SUMMARY OF ATSRAC RECOMMENDATIONS TO FAA

Task 1 (Sampling Inspection of the Fleet - August 2000)

1. The airplane manufacturers should evaluate, using the processes outlined in Appendix C [of the Task 1 Final Report], all Significant Inspection Items for appropriate additional action, including but not limited to design changes, enhanced inspection procedures, accelerated inspection intervals, etc. Results should be validated by the applicable airplane working groups prior to transmittal to ATSRAC. OEM's should also communicate pertinent data to affected operators.

   Update: The OEM's and representatives of participating airlines, the applicable OEM and the FAA which comprise the airplane model working groups have completed this recommended action. Results of the evaluation are provided in Appendix C [of the Task 1 Final Report].

2. Consider the content of each non-intrusive evaluation document in order to identify typical enhancements that will need to be implemented in existing maintenance programs.

3. Consider the content of ATA Specification 117, Wiring Maintenance Practices/Guidelines to enhance the awareness of wiring issues (i.e., inspection, installation, cleanliness, maintenance and repair).

4. Identify appropriate logic to develop specific inspection tasks to permit enhancement of maintenance program documents or upgrade to MSG-3 GVI criteria. Also review appropriate intervals.

5. Enhance standard practices by identifying recommendations that may be implemented in an individual airline foreign object damage (FOD) program to preclude debris contamination inside the aircraft during maintenance or modifications. Implement a "clean as you go" philosophy.

6. Incorporate into aircraft maintenance documentation additional cautions and procedures aimed at preventing accidental damage and/or contamination of wiring installations.

7. Review the above recommendations following the completion of the intrusive wiring inspection program for possible changes and/or amendments.

8. Determine requirement for and implement improved reporting for wiring service history through enhanced ATA chapter organization.

Task 2 (Review of Fleet Service History - August 2000)

1. The airplane manufacturers evaluate, using the processes as outlined in Appendix D [of the Task 1 Final Report], all service history documents categorized as A, B, or C for appropriate additional action. Appropriate action includes, but is not limited to, raising a document to Alert status. Priority should be given to Category A documents first, then B and C respectively. OEMs should also communicate pertinent data to affected operators.

   Update: OEMs accomplished this review for all categories of service documents. The results, as validated by representatives of participating airlines, the applicable OEM and the FAA which comprise the airplane model working groups, are provided in Appendix D [of the Task 1 Final Report] to this document.

2. The FAA review the eight airworthiness directives contained in Appendix H [of the Task 1 Final Report] to this report for consideration of mandating termination of the repetitive actions.

Task 3 (Improvement of Maintenance Criteria - March 2001)

1. The ATA's Maintenance Program Development Document (that contains the MSG-3 guidelines) is to be updated to reflect the revised definitions of General Visual Inspection and Detailed Inspection. Target: MSG-3 rev. 2001.

2. Training material utilized by regulators, OEMs, operators and 3rd party maintenance organizations to be updated to reflect the revised GVI/DET definitions.

3. Operators shall ensure that they have a dedicated Zonal Inspection section within their approved maintenance program. This may not have been developed for the original MRB report and thus OEM's will be required to assist operators to develop appropriate zonal inspections.

4. OEM's shall apply the enhanced zonal analysis procedure to their in-service products in order to identify additional tasks to better address deterioration of wiring installations. Once developed, operators shall introduce these tasks into their maintenance programs.

5. STC holders shall update the instructions for continued airworthiness that they provided in support of their design changes. This shall be done through application of the enhanced zonal analysis procedure. Once developed, these shall be introduced in operators maintenance programs.

6. Where possible, tasks originating from application of the enhanced zonal analysis procedure shall be included in MRB Reports. Where, due to the age of the aircraft, this is not feasible, the recommendations shall be published in a document appropriate to the importance of the issue e.g. Service Bulletin. Whatever method is used to promulgate the additional tasks, the accompanying text shall highlight that the tasks should not be consolidated within the zonal inspections at any time during the aircraft life.

7. Should any specific materials be proven to exhibit unacceptable combustion characteristics after removal of an ignition source, FAA should follow-up any necessary actions with the concerned parties.

