SMC
Industrial Base & Mission Assurance Practices

Supply Chain 2016

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October 25 – 27, 2016
NASA Goddard Space Flight Center (GSFC)

Mr Dave Davis
SMC Chief Systems Engineer
SMC/EN
WE DEVELOP, ACQUIRE, FIELD AND SUSTAIN SYSTEMS IN FOUR MAJOR MISSION AREAS

**Space Superiority**
- Space Situation Awareness
  - SBSS
- Space Fence
- Defensive Counter Space
- Offensive Counter Space

**Space Support**
- Launch Systems
- Spacelift Range
- Sat Control & Network

**Force Application**
- Conventional Missiles
- Prompt Global Strike

**Space Force Enhancement**
- Milstar/AEHF/EPS
- DSCS/GBS/WGS
- GPS
- DSP/SBIRS
- DMSP/DWSS
- NUDET (Nuclear Detection)

Developing, Delivering, and Supporting Military Space and Missile Capabilities to Preserve Peace and Win Conflicts
Space System Development

- Launch is a “one-strike-and-you’re-out” business
- Spacecraft must work by remote control for 15 years
  - Hostile environment
  - “Small” failures can cripple or end mission
  - No Beta Testing/LRIP and No On-Orbit Repair
  - Mandates Unique, High-Confidence Mission Assurance Culture

No “flight Testing” and No Service Calls in Space Mandates Unique, High-Confidence Mission Assurance Culture
Balancing the Needs for Space Acquisition

**Space Industrial Base**
- Threatened / diminishing supplier/product base
- IB product base commensurate with future system technology and product needs

**Specs & Standards**
- Right Sized –
- Not the “Gold Standard”
- Tailored Application
- Effective technical practices balanced with cost & schedule
- “Optimization” of Technical practices based on data and proven experience

**Product Technology**
- Effective technical practices balanced with cost & schedule
- Reliable Products For Space

**Reliable Products & Supply Base**
- Reliable Products & Supply Base
- Decision Analysis & Risk Mgmt

**Must Assure Critical Requirements and Industrial Supply Capability Necessary to Support Current and Future USG Space Programs**
• Achieving a state of “high reliability” and high confidence that a system and it’s supporting system components will perform the “Stated” mission.

  – The elements contributing to MA include all acquisition, contracting, legal, technical, and financial practices/policies, as well as manpower and skills which contribute to executing the mission.

  – Application of sound and proven requirements development, engineering, manufacturing, test/verification and the management control processes/practices which result in achieving a “high reliability” system.
Mission Assurance Processes Across Program Life Cycle

Joint Capabilities Integration Development System (JCIDS) Activities
- Pre KDP-A
- Phase A Concept Development
- Phase B Preliminary Design
- Phase C Complete Design
- Phase D Build & Operations

Key Decision Point (KDP)
- Pre KDP-A
- KDP-A
- KDP-B
- KDP-C

Build Approval
- Pre KDP-A
- KDP-A
- KDP-B
- KDP-C

Upgrade Decision
- Pre KDP-A
- KDP-A
- KDP-B
- KDP-C

Integrated/Iterative MA Processes
- Requirements Analysis & Validation
- Technology Readiness Assessment
- Industrial Base/ Workforce Capability Planning and Capability Assessment
- Budget Level vs. Program Risk Level Assessment vs. Mission Assurance Rqts
- Cost & Schedule Analysis & Validation
- Cyber Security Engineering / SCRM
- Design & Manufacturing Assurance
- Integration & Test Verification
- Program Management / Subcontractor - Supplier Management
- Operations Assurance

Mission Assurance Processes
- Joint Capabilities Integration Development System (JCIDS)
- Pre KDP-A Activities
- Phase A Concept Development
- Phase B Preliminary Design
- Phase C Complete Design
- Phase D Build & Operations
SMC Specifications and Standards Program
DoD Systems are Complex
SMC Compliance Standards List

- SMC Technical Baseline
  - 69 documents
- Includes all four space system segments
  - Military (MIL-STD)
  - International (ISO)
  - Industry (AIAA, IEEE, SAE, etc)
  - SMC Standards
- Reflects current best practices
- Updated periodically
- SMC Instruction 63-106, 31 July 15
- Applies to all new development, acquisition and sustainment contracts
- Contractual compliance through the supplier chain, as appropriate
Functional Areas of SMC Standards

