC holders should review the installed STCs to determine if the type certificate holder's EZAP derived EWIS ICA are still applicable and provide effective guidance for the area of the airplane that has been modified. If the determination is made that these ICA are no longer applicable and effective then the operators and STC holders should work together to perform an EZAP on their STC modifications. ICA developed by the STC EZAP should then be incorporated in the operator's scheduled maintenance program.

This appendix presents a process that would allow operators and STC holders to make a determination if an EZAP should be performed on the STC modification.

To address the task, the HWG developed a simple process that could be applied to existing STCs to determine if they had any impact on the baseline EZAP performed by the airplane manufacturer. The data gathered by the operators and STC holders under compliance with SFAR 88 could be used to identify which existing STCs impacted airplane wiring and then a three step process would be applied to make a determination as to the impact of the STC on the existing EZAP.

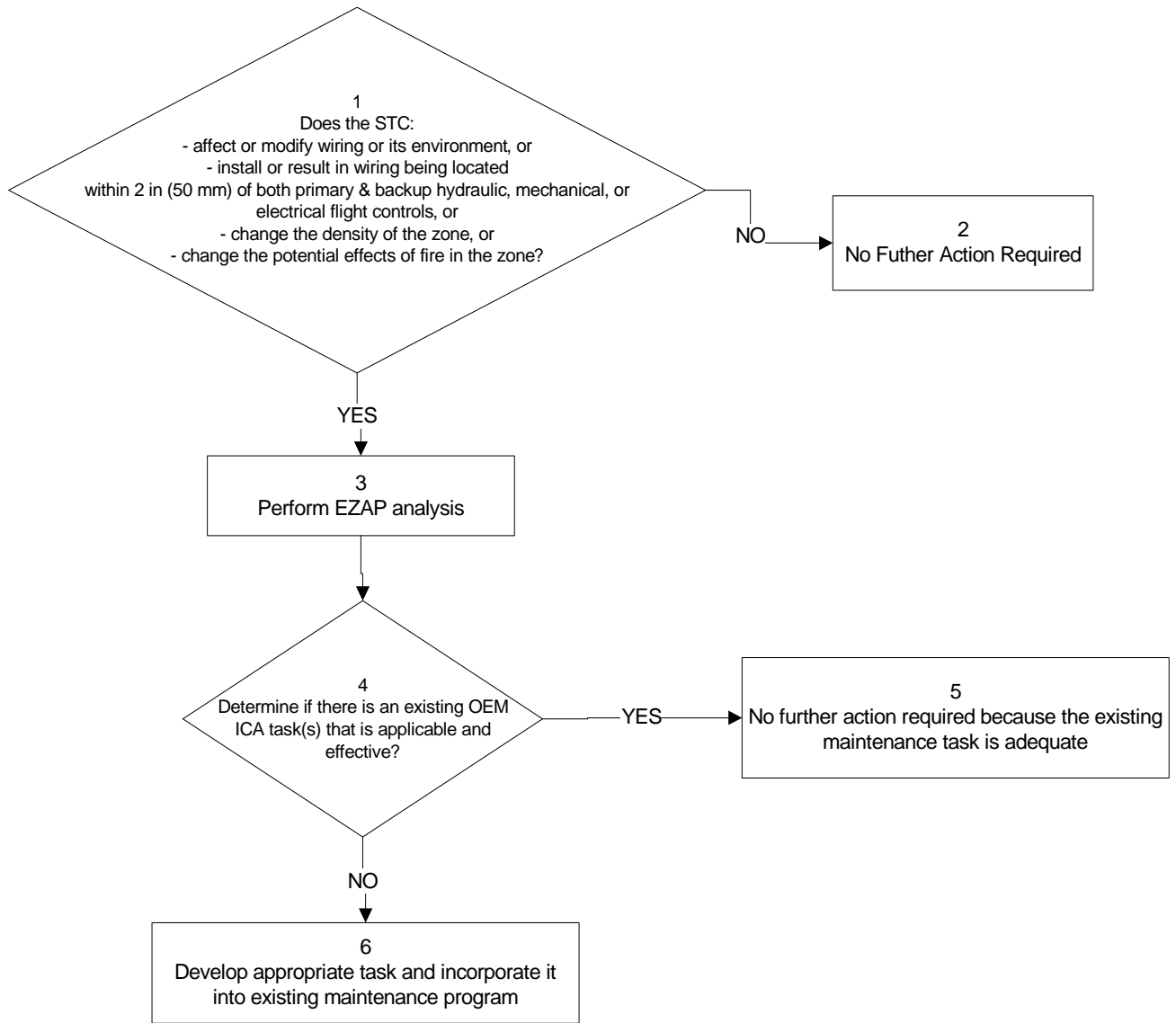
The following paragraphs explain the process:

This following flowchart presents a method to determine whether:

1. An existing STC needs an EZAP analysis in accordance with Advisory Circular (AC) 120-XX to be accomplished, or to determine if,
2. The Original Equipment Manufacturer (OEM) analysis derived EWIS maintenance tasks are adequate.

