INTRUSIVE INSPECTION REPORT RECOMMENDATIONS

STATUS REPORT ~JANUARY 16 2002

Prepared by ATSRAC Integration Team

Color Legend:

1. **COLOR** shows status of complete line item, eg 1.1

2. COLOR shows status of element for each line item, eg 1.1 TG7

3. GREEN ~ item or element closed, closed with comments, or currently on plan

4. YELLOW ~ item or element curently needs watching/help to meet plan

5. RED ~ item or element currently has no plan or backup to meet schedule

1	Table 7-5-1: Degraded Splice						
2	**Situation**	**Recommendations**					
3	1. Any high current circuit with one of more of the conditions identified below.	This finding is relatively infrequent. Pre-emptive replacement of spliced wire with new wire or the rework of splices can minimize the potential for repairs or splices to degrade beyond acceptable limits. Any repair should be accomplished using OEM/FAA approved methods and materials appropriate for the environment (which may exceed the requirements of originally approved practice for aged aircraft). Periodic diagnostic testing (e.g. resistance evaluation, time domain reflectometry) can help to identify failing (high resistance) repairs and splices.	OWNER	ECD	LAST	THIS	
4							
5		1.1 Task Group 4: Update splicing practices as necessary. Consider procedure to tag locations of splices to aid in future visual inspections.	Task 7			**GREEN**	
6							
7		Incorporation Plan:					
8		TG7 – Splicing practices will be included in the minimum SWPM/ESPM content recommendations. Updated splicing practices, and procedures to identify splice locations, will be added to the SWPM/ESPM following development by the OEMs .		Jun-02		GREEN	
9							
10		Supplemental Comments:					
11		Boeing - Boeing has reviewed our present splicing practices in light of the results of the intrusive inspection and believe that no changes are necessary at this time.		Closed		GREEN	
12							
13		1.2 Task Group 5: Update training guidelines on a regular basis to correspond to ESPM updates. Emphasize the need to inspect splices closely for obvious deterioration as well as proper materials and workmanship.	Task 8	**Closed**		**GREEN**	
14							
15		Incorporation Plan:					
16		TG8 - Wiring splice inspection and selection is covered in the Inspection Module C4: Wiring System Damage. And the Wire Module E6 (e): Terminals and splices.		Closed		GREEN	
17							

18		1.3 Aircraft Manufacturers: Where appropriate utilize design practices which facilitate the repair of electrical interconnect systems without the need for splices. Develop splice vs. replacement of wire guidelines.	OEMs			YELLOW
19						
20		Incorporation Plan:				
21		Boeing – Boeing review of our present splicing practices, as a result of both the IIWG results and previous operator input indicates that no changes to our current practices is warranted.		Closed		GREEN
22		Airbus -				YELLOW
23		Lockheed -				YELLOW
24						
25		1.4 Aircraft Operators: Review initial and proficiency training practices for splice installation and inspection. Ensure full awareness of approved materials and techniques.	Task 8	**Closed**		**GREEN**
26						
27		Incorporation Plan:				
28		TG8 - Initial and proficiency training practice of splicing must be carried out using hands-on practice in conjunction with operator's PMI review.		Closed		GREEN
29						
30		1.5 Other: (a) The FAA should revise AC 43-13-1B to stipulates that environmental splices are the preferred method of repairing wire in both SWAMP and non-SWAMP areas. (b) Develop wiring configuration management software that will track the installation and location of splices. (c) Develop best practices regarding the maximum number of splices permitted for various types of circuits based upon frequency and severity of potential splice failures.	(a) Task 6 (b/c) OEMs			**(a) GREEN (b) YELLOW**
31						
32		Incorporation Plan:				
33		TG6 - (a) Task Group 6 plans to include pertinent splicing information on wiring related advisory circular (AC). The revised or new AC material is expected to be provided to ATSRAC by July of 2002		Jul-02		GREEN
34		Boeing - (b) Boeing has no plans to develop configuration software to track the location of splices on in-service airplanes.		Closed		GREEN
35		Boeing - (c) Boeing presently specifies in the SWPM the maximum number of splices permissible for all circuits.		Closed		GREEN
36		Airbus - (b)				YELLOW
37		Airbus - (c)				YELLOW
38		Lockheed - (b)				YELLOW
39		Lockheed - (c)				YELLOW
40						
41	**Situation**	**Recommendations**				
42	1a. Potential for high resistance heating, flammable materials	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. In this situation the potential for fire exists.	OWNER	ECD	LAST	THIS
43						
44						
45		1a1 Aircraft Manufacturers: Consider updating splicing practice to reflect special considerations associated with 1) the proximity of the splice to non-fire-retardant materials and 2) the expected wire current.	OEMs Task 6			YELLOW
46						
47		Incorporation Plan:				
48		Boeing - Boeing has no plans to specify different splicing practices to accommodate adjacent materials or circuit loads.		Closed		GREEN
49		Airbus -				YELLOW
50		Lockheed -				YELLOW
51		TG6 - Task Group 6 reviewed the item in November task group meeting and agreed to consider updating the splicing section of the current advisory materials. Revised material is expected to be provided to ATSRAC by July 2002.		Jul-02		GREEN
52						
53	**Situation**	**Recommendations**				
54	1b. Potential for high resistance heating, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. In this situation the potential exists for loss of several flight-critical systems.	OWNER	ECD	LAST	THIS
55						

56		1b1 Aircraft Manufacturers: Consider updating splicing practice to reflect special consideration associated with high-current carrying splices in bundles with wire supporting multiple flight-critical systems.	OEMs			YELLOW
57						
58		Boeing - Boeing has no plans to specify different splicing practices to accommodate adjacent materials or circuit loads.		Closed		GREEN
59		Airbus -				YELLOW
60		Lockheed -				YELLOW
61						
62		Table 7-5-2: Heat Damaged or Burnt Wire				
63	**Situation**	**Recommendations**				
64	2. Any situation with one or more of the specific conditions identified below	This finding is relatively common. Localized heat damage (from external source or internal conductor heating) on adjacent wires may make these wires particularly subject to the formation of neighboring cracks and the potential for arcing or shorting. Visual Inspection can detect some conditions. Use of in-situ nondestructive testing methods may be used to detect additional insulation faults, especially if the heat damage effects a local area with several bundles, several wires within a single bundle, or a substantial length of a single wire.	OWNER	ECD	LAST	THIS
65						
66		2.1 Task Group 3: Modify the MSG3 process to include the consideration of potential heat sources when developing zonal inspection instructions	Task 9	**Closed**		**GREEN**
67						
68		Incorporation Plan:				
69		TG9 - MSG3 Rev 2001.1 EZAP logic requires assessment of environment in the selection of wiring system tasks and intervals. Presence of a heat source or other condition deemed hostile to wiring will be considered in the selection of tasks and intervals for wiring in the zone.		Closed		GREEN
70						
71		2.2 Task Group 4: Insure heat shield installation and maintenance are appropriately specified.	Task 7			**GREEN**
72						
73		Incorporation Plan:				
74		TG7 - Heat shields are typically included with the potentially offending system i.e. the installation of maintenance of which are not normally included in the SWPM.		Jun-02		GREEN
75						
76		2.3 Task Group 5: Review visual indications of overheating in order to more precisely characterize symptoms of heat-degraded wire.	Task 9			**GREEN**
77						
78		Incorporation Plan:				
79		TG9 - Recommendations from the Task 3 Report include guidance for accomplishing Zonal Inspections, with a list of discrepant conditions that should be visually identifiable, including, "Discoloration/evidence of overheat on terminal lugs/blocks", and wire damage "...due to mechanical impact, overheat, localized chafing, etc.". This guidance will be included in the recommended content of an FAA Advisory Circular as per ATSRAC Task 9.3.		Jul-02		GREEN
80						
81		2.4 Aircraft Manufacturers: Review design and maintenance practices regarding the use heat shields. Establish on-condition criteria for the replacement of wire in heat-damaged bundles (external and internal heat). Develop and implement configuration management processes to prevent load creep that may result in circuits operating near the rated capacity and conductor heating.	OEMs			YELLOW
82		Incorporation Plan:				
83		Boeing - Expected and actual sources of heat impinging on electrical wiring is presently taken into consideration during the design of the electrical system. Allowable wire damage criteria is presently specified in the SPWM. Boeing presently provides electrical load documents with the delivery of new airplanes and conducts electrical load analysis on in-service airplanes upon request.		Closed		GREEN
84		Airbus -				YELLOW
85		Lockheed -				YELLOW
86						
87		2.5 Aircraft Operators: Ensure awareness of the heat-shield requirements and proper maintenance.	Task 8/9			YELLOW
88						
89		Incorporation Plan:				