**Standard Practices**

- Program/Subcontract Management
  - Systems Engineering
  - Architecture Development
  - Design Reviews
  - Configuration Management
  - Quality Assurance
- Logistics
  - Manufacturing /Production Management
  - Parts Management (non-space)
- Parts Management & Technical Rqts (space)
  - Risk Management
- System Safety
  - Occupational Safety and Health
- Reliability/Availability

**Subsystem/Component Standards**

- Electrical Power, Batteries
- Electrical Power, Solar Cells/Panels
- Electromagnetic Interference & Control
- Environmental Engineering; Cleanliness
- Human Systems Integration
  - Interoperability
  - Maintainability
- Mass Properties
- Moving Mechanical Assemblies
- Ordnance
- Pressurized Systems & Components
  - Information Assurance/Program Protection
- Software Development
- Structures
  - Survivability
  - Test, Space & Ground

*Industry consensus standards developed or adopted for use on SMC contracts*
“Right Sizing” the SMC Specifications and Standards Program
Proven and Disciplined Technical Practices At the Core of SMC’s Mission Assurance Approach

• Proven Practices:
  – Based on 5+ decades of space experiences and often painful lessons learned
  – Key: Partnership with industry to provide a value-added check and balance (in the aftermath of 1990s Launch failures)
  – From launch revitalization to systems engineering revitalization to a mission assurance and Back-To-Basics focus
  – Fully collaborative with industry and the entire NSS space community: details captured in government regulations, policies, industrial and military Specifications & Standards (S&S), and in contractually compliant requirements
    • Encourage tailoring and use of equivalent Company or industry Command Media!

• Mission Assurance: The culmination of all the things the contractor and government team (organic and A&AS contractors etc) does to achieve mission success
  – Engineering, business practices, incentives, contract type, tailored oversight

• SMC policy mandates use of S&SS in two categories (SMCI 63-106)
  – Those that directly contribute to mission success
  – Those needed for effective program implementation
MA Tailoring is Essential

• SMC/EN works with program offices and contractors to tailor
  – Mission success, budget, cost, schedule, risk, affordability, and program performance carefully balanced

• Tailoring not to delete or dilute a SS, but to implement the “intent” efficiently and economically
  – To provide confidence in achieving mission success and reduce program risk

• Concept: “Trust, But Verify”

• 69 SS today: International (ISO), Industry (AIAA), SMC technical practices of “what to do”, not detailed “how to do”
Supply Chain Risk Management (SCRM)
Trusted Systems and Networks (TSN)

- DoDI 5200.44, November 5, 2012
  
  Protection of Mission Critical Functions to Achieve Trusted Systems and Networks

  “Establishes policy and assigns responsibilities to minimize the risk that DoD’s warfighting mission capability will be impaired due to vulnerabilities in system design or sabotage or subversion of a system’s mission critical functions or critical components by foreign intelligence, terrorists, or other hostile elements.”

Counterfeit Prevention

- DoDI 4140.67, April 26, 2013
  
  DoD Counterfeit Prevention Policy

  “Establishes policy and assigns responsibilities necessary to prevent the introduction of counterfeit materiel at any level of the DoD supply chain”
DoD Program Protection focuses on risks posed by malicious actors

Quality Escape: Product defect/inadequacy introduced either through mistake or negligence during design, production, and post-production handling resulting in the introduction of deficiencies, vulnerabilities, and degraded life-cycle performance.

Reliability Failure: Mission failure in the field due to environmental factors unique to military and aerospace environment factors such as particle strikes, device aging, hot-spots, electromagnetic pulse, etc.

Fraudulent Product: Counterfeit and other than genuine and new devices from the legally authorized source including relabeled, recycled, cloned, defective, out-of-spec, etc.

Malicious Insertion: The intentional insertion of malicious hard/soft coding, or defect to enable physical attacks or cause mission failure; includes logic bombs, Trojan ‘kill switches’ and backdoors for unauthorized control and access to logic and data.

