TIMED

Thermosphere • Ionosphere • Mesosphere • Energetics and Dynamics

PRODUCT ASSURANCE

CRITICAL DESIGN REVIEW

TIMED MISSION

Larry Mastracci

Phone: 301-953-5005

email:larry.mastracci@jhuapl.edu

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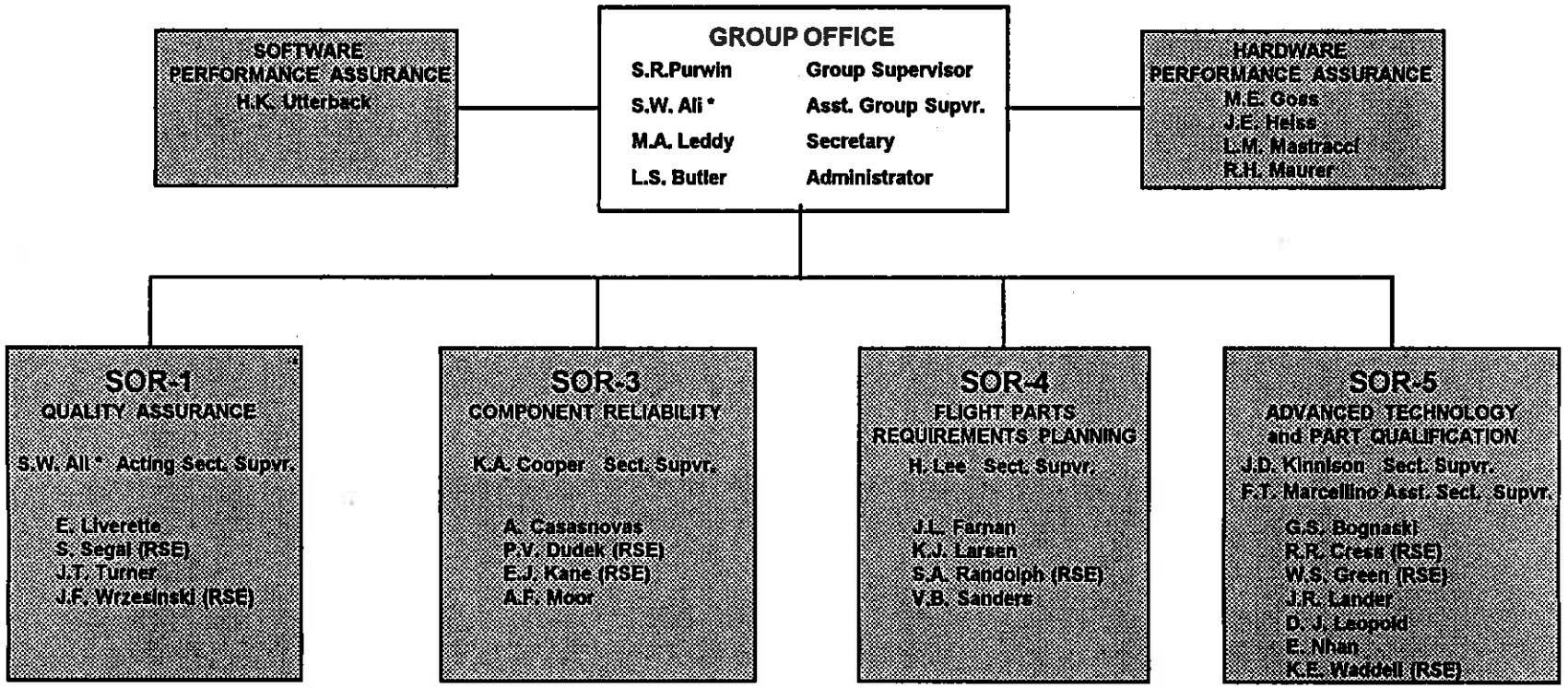
SOR
SPACE RELIABILITY and QUALITY ASSURANCE



* - Concurrent Assignment

RELIABILITY ANALYSIS\TRADE STUDY

- **A relative reliability analysis was completed to evaluate the configurations of the TIMED Integrated Electronic Module (IEM) subsystem concepts.**
- **A system design analysis based on the IEM configuration compared to the earlier "box and harness" system configuration using the "Bellcore" reliability analysis technique is in progress.**
- **The relative reliability analysis was used to confirm that the elimination of IEM cross-strapping results in a more reliable spacecraft configuration.**