90		TG9 - Installation of heat shields are an OEM design issue, and existing Zonal Inspection requirements should be adequate to detect malfunction, degradation, or failure of a heatshield. However, it is possible that a heat shield could inadvertently be left off after performing maintenance in a zone and the missing shield would not necessarily be clearly evident. While this could happen on any aircraft, T9HWG concludes that older aircraft that have undergone repetitive heavy maintenance events are more likely to have experienced such a situation. T9HWG recommends that aircraft manufacturers provide guidance to Operators where all such heat shields are required on each aircraft model. If an Operator finds that inadvertent removal has occurred, consideration should be given to enhancement of maintenance documents (task cards, manuals, etc.) with additional information to ensure compliance with heat shield installation requirements.		Closed		GREEN
91						
92		Supplemental OEM Comments:				
93		Boeing -				YELLOW
94		Airbus -				YELLOW
95		Lockheed -				YELLOW
96						
97		2.6 Other: Develop diagnostic technologies and techniques to identify and prevent the development of high resistance interconnects.	OEMs			**YELLOW**
98						
99		Incorporation Plan:				
100		Boeing - Boeing has no plans to develop additional technologies or techniques to prevent or identify high resistance interconnects.		Closed		GREEN
101		Airbus -				YELLOW
102		Lockheed -				YELLOW
103						
104	**Situation**	**Recommendations**				
105	2a. Flammable materials, cockpit or electronics bay.	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. Though the specific presence of moisture or contamination (to enable short circuiting) is not necessarily anticipated in this scenario, the specified zones and installations within these zones are critical enough to warrant extra care and precaution.	OWNER	ECD	LAST	THIS
106						
107						
108		2a1 Task Group 3: Investigate periodic, selective inspection and nondestructive testing of cockpit and electronics bay wiring.	Task 9	**Closed**		**GREEN**
109						
110		Incorporation Plan:				
111		TG9 - EZAP requires full application of the logic in the cockpit and electronics bay regardless of whether combustible materials are llikely to be present. Due to the congestion and difficult access to these zones, it is expected that a Zonal Inspection will not be assessed as adequate. The logic will identify dedicated visual inspections which could be Detailed Inspections in specific areas that warrant closer attention. While "periodic" and "selective" visual inspections will be identified, the use of non-destructive testing is insufficiently mature to apply on a scheduled basis at this time. Initially, new NDT methods would likely be used to support trouble-shooting activities which will provide the necessary experience to allow assessment of their use in scheduled maintenance. To further mitigate the concern for wiring in cockpit and electronics bay areas, EZAP requires consideration of the presence of combustible materials in a zone, and identification of tasks to remove significant accumulations of combustible contamination. In addition, enhancements to maintenance practices are proposed that will minimize the risk of damage and contam		Closed		GREEN
112						
113		2a2 Aircraft Manufacturers: Investigate periodic, selective inspection and nondestructive testing of cockpit and electronics bay wiring.	OEMs			**YELLOW**
114						
115		Incorporation Plan:				
116		Boeing - Boeing presently conducts periodic inspections of airplanes, including the E/E bay and flight deck. Selective inspections, as a result of in-service experience, are evaluated on a case by case basis.		Closed		GREEN
117		Airbus -				YELLOW
118		Lockheed -				YELLOW
119						
120		2a3 Aircraft Operators: Investigate periodic, selective inspection and nondestructive testing of cockpit and EE bay wiring. Accelerate removal of flammable materials from the cockpit and electronics bay.	Task 9			**GREEN**

121						
122		Incorporation Plan:				
123		TG9 - EZAP requires full application of the logic in the cockpit and electronics bay regardless of whether combustible materials are llikely to be present. Due to the congestion and difficult access to these zones, it is expected that a Zonal Inspection will not be assessed as adequate. The logic will identify dedicated visual inspections which could be Detailed Inspections in specific areas that warrant closer attention. While "periodic" and "selective" visual inspections will be identified, the use of non-destructive testing is insufficiently mature to apply on a scheduled basis at this time. Initially, new NDT methods would likely be used to support trouble-shooting activities which will provide the necessary experience to allow assessment of their use in scheduled maintenance. To further mitigate the concern for wiring in cockpit and electronics bay areas, EZAP requires consideration of the presence of combustible materials in a zone, and identification of tasks to remove significant accumulations of combustible contamination. In addition, enhancements to maintenance practices are proposed that will minimize the risk of damage and contamination to wiring caused by mainten		Closed		GREEN
124						
125	**Situation**	**Recommendations**				
126	2b. Moisture, flammable materials, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Effective intervention can include reduction of moisture intrusion and minimization of flammable materials in the proximity of susceptible installations. Installation of heat shielding to protect susceptible installations can eliminate or mitigate heat damage. Because embrittled wires can fail collectively, proper separation of critical system wiring is essential.				
127		Additional recommendations:	OWNER	ECD	LAST	THIS
128						
129		2b1 Task Group 3: Investigate periodic, selective inspection and non destructive testing of wire bundles supporting multiple flight critical systems.	Task 7			
130						
131		Incorporation Plan:				
132		TG7 - This action should rightly be addressed by TG9 as it concerns the periodic inspection of specific wiring.		Jun-02		GREEN
133						
134		Supplemental Comments:				
135		TG9 -				YELLOW
136						
137		2b2 Task Group 4: Insure that drip guard installation and maintenance are appropriately specified	Task 9			YELLOW
138						
139		Incorporation Plan:				
140		TG9 - Installation of drip shields are an OEM design issue, and existing Zonal Inspection requirements should be adequate to detect malfunction, degradation, or failure of a drip shield. However, it is possible that a drip shield could inadvertently be left off after performing maintenance in a zone and the missing shield would not necessarily be clearly evident. While this situation could exist on any aircraft, T9HWG concludes that older aircraft that have undergone repetitive heavy maintenance events are more likely to have experienced such an event. T9HWG recommends that aircraft manufacturers provide guidance to Operators for all such drip shields required on each aircraft model. If inspection for the shields reveals inadvertent removal has occurred, consideration should be given to enhancement of maintenance documents (task cards, manuals, etc.) with additional information to ensure compliance with drip shield installation requirements.		Closed		GREEN
141						
142		Supplemental OEM Comments:				
143		Boeing -				YELLOW
144		Airbus -				YELLOW
145		Lockheed -				YELLOW
146						
147		2b3 Aircraft Manufacturers: Review design practices regarding the use of drip shields for this specific situation, investigate periodic selective inspection and non destructive testing of wiring. Develop updated wiring separation guidelines that consider loss of multiple critical functions from a common mode failure.	OEMs			YELLOW
148						
149						

150		Incorporation Plan:				
151		Boeing - Expected and actual sources of moisture impinging on electrical wiring is presently taken into consideration during the design of the electrical system. Boeing presently conducts periodic inspections of airplanes, including the E/E bay and flight deck. Selective inspections, as a result of in-service experience, are evaluated on a case by case basis. Wire separation and segregation guidelines are presently contained within the SWPM and reflect current production design standard that account for loss of multiple or redundant systems. Any changes to the standards will be reflected in future revisions to the SWPM.		Closed		GREEN
152		Airbus -				YELLOW
153		Lockheed -				YELLOW
154						
155		2b4 Aircraft Operators: For this specific situation, investigate periodic, selective inspection and non destructive testing of wiring. Investigate segregation and separation of wire installed after manufacture of the aircraft.	(a) OEMs (b) FAA			YELLOW
156						
157		Incorporation Plan:				
158		Boeing - (a) Selective inspections, as a result of in-service experience, are evaluated on a case by case basis.		Closed		GREEN
159		Airbus - (a)				YELLOW
160		Lockheed; (a)				YELLOW
161		FAA (b) - The FAA will take action based on the recommendation of WG 6 sub-group addressing wire separation issues (T6.7) following the submittal of ATSRAC's final report to the FAA July 2002. Note that WG 6 sub-group recommendations will be for FAR/JAR 25 and are not "investigative" (2d4 states "Investigate separation and segregation of wire installed after manufacture of the aircraft."				YELLOW
162						
163	**Situation**	Recommendations				
164	2c. Moisture, flammable materials	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Effective intervention can include reduction of moisture intrusion, minimization of flammable materials in the proximity of susceptible installations, and installation of fire or heat barriers.	OWNER	ECD	LAST	THIS
165						
166		2c1 Task Group 4: Insure that drip guard installation and maintenance are appropriately specified.	Task 7/8/9			GREEN
167						
168		Incorporation Plan:				
169						
170		TG7 - Moisture protection will be recommended as SWPM/ESPM minimum content.		Jun-02		GREEN
171		TG8 - Drip guard installation and maintenance specifications are covered in the Housekeeping Module D2 (e): Galleys and toilets. Instructors must ensure that the student knows the airplane documentation that illustrates the correct installation.		Closed		GREEN
172		TG9 - Installation of drip shields are an OEM design issue, and existing Zonal Inspection requirements should be adequate to detect malfunction, degradation, or failure of a drip shield. However, it is possible that a drip shield could inadvertently be left off after performing maintenance in a zone and the missing shield would not necessarily be clearly evident. While this situation could exist on any aircraft, T9HWG concludes that older aircraft that have undergone repetitive heavy maintenance events are more likely to have experienced such an event. T9HWG recommends that aircraft manufacturers provide guidance to Operators for all such drip shields required on each aircraft model. If inspection for the shields reveals inadvertent removal has occurred, consideration should be given to enhancement of maintenance documents (task cards, manuals, etc.) with additional information to ensure compliance with drip shield installation requirements.		Closed		GREEN
173						
174		2c2 Aircraft Manufacturers: Review design practices regarding the use of drip guards for this specific situation. Investigate the use of nondestructive testing to troubleshoot suspect wire installations.	OEMs			YELLOW
175						
176		Incorporation Plan:				
177						