8. OEM/operator training material (for both aircraft inspection and MSG-3 analysis) and maintenance documentation (as appropriate) should include information on the typical deterioration that is expected to be seen and addressed during accomplishment of a zonal inspection. Chapter 7 [of the Task 3 Final Report] identifies some items that should be included in addition to the main system components and structural items.

9. As indicated in Items 1 through 12 in Chapter 8.0 [of the Task 3 Final Report], protections or cautions should be added to the specified locations for each of the maintenance or servicing tasks listed. See 'General Notes' under paragraph 8.3.

10. Standards for producing documents listed in the "Locations" section of Item 1 through 12 of Chapter 8 should be updated to ensure appropriate protection and caution information is incorporated in future documents. One example of a standard is ATA Spec 100/iSpec2200.

11. The FAA should be tasked with evaluating current structural anti-corrosion products for long-term affects on wiring. The results should be recommendations for or against the use of specific products on wiring given the high probability that wiring and electrical components will always be subject to some level of contamination by these products. Manufacturers of corrosion inhibiting compounds should be encouraged to adjust their products to minimize detrimental effects on wiring while preserving the highest levels of structural corrosion protection possible.

12. OEMs should be tasked with providing specific guidance for pressure washing to minimize adverse effects on wiring and electrical components (i.e., maximum pressures, minimum nozzle-to-surface distance, maximum cleaning solution pH, maximum temperatures of water, maximum air temperature, and rinse requirements). The results should be in the form of internationally accepted practices.

13. With respect to Carriage of Livestock and Carriage of Hazardous Materials, OEMs/operators should examine existing documentation to ensure that appropriate and complete instructions are given with respect to cleaning of any spillage that might occur despite the precautions taken. This documentation should emphasize the potential severity of deterioration caused to systems and structure by animal waste products, salt water, caustic chemicals, etc. Guidance should be given on the extent of the cleaning procedures since it is often insufficient to remove only the visible evidence of contamination.

14. FAA to promote/finance the production of a video aimed at convincing senior management within OEMs, Operators and 3rd Party Maintenance Organizations of the need to change the attitude towards wiring. This may use footage already available from the ATA Spec 117 video and should be complemented by pictures actual in-service conditions. Film taken during laboratory testing should not be used. Focus must be on what does occur in service, not theoretical events.

15. The importance of changing maintenance mentality towards electrical wiring installations will require more than simply updating manuals and enhancing training. The need for change must be promoted from above and thus actions must be taken to convince senior management that extended inspection

time and improved working procedures are fundamental in achieving an improvement in continuous airworthiness.

16. Update MSG-3 to better address SEDLP [Single Element Dual Load Path] item**s.**

    a) Add a new paragraph to the ATA's MSG-3 chapter 3-3, Aircraft Systems / Powerplant Analysis Method to read: *Defining some functional failures may require a detailed understanding of the system and its design principles. For example, for system components having single element dual load path features, such as concentric tubes or back to back plates, the function of both paths should be analyzed individually. The degradation and/or failure of one path may not be evident*

    b) Add an example MSG-3 analysis is to the ATA's MSG-3 guidelines document to address the function of dual load paths in flight controls. This should be introduced when the concept of a 'user's handbook' is developed.

17. Review existing MSG-3 analyses, and/or perform new MSG-3 analysis, on SEDLP components to ensure the dual load path function has been identified and analyzed with new awareness of the design principle.

Task 4 (Review and Update Standard Practices for Wiring - October 2000)

1. There are several reasons why simplification of the Wiring Diagram Manual (WDM) Chapter 20 manuals by users is not recommended:

   a. Would result in different standards from one airline to another.
   b. It would not be practical for the user to do this.
   c. The users need the details for inspection, maintenance and repair that are currently in the manufacturers WDM Chapter 20.
   d. The subject of simplification is addressed in the other recommendations that follow.