Reverse Engineering: Unauthorized extraction of sensitive intellectual property using reverse engineering, side channel scanning, runtime security analysis, embedded system security weakness, etc.

Information Losses: Stolen data provides potential adversaries extraordinary insight into US defense and industrial capabilities and allows them to save time and expense in developing similar capabilities.
COUNTERFEIT PARTS
• Existing comprehensive PM&P management/technical program
  – Historically, effective at assuring quality parts, but “silent” on subject of counterfeit parts
• SMC sponsored the update/revision of two PMP Standards (Aerospace TORs) for Space and Launch Vehicles
  – Requires all PMP to be procured from the original qualified parts/materials equipment manufacture (OEM), or it’s franchised/authorized distributor
  – Requires all parts be delivered with a certificate of compliance to military specification or space-level-equivalent source control drawing
  – Requires contractor to approve subcontractor PMP
  – Requires contractor to establish date/batch number control and two-way tractability for PMP used in flight hardware
  – Requires contractor to perform Destructive Physical Analysis (DPA) consistent with program technical requirements and MIL-STD-1580
• PMPCB
  – Requires establishment of a Parts, Materials and Processes Control Board (PMPCB) with the following responsibilities:
    • Review and approve all PMP
    • Establish and maintain all PMP lists
    • Review results of DPAs, Material Review Board (MRB) actions, and failure analysis.
    • Ensure laboratories and facilities used for screening and/or evaluation of PMP are adequate.
    • Establish and maintain a prohibited PMP list
    • Review all GIDEP, NASA, DOD, contractor, subcontractor and other agency PMP alerts, advisories, and reports for relevance to items used in the system.

• PMP Selection List
  – parts and materials are technically justified with approved and qualified sources of supply, approved procurement specifications, and defined application conditions

• Parts Procurement
  – All parts shall be procured from the part original equipment manufacturer (OEM) or its franchised, fully authorized distributor, and shall come with an OEM certificate of compliance.
Additional Standards - Counterfeit

- **SAE AS-5533A**
  - Fraudulent/Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition

- **MIL-STD-3018; w/CHANGE 2; 2 June 2015**
  - DEPARTMENT OF DEFENSE STANDARD PRACTICE - PARTS MANAGEMENT
  - 3.4 Counterfeit part. A suspect part that is a copy or substitute without legal right or authority to do so or one whose material, performance, or characteristics are knowingly misrepresented by a supplier in the supply chain. Parts which have been refinished, upscreened, or uprated and have been identified as such, are not considered counterfeit.
  - j. Counterfeit parts. The parts management plan shall address the detection, mitigation, and disposition of counterfeit parts. Electronic, electrical, and mechanical parts are to be addressed. AS5553 should be used as guidance for electronic parts.

- **SAE AS6500 (Manufacturing Management Program)**
  - SAE AS5553 Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition
  - 5.4.1 Supply Chain and Material Management
    - d. Counterfeit Parts: The organization shall implement a counterfeit parts prevention program to prevent the acquisition and incorporation of counterfeit parts or parts embedded with malicious logic into factory and test equipment and delivered products. The program shall include procedures for prevention, detection, and reporting of counterfeit parts.
4/12/2016 - PETERSON AIR FORCE BASE, Colo. -- General John Hyten, commander of Air Force Space Command, announced the command's Space Enterprise Vision here today. The SEV is the result of an AFSPC-commissioned study that looked at how to make the nation's national security space enterprise more resilient.

The August 2015 SEV study addressed the findings of several previous studies that identified the U.S. space enterprise is not resilient enough to be successful in a conflict that extends to space. The SEV also recognizes that acquisition and programmatic decisions can no longer occur in mission area stovepipes, but must instead be driven by an overarching space mission enterprise context.

To guide the development of this future enterprise, the SEV proposes using a new optimizing concept called "resilience capacity" to characterize and evaluate space capabilities. Resilience capacity will measure how well space enterprise forces can respond to the full range of known threats, and how quickly they can adapt to counter future threats, while continuing to deliver space effects to joint and coalition warfighters. It will replace the traditional "functional availability" metric used for decades to plan and manage individual constellations, but which does not account for emerging threats.
DATA COLLECTION/ ANALYSIS
Data shows reducing thermal cycles has an effect on problems during system thermal testing.