178		Boeing - Moisture ingression prevention guidelines are specified in the SWPM and are commonly used during the production of new airplanes. Detailed visual inspection is the preferred NDT inspection method to identify the presence of or indications of moisture ingression.		Closed		GREEN
179		Airbus -				YELLOW
180		Lockheed -				YELLOW
181						
182	**Situation**	**Recommendations**				
183	2d. Moisture, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Though the presence of flammable materials is not anticipated in this scenario, the potential for a common mode failure of many or all wires in a single bundle warrants extra care and precaution. Effective intervention can include reduction of moisture intrusion and installation of fire or heat barriers. Proper separation of critical systems wiring will mitigate the consequence of collective wire failure.	OWNER	ECD	LAST	THIS
184						
185		2d1 Task Group 3:				
186		2d2 Task Group 4: Insure that drip guard installation and maintenance are appropriately specified.	Task 7/8/9			YELLOW
187						
188		Incorporation Plan:				
189		TG7 - Moisture protection will be required as SWPM/ESPM minimum content.		Jun-02		GREEN
190		TG8 - Drip guard installation and maintenance specification is covered in the Housekeeping Module D2 (e): Galleys and toilets. Instructors must ensure that the student knows the airplane documentation that illustrates the correct installation.		Closed		GREEN
191		TG9 - Installation of drip shields are an OEM design issue, and existing Zonal Inspection requirements should be adequate to detect malfunction, degradation, or failure of a drip shield. However, it is possible that a drip shield could inadvertently be left off after performing maintenance in a zone and the missing shield would not necessarily be clearly evident. While this situation could exist on any aircraft, T9HWG concludes that older aircraft that have undergone repetitive heavy maintenance events are more likely to have experienced such an event. T9HWG recommends that aircraft manufacturers provide guidance to Operators for all such drip shields required on each aircraft model. If inspection for the shields reveals inadvertent removal has occurred, consideration should be given to enhancement of maintenance documents (task cards, manuals, etc.) with additional information to ensure compliance with drip shield installation requirements.		Closed		GREEN
192						
193		Supplemental OEM Comments:				
194		Boeing -				YELLOW
195		Airbus -				YELLOW
196		Lockheed -				YELLOW
197						
198		2d3 Aircraft Manufacturers: Review design practices regarding the use of drip guards. Investigate use of nondestructive testing to trouble-shoot suspect wire installations.	OEMs			YELLOW
199						
200		Incorporation Plan:				
201						
202		Boeing - Moisture ingression prevention guidelines are specified in the SWPM and are commonly used during the production of new airplanes. Detailed visual inspection is the preferred NDT inspection method to identify the presence of or indications of moisture ingression.		Closed		GREEN
203		Airbus -				YELLOW
204		Lockheed -				YELLOW
205						
206		2d4 Aircraft Operators: Investigate separation and segregation of wire installed after manufacture of the aircraft.	FAA Task 6			YELLOW
207						
208		Incorporation Plan:				
209		FAA - The FAA will take action based on the recommendation of WG 6 sub-group addressing wire separation issues (T6.7) following the submittal of ATSRAC's final report to the FAA July 2002. Note that WG 6 sub-group recommendations will be for FAR/JAR 25 and are not "investigative" (2d4 states "Investigate separation and and segregation of wire installed after manufacture of the aircraft."				YELLOW

210		TG6 - Task Group 6 has reviewed and discussed this item in the last meeting of the group. The team agreed to include advisory material and/or regulatory material on this subject.		Jul-02		GREEN
211						
212	**Situation**	**Recommendations**				
213	2e. Flammable materials or contamination, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. The potential for a common mode failure of many or all wires in a single bundle warrants extra care and precaution.	OWNER	ECD	LAST	THIS
214						
215		2e1 Task Group 3:				
216		2e2 Task Group 4: Ensure that wiring separation and segregation guidelines that consider loss of multiple critical functions from a common mode failure are specified.	Task 6/7			**GREEN**
217						
218		Incorporation Plan:				
219		TG6 - Task Group 6 has reviewed and discussed this item in the last Seattle meeting. A FAR requirement similar to JAR 25.1353 (d) is being considered to be included in the wiring FAR section.		Jul-02		GREEN
220		TG7 - Wiring separation and segregation requirements will be required as SWPM/ESPM minimum content.		Jun-02		GREEN
221						
222		2e3 Aircraft Manufacturers: Investigate use of nondestructive testing to trouble-shoot suspect wire installations. Review sources of potential contamination.	OEMs			YELLOW
223						
224		Incorporation Plan:				
225		Boeing - Presently available NDT/troubleshooting methods are provided within the specific airplane maintenance manual chapter appropriate for the system undergoing test. Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM.		Closed		GREEN
226		Airbus -				YELLOW
227		Lockheed -				YELLOW
228						
229		2e4 Aircraft Operators: - Investigate separation and segregation of wire installed after manufacture of the aircraft. Review sources of potential contamination.	FAA			YELLOW
230						
231		Incorporation Plan:				
232		FAA - The FAA will take action based on the recommendation of WG 6 sub-group addressing wire separation issues (T6.7) following the submittal of ATSRAC's final report to the FAA July 2002. Note that WG 6 sub-group recommendations will be for FAR/JAR 25 and are not "investigative" (2e4 states "Investigate separatioand and segregation of wire installed after manufacture of the aircraft." With regard to potential contamination, Task Group 6 may proposed new wire separation requirments to require adequate separation from contaminates such as water/waste, fule, and hydraulic fluid.				YELLOW
233						
234	**Situation**	**Recommendations**				
235	2f. Flammable materials, multiple critical systems, vibration	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Though moisture is not anticipated in this scenario, the potential for vibration (i.e. the relative motion of partially exposed conductors) to induce a common mode failure of many or all wires in a single critical bundle warrants extra care and precaution. Effective intervention can include reducing vibration potential with additional bundle security (clamps, ties, etc) and minimizing flammable materials in the proximity of susceptible installations.	OWNER	ECD	LAST	THIS
236						
237		2f1 Task Group 3:				
238		2f2 Task Group 4: Ensure that wiring separation and segregation guidelines that consider loss of multiple critical functions from a common mode failure are specified.	Task 6/7			**GREEN**
239						
240		Incorporation Plan:				
241		TG6 - Task Group 6 has reviewed and discussed this item in the last team meeting. A FAR requirement for general wiring separation is being considered for inclusion in the new Wiring FAR section. In addition, new Advisory Materials will also be developed.		Jul-02		GREEN

242		TG7 - Wiring separation and segregation requirements will be required as SWPM/ESPM minimum content.		Jun-02		GREEN
243						
244		2f3 Task Group 5: Insure that training adequately addresses wire bundle segregation, clamp and tie best practices specifically with regard to high vibration areas.	Task 8	**Closed**		**GREEN**
245						
246		Incorporation Plan:				
247		TG8 - Wire bundle segregation and clamping best practices are covered in Wire Module E4 (b, d & e); Segregation rules, Clamp inspection and Clamp removal and fitting. Tie best practices will be covered in Wiring Practices Documentation Module B3 (c): Electrical cable binding.		Closed		GREEN
248						
249		2f4 Aircraft Manufacturers: Review design practices regarding the clamping and tying of wire bundles. Investigate use of nondestructive testing to trouble-shoot suspect wire installations.	OEMs			**YELLOW**
250						
251		Incorporation Plan:				
252		Boeing - Review of Boeing wire clamping and bundle assembly techniques is complete with no changes expected to those currently specified Presently available NDT/troubleshooting methods are provided within the specific airplane maintenance manual chapter appropriate for the system undergoing test.		Closed		GREEN
253		Airbus -				YELLOW
254		Lockheed -				YELLOW
255						
256		2f5 Aircraft Operators: (a) Investigate use of nondestructive testing to trouble-shoot suspect wire installations. (b) Investigate separation and segregation of wire installed after manufacture of the aircraft.	(a) OEMs (b) FAA			**YELLOW**
257						
258		Incorporation Plan:				
259		Boeing - (a) Presently available NDT/troubleshooting methods are provided within the specific airplane maintenance manual chapter appropriate for the system undergoing test.		Closed		GREEN
260		Airbus - (a)				YELLOW
261		Lockheed - (a)				YELLOW
262		FAA - (b) - The FAA will take action based on the recommendation of WG 6 sub-group addressing wire separation issues (T6.7) following the submittal of ATSRAC's fianl report to the FAA July 2002. Note that WG 6 sub-group recommendations will be for FAR/JAR 25 and are not "investigative" (2d4 states "Investigate separation and and segregation of wire installed after manufacture of the aircraft."				YELLOW
263						
264		Table 7-5-3: Vibration Damage or Chafing				
265	**Situation**	**Recommendations**				
266	3. Any Situation involving one or more of the conditions identified below	This finding is relatively common. If the chafing agent is a conductive to ground or if multiple adjacent wires are chafing, short-circuiting can occur even in the absence of moisture or a conductive contaminant (i.e. through direct physical contact). Augmenting general visual inspection with a detailed or directed visual inspection in critical areas can mitigate this condition. The necessity for rework or redesign may result from identification of chronic or widespread chafing condition. An AFCB can mitigate this condition by minimizing damage and preventing electrical fire.	OWNER	ECD	LAST	THIS
267						
268		3.1 Task Group 3: For these high consequence situations, specify more detailed inspection (possibly requiring some disassembly of support hardware) to ensure potential chafing problems are spotted and corrected.	Task 9	**Closed**		**GREEN**
269						
270		Incorporation Plan:				
271						

272		TG9 - MSG3 Rev 2001.1 EZAP logic requires assessment of environment in the selection of wiring system tasks and intervals. Conditions that could lead to clamp deterioration and/or chafing of wiring (extreme temperatures, high vibration, frequent maintenance access) or other conditions deemed hostile to wiring will influence the selection of tasks and intervals for wiring in the zone with selection of Detailed Inspection possible. Also, MSG3 Rev 2001.1 revised the definition of GVI to include use of a mirror to provide visual access to all exposed surfaces of an installation or item. This should provide enhanced surveillence of wire clamping provisions, and detection of deterioration by the GVI should be cause for further investigation, including clamp disassembly to check the underlying wiring. Recommendations from the Task 3 Report includes guidance for accomplishing Zonal Inspections, with a list of discrepant conditions expected to be identified by a Zonal Inspection, including "wiring clamp protection/cushion damaged." This guidance will be included in the recommended content of an FAA Advisory Circular a		Closed	GREEN
273					
274		3.2 Task Group 4: Develop a catalog of unacceptable wire bundle configurations.	OEMs Task 8		YELLOW
275					
276		Incorporation Plan:			
277		Boeing - We have no plans to create and maintain a catalog of unacceptable wire bundle configurations but will ensure that the criteria for acceptable wire bundles is clear.		Closed	GREEN
278		Airbus -			YELLOW
279		Lockheed -			YELLOW
280		TG8 - Recommends that the OEM's construct a graphical database of model and zone specific wire system faults for Instructor and Technician training and knowledge.		Closed	GREEN
281					
282		3.3 Task Group 5: Develop enhanced training to ensure proper mechanical use of OEM/FAA approved tie downs, clamps, and wire separation/segregation are used in areas were wires or cables cross or come in contact. Ensure maintenance personnel recognize potential areas of chafing.	Task 8	**Closed**	**GREEN**
283					
284		Incorporation Plan:			
285		TG8 - Proper mechanical use of OEM/FAA approved tie downs, clamps and wire separation/segregation are covered in Wire Module E4 (b, d & e); Segregation rules, Clamp inspection and Clamp removal and fitting. Tie best practices will be covered in Wiring Practices Documentation Module B3 (c): Electrical cable binding. Maintenance personnel will be trained to recognize potential areas of chafing using Inspection Module C4 (e) Vibration/chafing.		Closed	GREEN
286					
287		3.4 Aircraft Manufacturers: Continue development of arc-fault circuit breaker technology. Develop generic implementation plans for the potential retrofit of arc-fault circuit breakers onto in-service aircraft.	OEMs		YELLOW
288					
289		Incorporation Plan:			
290		Boeing - Arc fault and aging wiring research continues through 2002. Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed	GREEN
291		Airbus -			YELLOW
292		Lockheed -			YELLOW
293					
294		3.5 Aircraft Operators: (a) Ensure that maintenance personnel are aware of the need to verify the security of all mounting hardware (i.e. specify tactile inspection). (b) Develop generic implementation plans for the potential retrofit of arc-fault circuit breakers onto in-service aircraft.	(a) Task 8 (b) OEMs		(a) **GREEN** (b) **YELLOW**
295					
296		Incorporation Plan:			
297		TG8 - (a) Security of mounting hardware including tactile inspections are covered in Wire ModuleE3 (a & b): Inspection of individual wiring and Inspection of wire bundles.		Closed	GREEN
298		Boeing: (b) Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed	GREEN
299		Airbus - (b)			YELLOW
300		Lockheed - (b)			YELLOW
301					