PRODUCT ASSURANCE

- **Scope**
  - **The JHU/APL Product Assurance (PA) activities are defined in**
  - **the approved TIMED Product Assurance Implementation Plan (PAIP), 7363-9028a, dated Sept. 4, 1996.**
- **Overview**
  - **This presentation shows a summary and status of the assurance activities that are being performed by JHU/APL for the TIMED program**

SUPPLIER CONTROLS

- **The applicable requirements of the PAIP are imposed upon subcontractors to assure compliance with the requirements of the TIMED program. Subcontractor PA requirements are specified in "PROCUREMENT PRODUCT ASSURANCE REQUIREMENTS (ProcPAR) for SUBCONTRACTORS ," 7363-9029.**
- **Exceptions to the ProcPAR are negotiated between the supplier and JHU/APL and documented.**
- **Suppliers of flight hardware are reviewed as part of the quality conformance program.**
- **Supplier PA activities are monitored and source inspection provided as required by the ProcPAR.**

SUPPLIER CONTROLS

- **TIMED experiment hardware (GUVI, SABER, SEE, TIDI) PA requirements are defined in individual PAIPs which have been prepared by the experimenters and approved by JHU/APL.**
- **EEE part identification and controls shall be maintained on the flight hardware during fabrication, assembly, and test.**
- **EEE flight parts purchased for the TIMED program shall be stored in controlled access areas.**

EEE PARTS SELECTION CRITERIA

- **Grade 1, APPROVED: Grade 1 parts as defined in the current GSFC PPL and/or MIL-STD-975.**
- **Grade 2, APPROVED: Grade 2 parts as defined in the current GSFC PPL and/or MIL-STD-975.**
- **Grade 3, APPROVED: Parts which meet the Space Dept. criteria for use in high reliability, space flight applications for multi-year missions. These include parts that fall into the following categories and are screened to NASA/GSFC 311-INST-001 Grade 3 requirements:**
  - **<u>MICROCIRCUITS</u>;**
  - **Fully compliant to MIL-STD-883, par.1.2.1 and supplied with a C of C. Defense Electronic Supply (DSCC) Standard Military Drawings (SMDs) are in this category.**

EEE PARTS SELECTION CRITERIA

- Microcircuits procured to Purchase Instruction (PI) documents that contain screening which meets MIL-M-38510, Class B levels as a minimum, and is supplied with a C of C.
- Microcircuits procured to a manufacturer's in-house reliability flow which meets MIL-M-38510, Class B screening as a minimum, and is supplied with a C 0f C.
- <u>SEMICONDUCTORS</u>;
- All QPL, QML, JANS, JANTXV, JANTX, Mil-S-19500 semiconductors not listed in the GSFC PPL or MIL-STD-975.
- Semiconductors procured to PI documents that contain screening which meets MIL-S-19500, JANTX levels as a minimum, and is supplied with a C of C.
- Semiconductors procured to a manufacturer's in-house high reliability flow which meets MIL-S-19500, JANTX levels as a minimum, and is supplied with a C of C.

EEE PARTS SELECTION CRITERIA

- **PASSIVE PARTS;**
- **All QPL, QML, Established Reliability parts not listed in the GSFC PPL or MIL-STD-975, which have as a minimum, an "ER" failure rate level of "P", as defined by the applicable Military Specification.**
- **ELECTRO-MECHANICAL & ELECTRO-OPTICAL PARTS;**
- **All QPL, QML, Established Reliability parts not listed in the GSFC PPL or MIL-STD-975, which have as a minimum, an "ER" failure rate level of "P", as defined by the applicable Military Specification.**
- **MISCELLANEOUS PARTS;**
- **All parts procured to PI documents that contain screening to the maximum possible subset of NASA Grade 3 requirements with data and a C of C for verification.**

EEE PARTS SELECTION CRITERIA

- **Grade 4, NONSTANDARD:**
  - **All parts not included in the Grade 1, Grade 2 or Grade 3 categories above.**
  - **Screening for Grade 4 parts shall be equivalent to that for Grade 3 parts whenever possible.**
  - **Usage of Grade 4 parts shall be evaluated by SOR Component Reliability Engineering for potential substitution and appropriate screening criteria.**
  - **As a minimum, Grade 4 parts shall be subjected to stress screening after assembly.**

