

National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center
2101 NASA Road 1
Houston, Texas 77058-3696



Reply to Attn of: EA2-07-048

September 7, 2007

TO: EA/GFP Chief Engineer
FROM: EA/Alpha Magnetic Spectrometer (AMS) Project Manager
SUBJECT: Response to Technical Authority Report of AMS Integration Review
Re: Memo EA4-07-012

Thank you for your recent participation and subsequent report of the Alpha Magnetic Spectrometer Integration Review held in Geneva, Switzerland on July 26-27, 2007. I would like to take this opportunity to respond to several issues you reported.

Issue 1: Recommendations with respect to JPR 8080.5

AMS Response: The AMS Project Office (APO) agrees that JPR 8080.5 is applicable to "human spacecraft" design, and since AMS is a payload, not a spacecraft, your recommendations are seen as valuable for mission success, but not to be levied as requirements. We also agree that we do generally comply with the intent of JPR 8080.5 Rev. A. The AMS project will take the following steps to comply with your recommendations:

1. APO will obtain concurrence on mitigation steps (i.e., conformal coating) taken for electrical components with pure tin internal plating by fully documenting the issue in our Phased Safety Data Packages. It should be noted that none of these boards are being produced by APO, but instead are being produced by the AMS Collaboration. Specific components without tin are not available, which is why the Collaboration has chosen the conformal coating approach.
2. APO will ensure that warm helium fittings are unique or clocked such that other fluids cannot be accidentally introduced.
3. As the payload is integrated, APO will verify adequate strain relief, support and chafing protection for plumbing and cable runs between subsystems to account for design loads, deflections, and thermal expansions/contractions. Analysis and/or review has already taken into account operational scenarios involving possible temperature differentials, across the payload as fluids are moved or involving possible temperature differentials across the payload as fluids are moved or vented, and account for shims, brackets, and straps.
4. APO will communicate to the AMS Collaboration that caps/bags on tubing should meet flight cleanliness specifications. We will discourage the use of plastic push-on caps which can generate particulate.
5. APO will communicate with the AMS Collaboration that if fluid quality is important for proper AMS sensor function, then Helium, Carbon Dioxide, and Xenon should be sampled prior to filling for flight, to verify vendor specifications.

6. APO has asked AMS Collaboration to consider replacing glued pins/clip washers on thermal blankets with grommets and lacing. This change will absolutely be made if current safety related issues can not be adequately addressed by the Collaboration.
7. APO will include a step in the master integration procedure to check for duplicate part numbers as the Acceptance Data Packages arrive. Alternate numbers will be assigned if required.

Issue 2: Recommendations with respect to NPR 7120.5D

AMS Response: NPR 7120.5D was implemented in March 2007. AMS-01 began in 1994 and flew on STS-91 in 1998. Much of the designs, components, and certification rationale for AMS-02 come from AMS-01. AMS-02 began in 19998 and completed its CDR in 2003. The System Integration Review is a new requirement added to this revision of NPR 7120.5D. Although NPR 7120.5D clearly applies to the work that is done by NASA in support of AMS, the APO believes this document does not apply to the AMS Collaboration which is sponsored by the US Department of Energy.

1. APO, through the AMS Collaboration, has made an attempt to comply with the intent of NPR 7120.5D. AMS is currently in Phase D, System Assembly, Integration, Test, and Launch, and according to NPR 7120.5D Section 2.5, does not require a Standing Review Board (see Section 2.5.2 Note 11). APO will request confirmation of this from the process owner. Once clarified, appropriate changes will be made to JSC 27296 to reflect any new requirements, reviews or agreements.
2. AMS will follow the standard deviations/waivers process for both the ISS and STS programs. JSC Technical Authority team members already participate in these deviation/waiver review processes, so AMS already complies with this recommendation.

Issue 3: Recommendations with respect to NPR 7123.1

AMS Response: NPR 7123.1 was implemented in March 2007. AMS-01 began in 1994 and flew on STS-91 in 1998. Much of the designs, components, and certification rationale for AMS-02 come from AMS-01. AMS-02 began in 1998 and completed its CDR in 2003.