	Situation	Recommendations				
303	3a. Flammable materials or contamination, cockpit or electronics bay	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. Wire or wire bundle chafing in the presence of flammable materials in the cockpit or electronics bay could result in wire-to-structure or wire-to-wire shorting arcing resulting in fire. Flammable contaminants increase the potential for ignition. More emphasis on cleaning and prevention of fluid contamination (e.g. drip shields) can mitigate the risks presented by contaminants and aid in the detection of chafing conditions. Nondestructive testing can detect wire chafing (after significant dielectric breakdown) and aid in repair.	OWNER	ECD	LAST	THIS
305		3a1 Task Group 3: (a) Develop situation-specific guidance to ensure the proper attention to protection and cleaning wire bundles. (b) Develop guidance on the separation of wire bundles from non-fire-retardant materials.	(a) Task 7/8/9 (b) Task 6			**GREEN**
307		Incorporation Plan: (a)				
308		TG7 - General and conditional wiring protection and cleaning procedures will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
309		TG8 - Protection and cleaning of wire bundles are covered in the Housekeeping Module D4, 5 & 6: Contamination Protection Planning, Protection During Airplane Maintenance, and Repair and Cleaning Processes		Closed		GREEN
310		TG9 - EZAP requires full application of the logic in the cockpit and electronics bay irrespecitive of whether combustible materials are likely to be present. Due to the congestion and difficult access to these zones, it is certain that a Zonal Inspection will not be assessed as adequate. The logic will identify dedicated visual inspections which could be Detailed Inspections in specific areas shown by the logic to warrant closer attention. While "periodic" and "selective" inspections will be identified, the use of non-destructive testing is insufficiently mature to apply on a scheduled basis. Initially, new NDT methods would likely be used to support trouble-shooting activities which will provide the necessary experience to allow assessment of their use in scheduled maintenance. To further mitigate the concern for wiring in cockpit and electronics bay areas, EZAP requires consideration of the presence of combustible materials in a zone, and identification of tasks to remove significant accumulations of combustible contamination. In addition, enhancements to maintenance practices ("Protection and Cautions") are proposed that will minimize th		Closed		GREEN
311		Incorporation Plan: (b)				
312		TG6 - New Regulatory as well as Advisory materials for Wiring separation are being developed by the group for inclusion in appropriate sections		Jul-02		GREEN
314		3a2 Task Group 4: (a) Specify situation-specific standards to ensure wire bundles are properly protected and cleaned based on OEM approved practice. (b) Specify nondestructive testing procedures for validating wire integrity in response to undiagnosed malfunctions of cockpit electrical equipment.	(a) Task 7 (b) OEMs			**(a) GREEN (b) YELLOW**
316		Incorporation Plan:				
317		TG7 - (a) General and conditional wiring protection and cleaning procedures will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
318		Boeing: (b) Troubleshooting guidance for system anomalies are contained within the specific Airplane Maintenance Manual chapter applicable to that system.		Closed		GREEN
319		Airbus - (b)				YELLOW
320		Lockheed - (b)				YELLOW
322		3a3 Aircraft Manufacturers: Develop design modification to minimize potential for contamination.	OEMs			**YELLOW**
324		Incorporation Plan:				
325		Boeing - Potential sources of contamination of airplane wiring are identified during the design and development of the airplane, and appropriate protection in the form of drip or heat shields are included to minimize the effects of contamination. When unanticipated sources of contamination are identified during service operation, additional protection is specified and available to operators through a service letter or service bulletin. In the case of general protection of wiring during unrelated maintenance, Boeing will be providing protection guidelines in an upcoming revision to the SWPM.		Closed		GREEN
326		Airbus -				YELLOW
327		Lockheed -				YELLOW

	Situation	Recommendations	OWNER	ECD	LAST	THIS
328						
329	**Situation**	**Recommendations**				
330	3b. Flammable materials or contamination, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. Wire chafing in the presence of flammable materials or contaminants with wires from multiple critical systems in close proximity could result in smoke and/or fire and loss of multiple flight-critical systems. Maintaining wire segregation for critical and redundant systems can mitigate the risk of multiple system failures. More emphasis on cleaning and prevention of fluid contamination (e.g. drip shields) can mitigate the risks presented by contaminants and aid in the detection of chafing conditions.				
331						
332		3b1 Task Group 3: (a) Develop situation-specific guidance to ensure the proper attention to protection and cleaning wire bundles. (b) Develop guidance on the separation of wire bundles from non-fire-retardant materials.	(a)Task 7/8/9 (b)Task6/OEMs			**(a) GREEN** (b) YELLOW
333						
334		Incorporation Plan:				
335		TG7 - (a) General and conditional wiring protection and cleaning procedures will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
336		TG8 - (a) Protection and cleaning of wire bundles are covered in the Housekeeping Module D4, 5 & 6: Contamination Protection Planning, Protection During Airplane Maintenance, and Repair and Cleaning Processes		Closed		GREEN
337		TG9 - (a) MSG3, Rev 2001.1 EZAP logic includes a determination if accumulation of combustible material likely in a zone, and selection of task(s) to prevent significant accumulation of combustible material.		Closed		GREEN
338		TG6 - (b) Task Group 6 has reviewed and discussed this item in the last Seattle meeting. It was agreed to include advisory material for this section in the new/revised wiring related AC.		Jul-02		GREEN
339		Boeing - (b) Spatial separation of wiring from structure, systems components, or other wiring is accounted for in the design of the wiring system. The guidelines used to design the wiring system are contained within the Standard Wiring Practices Manual		Closed		GREEN
340		Airbus - (b)				YELLOW
341		Lockheed - (b)				YELLOW
342						
343		3b2 Task Group 4: (a) Specify situation-specific standards to ensure wire bundles are properly protected and cleaned. (b) Specify updated wiring separation and segregation guidelines that consider loss of multiple critical functions from a common mode failure. (c) Specify nondestructive testing procedures for validating wire integrity in response to undiagnosed malfunctions of flight critical equipment.	(a) Task 7 (b)(c) OEMs			**YELLOW**
344						
345		Incorporation Plan:				
346						
347		TG7 - (a) General and conditional wiring protection and cleaning procedures will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
348		Boeing - (b)(c)Wire separation and segregation guidelines are presently contained within the SWPM and reflect current production design standard that account for loss of multiple or redundant systems. Any changes to the standards will be reflected in future revisions to the SWPM. Troubleshooting procedures to determine the cause of any system malfunction or anomaly, including non-destructive troubleshooting of the system wiring, is contained within the specific Airplane Maintenance Manual section applicable to the system under review.		Closed		GREEN
349		Airbus - (b)(c)				YELLOW
350		Lockheed - (b)(c)				YELLOW
351						
352		3b3 Aircraft Manufacturers: Develop design modification to minimize potential for contamination.	OEMs			**YELLOW**
353						
354		Incorporation Plan:				
355		Boeing - Potential sources of contamination of airplane wiring are identified during the design and development of the airplane, and appropriate protection in the form of drip or heat shields are included to minimize the effects of contamination. When unanticipated sources of contamination are identified during service operation, additional protection is specified and available to operators through a service letter or service bulletin. In the case of general protection of wiring during unrelated maintenance, Boeing will be providing protection guidelines in an upcoming revision to the SWPM.		Closed		GREEN
356		Airbus -				YELLOW