PARTS SELECTION PROCESS

- **Grade 1 or 2 parts shall be used when:**
  - **Available with no impact on program schedule.**
- **Grade 3 parts shall be used when:**
  - **Grade 1 and 2 parts are not available,**
  - **Cost and/or schedule impact of Grade 1 or 2 parts is prohibitive.**
- **Grade 4 parts (NONSTANDARD) shall be used when:**
  - **Grade 1, 2, and 3 parts are not available,**
  - **No known deficiency exists which would impact mission,**
  - **Screening criteria is acceptable to Component Engineering.**
- **Printed Wiring Boards (PWBs):**
  - **All PWBs shall be certified to MIL-P-55110.**

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MATERIAL CONTROL

- **Metallic materials shall be selected from Table 1 of MSFC-SPEC-522, Design Criteria for Controlling Stress Corrosion Cracking.**
- **Nonmetallic materials shall be selected using the outgassing requirements of NASA Publication 1124 as a guide, i.e.;**
  - **1.0% maximum Total Mass Loss (TML).**
  - **0.1% maximum Collected Volatile Condensable Material (CVCM).**
- **Potential outgassing components shall be baked out as required by the TIMED Contamination Control Plan (7363-9031).**
- **Lot traceability through purchase orders and certificates of compliance shall be maintained from procurement through all phases of assembly and test.**

CONFIGURATION MANAGEMENT

- **Spacecraft flight hardware shall be fabricated and assembled to Drawing Level 2 requirements as defined in TSD-STD-400.1. These drawings are changed by formal drawing change notices (DCNs).**
- **Science instruments and flight harnesses shall be fabricated to Level 2a drawings as defined in TSD-STD-400.1. These drawings are changed by red-lined engineering change control.**
- **System requirements, ICDs, Acceptance Test Plans, and other documents which affect spacecraft performance shall be maintained under Level 2 formal configuration control.**
- **Changes to Level 2 documents shall be by DCN with signature approval as defined by TIMED project office memo.**
- **Red-line drawing changes shall be approved by the cognizant design engineer and implemented by design drafting.**

CONFIGURATION MANAGEMENT

- **The as-built configuration for the flight hardware shall be maintained and verified throughout fabrication operations.**
- **Part identification and fabrication controls shall be maintained on the flight hardware.**
- **The disposition of nonconforming parts and materials shall be in accordance with the TIMED program Material Review Board (MRB) procedures as defined in the PAIP.**
- **Flight hardware and software shall be documented and reviewed in formal design reviews in accordance with the Space Dept. Design Review Guidelines, SDO-8336 and the TIMED Software QA Plan, 7363-9101.**

QUALITY ASSURANCE

- **Traceability**
  - **Purchasing and receiving records maintained for EEE parts.**
  - **C of C and test data reviewed for lot control.**
  - **Fabrication travelers with inspection stamps shall be maintained.**
  - **Parts and materials identified on detail and assembly drawings.**
  - **As-built configuration shall be verified by QA for flight hardware.**
- **Controlled Stockroom**
  - **Records of EEE parts kits as issued shall be maintained.**
  - **Limited access areas for EEE parts and assemblies in storage.**
  - **ESD protection provided for all electronic parts and assemblies.**

QUALITY ASSURANCE

- **Manufacturing Control**
  - **Shop travelers to document work operations, inspections and assembly processes.**
  - **QA verify configuration, traceability, and workmanship.**
  - **Standard fabrication processes are documented.**
- **Training and Certification**
  - **Critical procedures such as soldering and ESD have specific training courses.**
  - **Trained and certified personnel shall be used for all flight hardware operations.**
  - **QA shall verify the training and skills of personnel working on flight hardware.**

Quality Assurance

- QA Inspections
  - Receiving inspections
  - In-process inspections
  - Pre-lid inspections
  - Final inspections
- Testing
  - Acceptance testing shall be performed to the approved ATP.
  - Engineering level testing shall be recorded in log books.
  - Formal failure reporting shall begin at acceptance level testing using a Problem/Failure Reporting system which requires closure and sign-off.

QUALITY ASSURANCE

- **Nonconformance Control**
  - **All nonconformances shall be documented.**
  - **The disposition of nonconforming parts and materials shall be in accordance with the TIMED Program Material Review Board (MRB) procedures as defined in the PAIP.**
  - **Experiment suppliers shall have consistent MRB procedures in place.**
  - **When there is a discrepancy which affects safety, performance, reliability, weight, interface, or system requirements, the JHU/APL TIMED project office shall be part of the MRB activity.**
- **Contamination Control**
  - **The TIMED Program Contamination Control Plan, 7363-9031, shall be issued to define spacecraft contamination control requirements throughout assembly, integration, test and launch operations.**