Note: with increasing complexity comes increasing harness and thermal equipment problems. Unit level testing will not solve this system TV problem.

Equiv Cycles = Test cycles*(Delta °C/85)^2

Reducing unit thermal cycles results in increased system test defects.
## What Anomalies are Likely to be Detected?

**Vehicle dynamic test anomalies**

<table>
<thead>
<tr>
<th>Frequency Regime</th>
<th>Potentially Affected Components</th>
<th>Potential Anomalies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower - Vehicle</strong></td>
<td>&gt; Wire harnesses&lt;br&gt; &gt; Connectors&lt;br&gt; &gt; Hinges, latches, linkages&lt;br&gt; &gt; Panels/Embedded Heat Pipes&lt;br&gt; &gt; Propulsion tanks/piping&lt;br&gt; &gt; Wave guide&lt;br&gt; &gt; Antenna/SV interface</td>
<td>&gt; Connectors/pins loosened&lt;br&gt; &gt; Fasteners loosened&lt;br&gt; &gt; Parts loosened/debonded&lt;br&gt; &gt; Contaminates loosened/FOD&lt;br&gt; &gt; Wave guide misalignment&lt;br&gt; &gt; Antenna alignment shifts</td>
</tr>
<tr>
<td><strong>Vibration</strong>&lt;br&gt;(Typically &lt;150 Hz)</td>
<td></td>
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<tr>
<td><strong>Higher - Vehicle</strong></td>
<td>&gt; Electronics PCBs, slices, boards&lt;br&gt; &gt; Solder connections&lt;br&gt; &gt; Relays&lt;br&gt; &gt; Unit internal contamination&lt;br&gt; &gt; Deployment mechanisms&lt;br&gt; &gt; Propulsion fluid hardware</td>
<td>&gt; Wires/circuits shorted&lt;br&gt; &gt; Solder connections broken&lt;br&gt; &gt; Relay failure/chatter&lt;br&gt; &gt; Contamination dislodged&lt;br&gt; &gt; Preloads lost&lt;br&gt; &gt; Leakage&lt;br&gt; &gt; Unlatched components</td>
</tr>
<tr>
<td><strong>Acoustics</strong>&lt;br&gt;(Typically &gt;150 Hz)</td>
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What Anomalies are Detected in Vehicle Acoustics Tests?

Data from 108 NSS vehicle acceptance acoustics tests

- Acoustic test effectiveness: 0.4-0.7 Mission Degrading Anomalies (MDAs) per test
  - Consistently reported by Aerospace for 25 years
  - Verified by JPL and others
- Roughly one MDA per two space vehicles
- 69 total anomalies; 55 of 69 medium significance or worse
- Likelihood may be low, but impact severe
- Deployables particularly sensitive due to lack of redundancy
Space Industrial Base
Leverages inputs from Government, Aerospace and Industry to identify technologies at risk
### CTL Risk Matrix