357		Lockheed -				YELLOW
358						
359		3b4 Other: Develop and understanding of how vibration and contamination (solid and liquid) interact.	??????			**RED**
360						
361		Incorporation Plan:				
362		?????? -				RED
363						
364	**Situation**	**Recommendations**				
365	3c. Multiple critical systems, arc tracking potential	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. Wire chafing with arc tracking potential and wires from critical systems in close proximity could result in arcing and propagation to other wires, smoke and/or fire, and loss of multiple critical systems which can lead to excessive crew workload.	OWNER	ECD	LAST	THIS
366						
367		3c1 Task Group 3: (a) Specify guidelines to ensure the proper attention to protection and cleaning wire bundles. (b)Develop guidance to ensure the proper attention to protection of wire bundles.	(b) Task 6 (a) Task 7			**GREEN**
368						
369		Incorporation Plan:				
370		TG6 - (b) Task Group 6 reviewed the item in the November task group meeting and agreed to consider inclusion of this item in the appropriate section of the Advisory Materials. The revised material is expected to be provided to ATSRAC by July 2002.		Jul-02		GREEN
371		TG7 - (a) General and conditional wiring protection and cleaning procedures will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
372						
373		3c2 Task Group 4: (a) Specify situation-specific standards to ensure wire bundles are securely fastened and out of harm's way. (b) Develop situation specific wiring separation guidelines that consider loss of multiple critical functions from a common mode failure. (c) Specify nondestructive testing procedures for validating wire integrity in response to undiagnosed electrical malfunctions.	(a) OEMs (b) Task 6 (c) OEMs			**YELLOW**
374						
375		Incorporation Plan:				
376		Boeing - (a)(c) Wiring attachment guidelines are presently contained within the SWPM and are specific to the conditions in which the wiring is installed. Troubleshooting guidance for system anomalies are contained within the specific Airplane Maintenance Manual chapter applicable to that system.		Closed		GREEN
377		Airbus - (a)©				YELLOW
378		Lockheed - (a)©				YELLOW
379		TG6 - (b) Task Group 6 has reviewed and discussed this item in the last Seattle meeting. A FAR requirement similar to FAR/JAR 25.1309 is being considered for inclusion in the new Wiring FAR section.		Closed		GREEN
380						
381	**Situation**	**Recommendations**				
382	3d. Flammable materials	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Wire chafing in the presence of flammable materials can lead to arcing, smoke and /or in-flight fire and increased crew workload. Augmenting general visual inspection with a detailed or directed visual inspection in critical areas can mitigate this condition. Emphasis on minimizing flammable materials in close proximity to wiring can mitigate this condition.	OWNER	ECD	LAST	THIS
383						
384		3d1 Task Group 3: Specify guidelines on the separation of wire bundles from non-fire-retardant materials.	Task 6			**GREEN**
385						
386		Incorporation Plan:				
387		TG6 - Task Group 6 has reviewed and discussed this item in the last Seattle meeting. It was agreed to include advisory material for this section in the new/revised wiring related AC.		Jul-02		GREEN
388						
389	**Situation**	**Recommendations**				
390	3e. Contamination	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Wire chafing in the presence of contamination can lead to arcing, smoke and /or localized. Augmenting general visual inspection with a detailed or directed visual inspection in critical areas can mitigate this condition. Emphasis on cleaning of contaminants can mitigate the risk of enhanced flammability and aids in the inspection process.	OWNER	ECD	LAST	THIS

391						
392		3e1 Task Group 4: Specify enhanced standards to ensure that these wire bundles are properly protected and cleaned.	Task 7			**GREEN**
393						
394		Incorporation Plan:				
395		TG7 - General and conditional wiring protection and cleaning procedures will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
396						
397		3e2 Aircraft Manufacturer: Consider design modification to minimize potential for contamination.	OEMs Task 6			YELLOW
398						
399		Incorporation Plan:				
400		Boeing - Potential sources of contamination of airplane wiring are identified during the design and development of the airplane, and appropriate protection in the form of drip or heat shields are included to minimize the effects of contamination. When unanticipated sources of contamination are identified during service operation, additional protection is specified and available to operators through a service letter or service bulletin. In the case of general protection of wiring during unrelated maintenance, Boeing will be providing protection guidelines in an upcoming revision to the SWPM.		Closed		GREEN
401		Airbus -				YELLOW
402		Lockheed -				YELLOW
403		TG6 - Task Group 6 has reviewed and discussed this item in the last Seattle meeting. It was agreed to include advisory material for this section in the new/revised wiring related AC.		Jul-02		GREEN
404						
405		3e3 Other: Develop and understanding of how vibration and contamination (solid and liquid) interact.	??????			**RED**
406						
407		Incorporation Plan:				
408		?????? -				RED
409						
410	**Situation**	**Recommendations**				
411	3f. Multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Wire chafing with wires from critical systems in close proximity can lead to arcing and loss of multiple critical systems and increased crew workload. Augmenting general visual inspection with a detailed or directed visual inspection for bundles with multiple critical systems can mitigate this condition. Maintaining wiring separation for critical and redundant systems can mitigate the risk of multiple system failures.	OWNER	ECD	LAST	THIS
412						
413		3f1 Task Group 4: Specify situation-specific separation and segregation guidelines specifically for this situation.	Task 6			**GREEN**
414						
415		Incorporation Plan:				
416		TG6 - Task Group 6 has reviewed and discussed this item in the last team meeting. A FAR requirement for general wiring separation is being considered for inclusion in the new Wiring FAR section. In addition, new Advisory Materials will also be developed.		Jul-02		GREEN
417						
418	**Situation**	**Recommendations**				
419	3g. Feeder cable	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Chafing of a primary power feeder cable can lead to loss of a primary power source and violent arcing with damage to other systems and structure. Augmenting general visual inspection with a detailed or directed visual inspection (emphasizing the special requirements for integrity and configuration of power feeder cables) can mitigate this condition. Nondestructive testing can detect wire chafing (after significant dielectric breakdown) and aid in expedient repair. Because there are relatively few power feeder cables, more sophisticated testing is practical and should be specified.	OWNER	ECD	LAST	THIS
420						
421		3g1 Task Group 3: Specify more detailed inspection and testing to ensure potential chafing problems are spotted and corrected.	Task 9	Closed		**GREEN**
422						
423		Incorporation Plan:				

424		TG9 - MSG3 Rev 2001.1 EZAP logic includes a detailed listing of "Details of Zone", where installed equipment, wire bundles, possible combustible materials present, L/HIRF protection features, etc., are determined as a prerequisite to conducting Zonal Analysis of a zone. Due to their high current potential and ease of identification (size), presence of feeder cables should be specifically noted in the list of details in a zone and considered for Detailed Inspection based on zone environment and frequency of maintenance access to the zone where potential damage could occur. Use of non-destructive testing is insufficiently mature to apply on a scheduled basis. Initially, new NDT methods would likely be used to support trouble-shooting activities which will provide the necessary experience to allow assessment of their use in scheduled maintenance.		Closed		GREEN
425						
426		3g2 Task Group 4: (a) Establish specific nondestructive testing protocols for power feeder cable. (b) Establish enhanced separation requirements specifically for this situation.	(a) Task 6 (b)OEMs/Task 6			**(a) GREEN (b) YELLOW**
427						
428		Incorporation Plan:				
429		TG6 - (a) Task Group 6 believes that this is not part of task 6 charter. Task Group 6 recommends that this be handled by FAA R&D Group.		Closed		GREEN
430		Boeing - (b) Routing, separation and attachment guidelines unique to airplane power feeder cables is presently available in the SWPM.		Closed		GREEN
431		Airbus - (b)				YELLOW
432		Lockheed - (b)				YELLOW
433		TG6 - (b) Task Group 6 has reviewed and discussed this item in the last team meeting. A FAR requirement for general wiring separation is being considered for inclusion in the new Wiring FAR section.		Jul-02		GREEN
434						
435		Supplemental Comments:				
436		FAA -				YELLOW
437						
438		3g3 Aircraft Operators: Ensure awareness of best-practice considerations for feeder cables.	Task 7 FAA			**YELLOW**
439						
440		Incorporation Plan:				
441		TG7 - Proper installation and maintenance of electrical power feeder cables will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
442		FAA - Coordination with FSDO is necessary prior to supplying an FAA action plan				YELLOW
443						
444	Table 7-5-4: Cracked Insulation					
445	**Situation**	**Recommendations**				
446	4. Any situation involving one or more of the conditions identified below.	This finding is relatively common. Concentrations of cracks (through to the conductor) may under special circumstances result arcing or shorting. Visual inspection cannot be relied upon to detect cracks directly, and while testing technologies can detect certain bulk changes in insulation properties, there is no reliable and convenient means of identifying cracks. An AFCB can mitigate this condition by minimizing damage and preventing electrical fire.	OWNER	ECD	LAST	THIS
447						
448		4.1 Aircraft Manufacturers: Continue development of arc-fault circuit breaker technology. Develop generic implementation plans for the potential retrofit of arc-fault circuit breakers onto in-service aircraft.	OEMs			**YELLOW**
449						
450		Incorporation Plan:				
451		Boeing - Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed		GREEN
452		Airbus -				YELLOW
453		Lockheed -				YELLOW
454						
455		4.2 Aircraft Operators: Develop generic implementation plans for the potential retrofit of arc-fault circuit breakers onto in-service aircraft.	OEMs			**YELLOW**
456						
457		Incorporation Plan:				
458		Boeing - Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed		GREEN
459		Airbus -				YELLOW
460		Lockheed -				YELLOW
461						

462		4.3 Other: Research and develop nondestructive testing techniques capable of identifying and locating insulation cracks. Consider using these techniques for both inspection and troubleshooting of suspect wires. Consider utilization of such techniques to establish on-condition criteria for replacement of endemic cracking wire.	OEMs			YELLOW
463						
464		Incorporation Plan:				
465		Boeing - We are presently conducting testing of wiring removed from service airplanes with the intent of identifying techniques to replace suspect wiring. This testing is ongoing and may result in the identification of and limits to insulation cracking.		Closed		GREEN
466		Airbus -				YELLOW
467		Lockheed -				YELLOW
468						
469	**Situation**	**Recommendations**				
470	4a. Flammable materials. Cockpit or electronics bay	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. Though moisture may or may note be present in the scenario, the specified zones and installation within these zones are critical enough to warrant extra care and precaution. If visual inspection is used, it should be supplemented by the removal of flammable materials from these locations.	OWNER	ECD	LAST	THIS
471						
472		4a1 Task Group 3: Specify accelerated removal of flammable materials.	Task 7			GREEN
473						
474		Incorporation Plan:				
475		TG7 - General and conditional cleaning procedures will be included in the SWPM/ESPM minimum content.		Jun-02		GREEN
476						
477		4a2 Task Group 3: Consider local design modification to replace non-fire-retardant materials.	OEMs			YELLOW
478						
479		Incorporation Plan:				
480		Boeing - Specification and use of materials in the manufacture of an airplane, especially the ability of the material to self-extinguish, comply with federal regulations at the time of certification. Service experience or a change in the use of the airplane would be used to determine whether an original material should be replaced by a material meeting a different flammability standard.		Closed		GREEN
481		Airbus -				YELLOW
482		Lockheed -				YELLOW
483						
484		4a3 Aircraft Operators: Accelerate removal of flammable materials from the cockpit and electronics bay.	ARAC/FAA			YELLOW
485						
486		Incorporation Plan:				
487		ARAC/FAA - Airworthiness Directives have been issued for the metalized mylar insulation				YELLOW
488						
489		4a4 Other: Research and develop fire retarding and suppressing materials and systems for cockpit or electronics bay use.	OEMs			YELLOW
490						
491		Incorporation Plan:				
492		Boeing - There are several ongoing studies aimed at reducing or eliminating the use of flammable materials in the flight deck and E/E bay areas, one of which is an ARAC. Boeing will actively participate in these studies in order to identify acceptable materials, and will consider use of these materials in present and future airplanes.		Closed		GREEN
493		Airbus -				YELLOW
494		Lockheed -				YELLOW
495						
496	**Situation**	**Recommendations**				
497	**Situation**	**Recommendations**				