Based on information collected from the Special Federal Aviation Regulation (SFAR) 88 STC review, this logic chart is designed to target only those STCs which affect or modify wiring or its environment.

The results of this review will identify those STCs that require the STC holder or operator to apply EZAP methodology. Active STC holders are encouraged to analyze their STCs by use of this logic. For orphaned STC (STCs whose holders have gone out of business and who no longer support them) the operator is encouraged to analyze the STC by use of this logic.



Step 1: Does the STC:

Affect or modify wiring or its environment?

The question asks whether the STC affects or modifies wiring. Modifications to wiring or other EWIS components includes, but not limited to removal, addition, relocation, etc.

Note: This question may have been answered for SFAR88 compliance, thus further simplifying the task.

Does the STC install or results in wiring being located within 2 inches of primary and back-up hydraulic, mechanical or electric flight controls, change the density of the zone or change the potential effects of fire in the zone?

Does the STC affect zone density? If the STC includes the addition or deletion of numerous components in a small area, the density of the zone could be changed even if wire bundles are untouched. A significant change in the zone density should warrant re-analysis of the zone.

Potential effects of fire on adjacent wiring and systems requires the analyst to assess the potential effect of a localized fire on adjacent wiring and systems by considering the potential for loss of multiple functions to the extent that a hazard could be introduced. Consideration of potential effect must also include whether wiring is in close proximity (i.e. within 2 inches/50 mm) to both primary and back-up flight controls.

Additionally, this question requires an evaluation of whether the zone might contain combustible material that could cause a fire to be sustained in the event of an ignition source arising in adjacent wiring. Examples include the possible presence of fuel vapors, dust/lint accumulation, and contaminated insulation blankets.

With respect to commonly used liquids (e.g., oils, hydraulic fluids, and corrosion prevention compounds), the analyst should refer to the product specification in order to assess the potential for combustibility. The product may be readily combustible only in vapor/mist form and thus an assessment is required to determine if conditions might exist in the zone for the product to be in this state.

Although liquid contamination of wiring by most synthetic oil and hydraulic fluids (e.g., skydrol) may not be considered combustible, it is a cause for concern if it occurs in a zone where contamination causes significant adherence of dust and lint.

If the answer to this question is “No”, then no further action is required (Step 2), because the density of the zone or the potential effects of fire in the zone has not changed.

Step 3: Perform an EZAP analysis per AC 120-XX

If the answer to question 1 is “yes,” then the only way to determine if existing EWIS maintenance tasks are sufficient is to perform the EZAP for the STC and compare the results with the existing EWIS maintenance tasks (see Step 4).;

Step 4: Is there an existing OEM ICA task(s) that is applicable and effective?

Once the STC EZAP has been accomplished, a comparison of the derived maintenance tasks can be made with the existing EWIS maintenance tasks. If the existing task are adequate, then no further action regarding EWIS maintenance actions for the STC is necessary.

Step 5: No further action required because the existing maintenance task is adequate.

Step 6: Develop an appropriate task and incorporate it into the existing maintenance program.

These tasks should be incorporated into the operator's existing maintenance program.

Thoughts on how to impact voluntary compliance

The following points should be considered as possible actions that could be taken to help achieve voluntary compliance in completing EZAP analysis on existing STCs.

- Use of "first cut" logic...simplified process to determine applicability. Use of data gathered from compliance with SFAR 88 will allow operators and STC holders to quickly identify those STCs that have a potential affect on wiring or those that modify or add wiring.
- FAA management (AVR-1 or above) should meet with top management of air carriers' to encourage them to review STCs for their potential impact on the TC holder developed EZAP maintenance tasks.
- Although economic considerations do not always support voluntary compliance of some initiatives, it is the right thing to do.
- Operators should realize reliability improvements by ensuring that all EZAP maintenance tasks are properly identified and incorporated into their maintenance program.
- Operators could encourage STC holders to work with them to complete this task because the STC holders' ability to market new STC to the operators could depend on their willingness to participate.
- STCs that have an EZAP completed could be a potential marketing tool for the STC holders, thus it could be a potential revenue source.

HWG 11 Recommendation 4

The FAA should ask for volunteers to use the process described in the original HWG11 Recommendation 3 in order to validate the process. It is suggested that STC candidates be selected from both the specific items in HWG11 Recommendation 3 and from STC not fitting those criteria.

END