#### ID | Name
---|---
1 | A40 Aluminum
2 | Packaging/House
3 | Aerospace-Grade Rayon
4 | Ammonium Perchlorate
5 | Atomic Clocks
6 | Bearings
7 | Carbon Fibers
8 | CCDs
8a | CdZnTe Substrates for IR Detectors (111)
8b | CdZnTe Substrates for IR Detectors (211)
9 | Cellophane for Batteries
10 | Ceramic Packages
11 | Connectors
12 | Control Moment Gyros
13 | Cryocoolers
14 | Diode Glass
15 | Diodes
16 | Fast Steering Mirrors
17 | Fiber Optics Cable
18 | Fuel Valves
19 | Fuses
20 | GaAs FET
21 | Gas Valves and Regulators
22 | Germanium Substrates for Solar Cells
23 | Glass for Optics
24 | HBTs
25 | Helium
26 | Hermetic Tantalum Capacitors
27 | High Current Relays
28 | High Efficiency Power Supplies
29 | High Power Laser Diodes
30 | High Speed Digital Electronics for Fiber Optics Systems
31 | High-Power Solid State Amplifiers
32 | IBC Detectors
33 | Infrared Dispersive Elements
34 | Integrated Optics Chips
35 | Lead Free Coatings
36 | Lightweight Structures
37 | Liquid Rocket Engines
38 | Loop Heat Pipes
39 | Low CTE Glass
40 | Lubricant
41 | MMICs
42 | Nickel-Coated Graphite Powders
43 | NiH2 Batteries
44 | non-volatile Memory/Flash Memory
45 | OCXO and Resonators
46 | Optical Coating for Mirrors
47 | Optical Coatings for Solar Cells
48 | Optical Filter
49 | Optical Mirror Materials - Beryllium
50 | Optical Mirror Materials - SiC
51 | Ordnance
52 | Power MOSFETs
53 | Precision Foil Resistors
54 | Precision Gyroscopes
55 | Printed Wiring Boards
56 | Rad - Hard ASIC
57 | Rad-Hard FPGA
58 | Rare Earth Metals
59 | Reaction Wheel Assembly
60 | Read-out Integrated Circuits (ROICs)
61 | Rocket Fuels (Hydrazine)
62 | Rocket Fuels (N2O4)
63 | Sapphire Substrates
64 | Sensor Chip Assemblies
65 | Silver-Zinc Batteries
66 | Slip Rings
67 | Solid Rocket Motors
68 | Star Tracker
69 | Super Luminescent Diodes
70 | Tantalum Chip Capacitors
71 | Transistors
72 | Traveling Wave Tube Amplifiers (TWTAs)
73 | Viscous Dampers
Wide Breath of IB Projects

- Traveling Wave Tubes
- Batteries
- Star Trackers
- Photovoltaics
- Infrared Detectors
- RL10 Rocket Engine
- Radiation Hardened Electronics
- Trusted Foundries/Services
- Reaction Wheel Assemblies
Radiation Environments/ Effects

Natural Space Radiation

Solar Array
Fiber Optic Data Bus
CCD/CID Sensor
Payload

- Total Ionizing Dose
  - Trapped Electrons
  - Trapped Protons

- Single Event Effects (SEE)
  - Galactic Cosmic Rays
  - Solar Enhanced Particles
  - Energetic Protons & Neutrons

- Displacement Damage
  - Energetic Protons & Neutrons

Nuclear Detonations

X-rays
γ-rays
Electrons
Neutrons
Thermo-mechanical

Trapped electron belt
Atmosphere
A Space Radiation Effects Infrastructure

Flight Test & Operations Information
- Flight Anomalies – Root Cause
- Flight Experiments
- Component, Subsystem, & System Data

Mitigation of Effects
- Hardness-by-Process
- Redundancy
- Hardness-by-Design
- University Programs
- Conferences, Symposia, Workshops
- On the Job Training, Staff Retention

Ground Test
- Total Ionizing Dose
- Single Event Effects
- Displacement Damage
- Handbooks
- Standards, Test Methods
- Specs
- PRFs

Test Methods & Procedures
- Theory & Modeling
- Interaction of Radiation with Materials & Devices
- Space Environment
- Radiation Transport

Mission Success
- Research on devices, technologies, qualification methods
- Flight project qualification requirements
- System, sub-system, and component manufacturer qualification tests
- Anomaly resolution

Workforce Expertise
- University Programs
- Conferences, Symposia, Workshops
- On the Job Training, Staff Retention
Committee on Foreign Investment in the United States (CFIUS)
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- The Committee on Foreign Investment in the United States (CFIUS) reviews foreign acquisitions, mergers and takeovers of U.S. businesses that raise national security issues.
- CFIUS, working by consensus, has the power to approve a transaction or send it to the President for his decision.
- CFIUS operates on statutory deadlines consisting of an initial 30-day review, a possible further 45-day investigation, and a possible Presidential decision lasting 15 days.
- CFIUS is chaired by the Department of Treasury (Treasury), and includes representatives from 15 other United States government departments, agencies and offices.
- While filing with CFIUS is generally voluntary, and the Committee reviews less than 10% of all inbound foreign transactions, it has the authority to compel a review of a transaction that is not filed voluntarily.
• Use of Product/technology on space systems
  – Is it a company that is critical to the space industrial base?
    • Do they supply parts to SMC programs (Space, Ground, User Terminals)
    • Are SMC programs planning to use the supplier in the future
    • Do other NSS programs or NASA use this supplier
    • Do their products need to be Trusted though the DMEA process
    • Are they a single source or do other companies supply similar or identical parts at the same level of trust
    • How long would it take to reconstitute the capability
  – Is the company's technology critical to SMC?
    • Does this company possess Intellectual Property (IP) that is critical to SMC and other space providers.
    • Has the government invested in the company to help them create the IP needed for NSS programs
    • Does this IP extend beyond the space community; Does it effect other DOD areas
    • Is the company ITAR compliant
    • Does the IP need to be ITAR protected from the foreign buyer
    • Is their customer's IP (designs, masks, ...) potentially vulnerable, with the new company construct
    • Do other companies/sources have equivalent IP for use on SMC programs
      – if so, do they have sufficient protections in place to protect their customer's IP
SMC/NRO/MDA/NASA/Industry