498	4b. Moisture, flammable materials, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. The potential for fire and multiple critical system failures exists. Multiple cracks in a localized area of a bundle serving multiple critical systems can also result in stray currents which adversely affect the functionality of those systems. If visual inspection is used, it should be supplemented by efforts to eliminate the potential for moisture intrusion and the removal of flammable materials. Maintaining wiring separation for critical and redundant systems can mitigate the risk of multiple system failures.	OWNER	ECD	THIS	LAST
499						
500		4b1 Task Group 3: Specify accelerated removal of flammable materials. Specify guidelines to minimize moisture intrusion into wire bundles (e.g. specify drip shields over bundles running under lavatories). Specify guidelines to minimize moisture accumulation on or near bundles.	OEMs			YELLOW
501						
502		Incorporation Plan:				
503		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM. Procedures for the use of drip loops as a method of prevention for moisture ingression into connectors is presently outlined in the SWPM. Additional guidelines for the removal of moisture accumulations within the airplane as a whole are contained within the specific AMM chapter applicable to the system or zone under review.		Closed		GREEN
504		Airbus -				YELLOW
505		Lockheed -				YELLOW
506						
507		4b2 Task Group 4: Specify situation-specific wiring separation and segregation guidelines that consider loss of multiple critical functions from a common mode failure.	OEMs			YELLOW
508						
509		Incorporation Plan:				
510		Boeing - Wire separation and segregation guidelines are presently contained within the SWPM and reflect current production design standard that account for loss of multiple or redundant systems. Any changes to the standards will be reflected in future revisions to the SWPM.		Closed		GREEN
511		Airbus -				YELLOW
512		Lockheed -				YELLOW
513						
514		4b3 Aircraft Manufacturers: Consider design modification to enhance wire separation requirements for this specific situation. Consider local design modification to replace non-fire-retardant materials.	Task 6			GREEN
515						
516		Incorporation Plan:				
517		TG6 - Task Group 6 is considering development of new Advisory Materials for this item. The new AC material will be included in the revised AC for wiring.		Jul-02		GREEN
518						
519		4b4 Aircraft Operators: Accelerate removal of flammable materials.	OEMs			YELLOW
520						
521		Incorporation Plan:				
522						
523		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM. Additional guidelines for the removal of accumulations of flammable materials are contained within the specific AMM chapter applicable to the system or zone under review.		Closed		GREEN
524		Airbus -				YELLOW
525		Lockheed -				YELLOW
526						
527		4b5 Other: Research and develop fire retarding and suppressing materials and systems suitable for this situation..	??????			RED
528						
529		Incorporation Plan:				
530		?????? -				RED
531						
532	**Situation**	**Recommendations**				
533	4c. Moisture, flammable materials	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. If visual inspection is used, it should be supplemented by efforts to eliminate the potential for moisture intrusion and the removal of flammable materials.	OWNER	ECD	LAST	THIS

534						
535		4c1 Task Group 3: Specify guidelines to minimize moisture intrusion. Specify guidelines to minimize moisture accumulation on or near bundles.	OEMs			YELLOW
536						
537		Incorporation Plan:				
538		Boeing - Procedures for the use of drip loops as a method of prevention for moisture ingression into connectors is presently outlined in the SWPM. Additional guidelines for the removal of moisture accumulations within the airplane as a whole are contained within the specific AMM chapter applicable to the system or zone under review.		Closed		GREEN
539		Airbus -				YELLOW
540		Lockheed -				YELLOW
541						
542		4c2 Aircraft Operators: Accelerate removal of flammable materials.	OEMs			YELLOW
543						
544		Incorporation Plan:				
545						
546		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM. Additional guidelines for the removal of accumulations of flammable materials are contained within the specific AMM chapter applicable to the system or zone under review.		Closed		GREEN
547		Airbus -				YELLOW
548		Lockheed -				YELLOW
549						
550						
551	**Situation**	**Recommendations**				
552	4d. Moisture, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. The potential for multiple critical system failures exists. Multiple cracks in a localized area of a bundle serving multiple critical systems can also result in stray currents which adversely affect the functionality of those systems. If visual inspection is used, it should be supplemented by efforts to eliminate the potential for moisture intrusion.	OWNER	ECD	THIS	LAST
553						
554		4d1 Task Group 3: Specify guidelines to minimize moisture intrusion. Specify guidelines to minimize moisture accumulation on or near bundles.	OEMs Task 6			YELLOW
555						
556		Incorporation Plan:				
557		Boeing - Procedures for the use of drip loops as a method of prevention for moisture ingression into connectors is presently outlined in the SWPM. Additional guidelines for the removal of moisture accumulations within the airplane as a whole are contained within the specific AMM chapter applicable to the system or zone under review.		Closed		GREEN
558		Airbus -				YELLOW
559		Lockheed -				YELLOW
560		TG6 - Task Group 6 is considering development of new Advisory Materials for this item. The new AC material will be included in the revised AC for wiring.		Jul-02		GREEN
561						
562	**Situation**	**Recommendations**				
563	4e. Contamination, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Concentrations of cracks (through to the conductor) can (in the presence of some conductive contaminant) result arcing or shorting. Though flammable materials may or may not be present in this scenario, the potential for combustion (with flammable contaminants) or multiple critical system failures exists. In addition, multiple cracks in a localized area of a bundle serving multiple critical systems can also result in stray currents which adversely affect the functionality of those systems. If visual inspection is used, it should be supplemented by efforts to eliminate the potential for contamination (i.e. drip or splatter shields).	OWNER	ECD	LAST	THIS
564						
565		4e1 Task Group 4: Develop enhanced standards to ensure that these wire bundles are properly protected and cleaned.	Task 6/9			GREEN
566						
567		Incorporation Plan:				
568						

569		TG6 - This was reviewed by Task Group 6 in the last meeting of the group. It was agreed to development new Advisory Materials for this item. The new AC material will be included in the revised AC for wiring.		Jul-02		GREEN
570		TG9 - MSG3, Rev 2001.1 EZAP logic includes a determination if accumulation of combustible material likely in a zone, and selection of task(s) to prevent significant accumulation of combustible material.		Closed		GREEN
571						
572		4e2 Aircraft Manufacturers: Consider design modification to minimize potential for contamination.	OEMs			YELLOW
573						
574		Incorporation Plan:				
575		Boeing - Potential sources of contamination of airplane wiring are identified during the design and development of the airplane, and appropriate protection in the form of drip or heat shields are included to minimize the effects of contamination. When unanticipated sources of contamination are identified during service operation, additional protection is specified and available to operators through a service letter or service bulletin. In the case of general protection of wiring during unrelated maintenance, Boeing will be providing protection guidelines in an upcoming revision to the SWPM		Closed		GREEN
576		Airbus -				YELLOW
577		Lockheed -				YELLOW
578						
579	**Situation**	**Recommendations**				
580	4f. Flammable materials, multiple critical systems, vibration	Given the specified conditions, the occurrence of this fault could lead to potentially severe consequences. Concentrations of large cracks (through to the conductor) can (if brought into physical contact by vibration) result arcing or shorting. In addition, vibration of cracked insulation can accelerate the degeneration of this condition. The potential for combustion or multiple critical system failures exists. In addition, multiple cracks in a localized area of a bundle serving multiple critical systems can also result in stray currents which adversely affect the functionality of those systems. If visual inspection is used, it should be supplemented by efforts to minimize exposure to flammable materials. Additional security (clamps, ties, etc) should be used to reduce the potential for accelerated damage and failure.	OWNER	ECD	LAST	THIS
581						
582		4f1Task Group 3: Specify accelerated removal of flammable materials. Establish guidelines to ensure, and enhance where necessary, the secure installation of wire bundles.	OEMs			YELLOW
583						
584		Incorporation Plan:				
585						
586		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM. In addition, specific unique procedures for the attachment and prevention of damage to wiring in high vibration areas is presently provided in the SWPM.		Closed		GREEN
587		Airbus -				YELLOW
588		Lockheed -				YELLOW
589						
590		4f2Aircraft Operators: Accelerate removal of flammable materials in suspect areas.	OEMs			YELLOW
591						
592		Incorporation Plan:				
593		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM.		Closed		GREEN
594		Airbus -				YELLOW
595		Lockheed -				YELLOW
596						
597		Table 7-5-5: Delamination				
598	**Situation**	**Recommendations**				
599	5. Any situation involving one or more of the conditions identified below	This finding is relatively infrequent. Delaminations (through to the conductor) may under special circumstances result arcing or shorting. Visual inspection may not be able to detect delamination. (Data on the visual detect ability of delamination is very limited.) If visual inspection is used, it should be supplemented by efforts to eliminate the potential for moisture intrusion and efforts to minimize exposure to flammable materials. An AFCB can mitigate this condition by minimizing damage and preventing electrical fire.	OWNER	ECD	LAST	THIS
600						