1. APO, through the AMS Collaboration, has made an attempt to comply with the intent of NPR 7123.1. Although NPR 7123.1 clearly applies to the work that is done by NASA in support of AMS, the APO believes this document does not apply to the AMS Collaboration which is sponsored by the US Department of Energy. APO will request confirmation of this from the process owner. Once clarified, appropriate changes will be made to JSC 27296 to reflect any new requirements, reviews or agreements.
2. APO has already begun the process to incorporate paper product (integration procedures, ADPs, etc.) required delivery dates and review times into the AMS master integration schedule.
3. APO has already begun the process to include integration procedures and drawings in the master document tree.
4. APO understands and has communicated the risk that the Collaboration has chosen to accept by not having all products as defined in NPR 7123.1 Table G10 at the Integration Review. Our mitigation approach is defined below.

5. The AMS-02 payload is comprised of 8 major subsystems. Prior to integrating any one of these subsystems onto the NASA provided Payload Integration Hardware, APO will complete a checklist, modeled after NPR 7123.1 Table G10 (draft checklist enclosed). All items on the checklist will be complete, or a plan for completion will be identified and agreed by all parties. The checklist will be reviewed by an internal integration committee who must approve before integration activities can begin. This will effectively implement a 'mini-System Integration Review' for each of the 8 subsystems. The AMS-02 payload is also mitigating the integration risk by performing "pre-integration of most detector, electrical, electronic, and thermal systems prior to delivery of the Superconducting Magnet and cryostat. This is being accomplished with the Structural Test Article Vacuum Case, which is an identical flight spare for the flight Vacuum Case. APO feels this will flush out most if not all assembly errors, dimensional interferences, re-work issues, and potential integrated test problems.
6. Only one CDR RID remains open. The RID should not affect the integration of AMS, since it involves the analysis and design of the meteoroid and orbital debris shields will be installed last onto the payload. The technical issues associated with the RID were addressed during the Phase II Flight Safety Review and a resolution plan has been identified in the safety verification methods. APO will document compliance with this plan at the Phase III Safety Review.

Thanks,



Trent Martin

Enclosure

cc:

EA2/K. Bollweg

EA2/L. K. Bromley

EA2/J. Hall

EA3/S. Porter

EA4/C. Hansen

EA4/I. Kaye

EA4/J. P. McManamen

NT/W. Bostick

ESCG/M. Fohey

ESCG/C. Tutt

AMS Major Component Pre-Integration Checklist

The following checklist must be completed prior to integration of any of the major AMS subsystems onto the NASA provided Payload Integration Hardware. All open issues must be documented and dispositions must be approved by all parties.

Name of Major AMS Component: _____

Integration Review Items

- All integration plans and procedures have been completed and approved.
- All hardware, including interfaces fasteners, is available for integration.
- Mechanical and electrical interfaces have been verified against the interface control documentation.
- All applicable functional, unit-level, subsystem, and qualification testing has been conducted successfully.
- Integration facilities, including clean room, ground support equipment, handling fixtures, cranes, and electrical test equipment are ready and available.
- Support personnel have been adequately trained and will be available at the integration facility.
- Handling and safety requirements have been documented.
- All known system discrepancies have been identified and disposed in accordance with an agreed-upon plan.
- All previous design review success criteria and key issues have been satisfied in accordance with an agreed-upon plan.
- The quality control organization is ready to support the integration effort.

Acceptance Data Package Items

- | Y | N | N/A | |
|--------------------------|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Historical Log/Notes/Comments Received |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Waivers/Deviations Received |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Unexplained Anomalies Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Unplanned/Deferred Work Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Preplanned/Assigned Work Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Identification-as-Designed Configuration |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Operating Time/Cycle Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Age Sensitive/Time Action Items Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Non-standard Calibration Data Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Repair Limitations Data Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Pressure Vessel Data Received |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Non-flight Hardware/Temporary Installations Reported |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Certifications Received |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | MSDS Received |