2. Aircraft and component manufacturers should provide standard practices for care and maintenance of wiring systems. Some examples to be included as a minimum are:

   - Cleaning requirements & methods
   - Wire & cable identification
   - Damage limits by wire/cable type
   - Installation limits/requirements dealing with clamping/support, bundle clearances, routing, etc.
   - Inspection methods
   - Repair/replacement procedures
   - Wire & cable replacement alternatives, noting effectivity limits
   - General maintenance practices in the aircraft maintenance, structural repair & component manuals to prevent damage to wire & cable during accomplishment of servicing, inspection or repairs
   - Types and number of splice repairs including time and location limitations for their replacement

3. Add requirements in ATA 100/i2200 for standard practices for wiring systems. The ATA Working Group should define a structure of major sections for standard practices dealing with wire, cable and other components of the aircraft's electrical system in ATA 100/i2200. These may be included as a new chapter (19) within the aircraft maintenance manual or remain as Chapter 20 within the WDM. The structure should also make provisions for use by component manufacturers and lend itself to the classification of corrective action for reliability reporting by operators. Manufacturers would provide detail and content for the subsections.

4. Include in Chapter 20 any standard practices that may be required to support any revised maintenance programs coming out of Task Group 3.

5. Assess changes in standard practices for wiring systems which are brought about by recommendations in the final report from the Intrusive Inspections.

6. Establish the requirement for recurrent qualification training of maintenance technicians to include WDM Chapter 20 content, with particular attention to aging concerns including:

    - Safety
    - Degradation of wire installations
    - Corrosion of components
    - Contamination due to chemically active material
    - Accumulation of dust, lint, debris
    - Damage prevention and cleaning

7. Encourage all applicable training programs to highlight prevention as number one and "clean as you go" approaches to reduce potential for compromising nearby wiring installations.

8. WDM Chapter 20 standard and supporting documentation including ATA Spec. 117 and applicable FAA circulars should be included as source data to create a training program.

9. Highlight the "human factors" element during training for all disciplines to assure that standard practices are followed.

Task 5 (Air Carrier and Repair Station Inspection and Repair Training Programs - March 2001)

1. The recommended training [described on pages 11-31 of the Task 5 Final Report] is to be used by training providers for all airplane technicians at any stage in their careers. The technician can be trained to the appropriate level using the applicable modules, depending upon the technician's experience, work assignment and the operator's policy. The following eight course modules are defined in detail within the report:

Module A – Introduction
Module B – Chapter 20 Structure
Module C – Inspection
Module D – Housekeeping
Module E – Wire
Module F – Connective Devices
Module G – Connective Device Repair (OEM specific)
Module H – Line Replaceable Units (LRU)

2. Because of the level of contamination of airplane wiring systems with dirt and debris, it is recommended that all airplane workers are taught Module D, Housekeeping.

Intrusive Inspection Report (December 2000)

General Recommendation

1. 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 [Training Programs] should implement this recommendation by including appropriate material in their proposed training curricula.

Research Recommendations

2. 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.

3. As part of the degradation assessment project the FAA should analyze the effects of wire-to-wire chafing.

4. 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.

5. 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.

6. 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.

7. 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.

8. The intrusive inspection report 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.

9. 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..

10. The FAA should determine the frequency and significance of non-environmental splices, and assess their potential impact on flight safety. The FAA should also conduct research to assess the significance of unacceptably high resistance connections.

Specific Recommendations (selected items)

11. Aircraft manufacturers should, 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.

12. The FAA should revise AC 43-13-1B and other guidance material to stipulate that environmental splices are the preferred method of repairing wire in both SWAMP and non-SWAMP areas. Develop wiring configuration management software that will track the installation and location of splices. Develop best practices regarding the maximum number of splices permitted for various types of circuits based upon frequency and severity of potential splice failures.

13. Aircraft manufacturers should consider updating splicing practice to reflect special considerations associated with:

    a. the proximity of the splice to non-fire-retardant materials
    b. the expected wire current
    c. high-current carrying splices in bundles with wires supporting multiple flight-critical systems

14. Aircraft manufacturers should review design and maintenance practices regarding the use of heat shields. Establish on-condition criteria for the replacement of wire in heat-damaged bundles (external and internal heat).

15. Aircraft manufacturers should review design practices regarding the clamping and tying of wire bundles. Investigate use of non-destructive testing to trouble-shoot suspect wire installations.