601		5.1 Task Group 3: Specify guidelines that precipitate an invasive inspection or nondestructive testing of wire bundles exposed to suspected high or low pH contaminants. Specify guidelines for decontamination procedures for wire to neutralize the effects of chemically aggressive contaminants.	OEMs			YELLOW
602						
603		Incorporation Plan:				
604						
605		Boeing- Guidelines for the cleaning and conditional inspection of contaminated wiring will soon be included in the SWPM and Maintenance Planning Document applicable to the specific model airplane.		Closed		GREEN
606		Airbus -				YELLOW
607		Lockheed -				YELLOW
608						
609		5.2 Aircraft Manufacturers: Continue development of arc-fault circuit breaker technology. Develop generic implementation plans for the potential retrofit of arc-fault circuit breakers onto in-service aircraft.	OEMs			YELLOW
610						
611		Incorporation Plan:				
612						
613		Boeing - Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed		GREEN
614		Airbus -				YELLOW
615		Lockheed -				YELLOW
616						
617		5.3 Operators: Specify maintenance procedures and training to instruct technicians on use of techniques to identify suspect wires.	Task 8	Closed		GREEN
618						
619		Incorporation Plan:				
620						
621		TG8 - Maintenance procedures will be discussed during Wire Module E6: Maintenance and Repair Procedures. Techniques of identifying suspect wires are covered in Wire Module E5: Typical Damage and Areas Found (airplane specific)		Closed		GREEN
622						
623		5.4 Other: (a) Specify use of in-situ indicators to identify exposure to precipitating agents or conditions – a "canary". (In particular, use in-situ litmus testing to identify exposure of wrapped construction wire to high or low pH solutions or contaminants.) (b) Develop updated wiring separation guidelines that consider loss of multiple critical functions from a common mode failure.	OEMs Task 6			YELLOW
624						
625		Incorporation Plan:				
626						
627		Boeing- Guidelines for the cleaning and conditional inspection of contaminated wiring will soon be included in the SWPM and Maintenance Planning Document applicable to the specific model airplane. A review of the wiring separation guidelines is anticipated as a result of the changes noted in the TG6 comment below.		Closed		GREEN
628		Airbus -				YELLOW
629		Lockheed -				YELLOW
630		TG6 - Task Group 6 has reviewed and discussed this item in the last Seattle meeting. A FAR requirement similar to FAR 25.1309 is being considered for inclusion in the new wiring FAR section.		Jul-02		GREEN
631						
632	**Situation**	**Recommendations**				
633	5a. Flammable materials, cockpit or electronics bay	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. Though moisture may or may not be present in this scenario, the specified zones and installations within these zones are critical enough to warrant extra care and precaution.	OWNER	ECD	LAST	THIS
634						
635		5a1 Aircraft Manufacturers: Consider design modification to eliminate non-fire-retardant materials.	OEMs			YELLOW
636						
637		Boeing - Specification and use of materials in the manufacture of an airplane, especially the ability of the material to self-extinguish, comply with federal regulations at the time of certification. Service experience or a change in the use of the airplane would be used to determine whether an original material should be replaced by a material meeting a different flammability standard.		Closed		GREEN
638		Airbus -				YELLOW

639		Lockheed -				YELLOW
640						
641		5a2 Operators: Accelerate removal of flammable materials.	OEMs			YELLOW
642						
643		Incorporation Plan:				
644		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM.		Closed		GREEN
645		Airbus -				YELLOW
646		Lockheed -				YELLOW
647						
648		Table 7-5-6: Arcing				
649	**Situation**	**Recommendations**				
650	6. Any situation involving one or more of the conditions identified below.	This finding is relatively infrequent. Arcing can result from degraded or damaged wire or non-environmental or degraded splices. Because visual inspection will probably not detect initial arcing, efforts should focus on minimizing wire exposure to chafing, traumatic impact during maintenance operation in the area. Use of environmental splices can reduce the potential for a hazardous arc. Use of an AFCB can mitigate the consequences of arcing. Operational procedures, including Flight Standards Information Bulletin 00/08A, can also mitigate the consequences of initial failure.	OWNER	ECD	LAST	THIS
651						
652		6.1 Task Group 5: Develop guidelines that ensure that all maintenance personnel, not just electrical maintenance technicians, are made aware of those actions that could result in breached wire. Small breaches (such as those resulting from the needling of wire) should not be dismissed as inconsequential.	Task 8	Closed		**GREEN**
653						
654		Incorporation Plan:				
655						
656		TG8 - Guidelines for all maintenance personnel to prevent insulation breaches of airplane wire are found in Housekeeping Module D5: Protection During Airplane Maintenance and Repair. The dangers of needling wire (insertion of probes through insulation) will be covered in Introduction Module A6; Measurement and Troubleshooting Using Meters and Wire Module E2; Insulation Qualities.		Closed		GREEN
657						
658		6.2 Aircraft Manufacturers: Continue development of arc-fault circuit breaker technology. Develop generic implementation plans for the potential retrofit of arc-fault circuit breakers onto in-service aircraft.	OEM's			YELLOW
659						
660		Incorporation Plan:				
661		Boeing - Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed		GREEN
662		Airbus -				YELLOW
663		Lockheed -				YELLOW
664						
665		6.3 Operators: (a) Develop generic implementation plans for the potential retrofit of arc-fault circuit breakers onto in-service aircraft. (b)Make maintenance personnel aware of the dangers of arcing.	(a) OEMs (b) Task 8			YELLOW
666						
667		Incorporation Plan:				
668						
669		Boeing - (a) Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed		GREEN
670		Airbus - (a)				YELLOW
671		Lockheed - (a)				YELLOW
672		TG8 - (b) Arcing and carbon arcing are found in Wire Module E2 (c): Carbon arcing.		Closed		GREEN
673						
674		6.4 Other: Continue research necessary to support the development of arc-fault circuit breakers and incorporate AFCB into other circuit switching devices and selected electrical components. Conduct research into other technologies that mitigate the risk of arcing.	OEMs			YELLOW
675						
676		Incorporation Plan:				
677						
678		Boeing - Implementation of any new technology will be evaluated as it is being developed and with the input of the operators.		Closed		GREEN

679		Airbus -				YELLOW
680		Lockheed -				YELLOW
681						
682	**Situation**	**Recommendations**				
683	6a. Flammable materials, cockpit or electronics bay	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. The existence of an arcing condition in the presence of flammable materials is unacceptable. The cockpit and electronics bay warrant special attention. Elimination of flammable materials can mitigate the consequences of arcing.	OWNER	ECD	LAST	THIS
684						
685		6a1 Operators: Accelerate removal of flammable materials from the cockpit and electronics bay.	OEMs			YELLOW
686						
687		Incorporation Plan:				
688						
689		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM. Additional guidelines for the removal of accumulations of contamination are contained within the specific AMM chapter applicable to the system or zone under review.		Closed		GREEN
690		Airbus -				YELLOW
691		Lockheed -				YELLOW
692						
693	**Situation**	**Recommendations**				
694	6b. Flammable materials, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. The existence of an arcing condition in the presence of flammable materials is unacceptable. In addition to the fire threat, multiple critical systems may fail. Elimination or segregation of flammable materials can mitigate the consequences of arcing.	OWNER	ECD	LAST	THIS
695						
696						
697		6b1 Operators: Accelerate removal of flammable materials. Ensure separation of wire bundles from flammable materials.	OEMs			YELLOW
698						
699		Incorporation Plan:				
700		Boeing - Prevention of contamination, and cleaning of noted contamination on the exterior of wiring will be included in the Boeing SWPM. Additional guidelines for the removal of accumulations of contamination are contained within the specific AMM chapter applicable to the system or zone under review.		Closed		GREEN
701		Airbus -				YELLOW
702		Lockheed -				YELLOW
703						
704	**Situation**	**Recommendations**				
705	6c. Contamination, cockpit or electronics bay	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. The existence of an arcing condition in the presence of flammable contaminants is unacceptable. The cockpit and electronics bay warrant special attention. Exposure of wire to fluid contaminants (e.g. water waste, hydraulic) and solid debris (e.g. drill shavings, foreign objects) must be minimized. Susceptible wire bundles should be kept free of flammable dust and lint build-up.	OWNER	ECD	LAST	THIS
706						
707		6c1 Aircraft Manufacturers: Consider design modification to minimize potential for contamination.	OEMs			YELLOW
708		Incorporation Plan:				
709						
710		Boeing - Potential sources of contamination of airplane wiring are identified during the design and development of the airplane, and appropriate protection in the form of drip or heat shields are included to minimize the effects of contamination. When unanticipated sources of contamination are identified during service operation, additional protection is specified and available to operators through a service letter or service bulletin. In the case of general protection of wiring during unrelated maintenance, Boeing will be providing protection guidelines in an upcoming revision to the SWPM		Closed		GREEN
711		Airbus -				YELLOW
712		Lockheed -				YELLOW
713						
714		6c2 Operators: Use additional precautions when performing maintenance in the cockpit and electronics bay.	Task 8/9	Closed		GREEN
715						

716		Incorporation Plan:				
717						
718		TG8 - Precautions when performing maintenance in cockpit and electronics bay are covered in Inspection Module C3; Zonal Areas of Inspection and Housekeeping Module D2 & 3; Airplane Internal Contamination Sources, and Other Contamination Sources.		Closed		GREEN
719						
720		TG9 - This concern is addressed in Task Group 3 Report with recommendations that OEM's strengthen language in their Maintenance Documents under Specific precautions regarding protection of wiring from contaminates and damage.		Closed		GREEN
721						
722	**Situation**	**Recommendations**				
723	6d. Contamination, multiple critical systems	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. The existence of an arcing condition in the presence of flammable contaminants is unacceptable. Exposure of wire to fluid contaminants (e.g. water waste, hydraulic) and solid debris (e.g. drill shavings, foreign objects) must be minimized. Susceptible wire bundles should be kept free of flammable dust and lint build-up.	OWNER	ECD	LAST	THIS
724						
725		6d1 Aircraft Manufacturers: Consider design modification to minimize potential for contamination.	OEMs			YELLOW
726						
727		Incorporation Plan:				
728						
729		Boeing - Potential sources of contamination of airplane wiring are identified during the design and development of the airplane, and appropriate protection in the form of drip or heat shields are included to minimize the effects of contamination. When unanticipated sources of contamination are identified during service operation, additional protection is specified and available to operators through a service letter or service bulletin. In the case of general protection of wiring during unrelated maintenance, Boeing will be providing protection guidelines in an upcoming revision to the SWPM		Closed		GREEN
730		Airbus -				YELLOW
731		Lockheed -				YELLOW
732						
733		6d2 Operators: Use additional precautions when performing maintenance in the vicinity of wire bundles supporting multiple flight-critical systems.	Task 8	Closed		**GREEN**
734						
735		Incorporation Plan:				
736		TG8 - Because of the difficulty of identifying flight critical wire bundles, all wire bundles are to be treated identically. ESPM data will be used at all times as covered in Wiring Practices Documentation Module B and Wire Module E3, 4 & 6; Inspection Criteria and Standards of Wire and Wire Bundles, Wire Bundle Installation Practices, and Maintenance and Repair Procedures.				GREEN
737						
738	**Situation**	**Recommendations**				
739	6e. Multiple critical systems, arc-tracking potential	Given the specified conditions, the occurrence of this fault could lead to potentially critical consequences. Though this scenario does not assume the presence of flammable materials or contaminants, arc tracking on a bundle with multiple critical system wires can result in multiple flight-critical system failures. Separation of critical wiring into physically separate and smaller bundles can reduce the possibility of cascading failure.	OWNER	ECD	LAST	THIS
740						
741		6e1 Task Group 4: Specify enhanced separation requirements for wires with known arc-tracking potential. Specify enhanced routing requirements for wires with known arc-tracking potential that prohibit or minimize hazardous conditions such as chafing, or damage from regular activities in/about the aircraft.	Task 6			**GREEN**
742						
743		Incorporation Plan:				
744		TG6 - Task Group 6 has reviewed and discussed this item in the last Seattle meeting. A FAR requirement similar to FAR 25.1309 is being considered for inclusion in the new wiring FAR section.		Jul-02		GREEN
745						
746						
747	General Recommendation					

748

749 There are many ATSRAC supported activities that will result in great improvement to the inspection and maintenance of aircraft electrical systems. The recommendations stemming from these activities are extremely important. The following general recommendation is meant to supplement those other recommendations. This recommendation should be considered in conjunction with those recommendations without any presumption

		OWNER	ECD	LAST	THIS
750					
751					
752	GR1. Inspection and maintenance personnel should be made aware of the characteristic degenerative failure modes for specific wire types. Furthermore these personnel should be made aware of the types of wire they are likely to encounter on the aircraft they maintain. Task Group 5 should implement this recommendation by including appropriate material in their proposed training curricula.	Task 8			**GREEN**
753					
754	Incorporation Plan:				
755					
756	TG8 - Failure modes for specific wire types are covered in Wire Module, E2 Insulation Qualities, E3 Inspection Criteria and Standards of Wire and Wire Bundles and E5, Typical Damage and Areas Found (airplane specific). Airplane model wire types found on the airplanes that the technician maintains, will be covered in Wire Module E1, Identification, Type and Construction		Closed		GREEN
757					
758					
759					
760	Research Recommendations of the Intrusive Inspection Working Group				
761					

			FAA OWNER	ECD	LAST	THIS
762	The intrusive inspection project is only a first look at state of wire in aged aircraft. As with most investigative studies of this nature, it answered some questions, failed to fully answer other questions, and raised still more questions. Cognizant of the results of this project, the working group makes the following recommendations for further research:					
763						
764		GR2 The FAA should fully support its commitment to its wire degradation assessment project to begin this year. With reference to this report, the degradation assessment project should attempt to explain observed or suspected – but yet unanalyzed – phenomena on the dominant aged wire types. This research should focus on characteristic failure modes and the factors that aggravate or retard degradation. The goal of such research should be a methodology that allows us to predict with a high degree of certainty the fitness for service of wire subject to a known service environment.	AAR-433			**GREEN**
765						
766		Incorporation Plan:				
767		The FAA has established a contract with Raytheon Technical Services to perform the GR2 tasking.				GREEN
768						
769		GR3 As part of the degradation assessment project the FAA should analyze the effects of wire-to-wire chaffing. Wires are currently selected by the aircraft manufacturer based on their specific application and their proximity to other wires in a bundle. Maintenance and subsequent modifications may result in the mixing of wire types not anticipated during original design. There is lingering concern that wires with different insulations can damage each other if bundled together. Building upon the work of the Navy Avionics Center report TR 2333 and Airbus investigations into this issue, this suspicion should be re-examined.	AAR-433			**GREEN**
770						
771		Incorporation Plan:				
772		AAR-433 - Research plan is complete and under review by sponsor. Arrangements to contract work are underway.				GREEN
773						
774	.	GR4 Also as part of the degradation assessment project the FAA should analyze the effects of common contaminants on wire. Special attention should be paid to corrosion control compounds. This follow-on effort should be fully consistent with and build upon the work presented in the Intrusive Inspection Working Group Report. In particular, the analysis of wire bundles taken from retired aircraft is an essential part of any such effort. The FAA should consider pursuing further laboratory testing per the intrusive inspection protocol on the currently available specimens. This would include:	AAR-433			**GREEN**
775						
776		o Perform additional laboratory visual analysis of 747-, L1011-, and A300- specimens.				
777		o Perform additional laboratory tests based on original intrusive inspection laboratory test protocol.				
778		o Investigation of the effects of lavatory fluid contamination of PVC insulation. Also investigate other fluids/chemicals used in aircrafts.				

779	o Determine probable cause of the observed degenerative conditions (e.g. internal or external heating, fluid contamination, aging).		
780	o For PVC/Glass/Nylon, correlate the specific symptoms of aging with the mechanical and electrical properties of the insulation.		
781			
782	Incorporation Plan:		
783	AAR-433 - This work is being conducted as part of the research project described in		GREEN
784			
785	GR5 Excessive wire heating presents the risk of electrical fire or ignition of surrounding combustible materials. High resistance inter-connections where electrical heating is sufficient to damage the wire insulation are typically detected by visual inspection for embrittled, charred or missing insulation. However, the relationship of observable thermal damage to wire hot enough to hazard the aircraft is still unknown. It is recommended that the FAA conduct research to determine how best to manage this issue.	AAR-433	**RED**
786			
787	Incorporation Plan:		
788	AAR-433 - This is not currently part of the FAA Electrical Systems Research Program.		RED
789			
790	GR6 The FAA should aggressively pursue and promote arc-fault circuit breaker development. Many of the recommendations of this report specify this as a potential option to eliminate or mitigate electrical hazards.	AAR-433	**GREEN**
791			
792	Incorporation Plan:		
793	AAR-433 - 115VAC AFCB development is nearing completion. EATON Aerospace 115V AFCB has completed FAA and Navy flight testing. Hendry Telephone Systems AFCB will begin flight testing in summer 2002. 28VDC, and 3 phase AFCB breaker development will begin in spring 2002. This will include an effort to miniaturize the AFCB to an MS3320 size package		GREEN
794			
795	GR7 The FAA should aggressively pursue and promote the development of nondestructive test equipment for aircraft wiring. Many of the recommendations of this report specify this as a potential option to eliminate or mitigate electrical hazards.	AAR-433	**GREEN**
796			
797	AAR-433 -The FAA is currently funding 8 NDI R&D programs. The programs are developing a broad range of technologies for the test and inspection of aircraft electrical interconnect systems.		GREEN
798			
799	GR8 By their very nature connectors and terminals are designed to be serviceable, and they are physically localized. This suggests that these components should be less problematic than wires, which may stretch from one end of the aircraft to the other. On the other hand their relatively frequent handling and exposure to collateral damage, make connectors, terminals, their lead wires subject to repetitive stress and accidental damage. Furthermore, experience has shown that we cannot rule-out the possibility of a fire resulting from a defective or broken connector.	AAR-433	**GREEN**
800			
801	Incorporation Plan:		
802	AAR-433 - The FAA is completing an evaluation of aging circuit breakers. Upon completing this project, work will begin on evaluation of the performance of other aging electrical interconnect components, including connectors, terminals, etc.		GREEN
803			
804	GR9 The intrusive inspection project did not fully consider connector issues. The military and commercial aviation community should sponsor efforts to scope the problem and establish research projects and maintenance guidelines to address the issue.	AAR-433	**GREEN**
805			
806	Incorporation Plan:		
807	AAR-433 - The FAA is completing an evaluation of aging circuit breakers. Upon completing this project, work will begin on evaluation of the performance of other aging electrical interconnect components, including connectors, terminals, etc.		GREEN
808			

809		GR10 Though wires and connectors are the most obvious component in electrical interconnect systems, there are others. The FAA should investigate the physical and functional integrity of any electrical system component whose failure could hazard the aircraft. This includes: circuit breakers, relays, switches, wire support and bundling systems (including conduit), shielding, ground blocks, etc.	AAR-433	**GREEN**
810				
811		Incorporation Plan:		
812		AAR-433 - The FAA is completing an evaluation of aging circuit breakers. Upon completing this project, work will begin on evaluation of the performance of other aging electrical interconnect components, including connectors, terminals, etc.		GREEN
813				
814		GR11 The working group observed wires with breaches and non-environmental splices, and found reduced insulation resistance in certain wet wires. Though the working group did not document wire bundles with numerous, collocated breaches or non-environmental splices, the possibility should be considered. In the presence of moisture this situation could result in stray electrical currents affecting multiple systems. The FAA should investigate the possibility of this situation and its potential to hazard the aircraft.	AAR-433	**GREEN**
815				
816		Incorporation Plan:		
817		AAR-433 - This issue is or will be looked at via several avenues of the research program. Mitigation of this hazard is accomplished with the use of AFCB technology. The hazard will also be explored as part of the program to develop advanced risk assessment tools for aircraft electrical systems.		GREEN