COLABORATION
• **JEDEC Committee:**
  • Government Liaison JC-13JC-13 is responsible for standardizing quality and reliability methodologies for solid state products used in military, space, and other environments requiring special-use condition capabilities beyond standard commercial practices. This includes long-term reliability and/or special screening requirements.
  • JC-13: Government Liaison
  • JC-13.1 Subcommittee: Discrete Devices
  • JC-13.2 Subcommittee: Microelectronic Devices
  • JC-13.4 Subcommittee: Radiation Hardness: Assurance and Characterization
  • JC-13.5 Subcommittee: Hybrid, RF/Microwave, and MCM Technology

• **G12 Solid State Devices Committee**
  • The G-12 Solid State Devices Committee develops solutions to technical problems in the application, standardization, and reliability of solid state devices. This is implemented by evaluation and preparation of recommendations for specifications, standards, and other documents, both government and industry, to assure that solid state devices are suitable for their intended purposes.
NASA Electronics Parts Advisory Group (NEPAG)

- NASA Electronics Parts Advisory Group (NEPAG) Domestic Telecon (weekly/~2hrs) International Telecon (monthly)

- Participants (Org)
  - NASA HQ; Ames Research Center; Glenn Research Center; Goddard Space Flight Center; Jet Propulsion Laboratory; Johnson Space Center; Kennedy Space Center; Langley Research Center; Marshall Space Flight Center; U.S. Air Force / SMC; The Aerospace Corporation; DLA Land and Maritime; Def. Stand. Prog. Off. (DSPO) / GIDEP; Johns Hopkins University-APL; Missile Defense Agency (MDA); National Reconnaissance Office (NRO); Northrop Grumman ICBM Support; U. S. Air Force / NWC ICBM Sys Div; U. S. Army / AMRDEC; U. S. Navy / NAVSEA

- Example Topics for the Week:
  - DLA Land and Maritime Audit Schedule; DLA-VQ Audits Projection for FY14; DLA News - Major issues being worked (DLA-VA, DLA-VQ) VQ); Deutsch Audit Report ; Mismating of D-SUB Connectors; Industry V5 Telecom Update; Semicoa Update; PIND Test Enhancement; DLA Land and Maritime SMDs Review Status
Aerospace Technical Forums

- **Spacecraft Thermal Control Workshop**
  - The Spacecraft Thermal Control Workshop, now in its 25th year, provides the aerospace community a forum to share new technology developments, analytical techniques, and lessons learned in spacecraft thermal control. Companion Workshop on Thermophysics in Microgravity

- **Aerospace Testing Seminar**
  - The Aerospace Testing Seminar (ATS) provides a forum to communicate and exchange knowledge for the improvement and implementation of aerospace testing technology.

- **Space Power Workshop**
  - The Space Power Workshop provides an informal, unclassified, international forum for the exchange of ideas and information on space power. Technical presentations on advances in both components and system concepts are presented.

- **Spacecraft and Launch Vehicle Dynamic Environments Workshop**
  - Workshop objective is a forum to discuss the best approaches for designing, modeling, analyzing, and testing modern space systems for acoustic, vibration, and shock environments.

- **Manufacturing Problem Prevention Program (MP3)**
  - The MP3 meeting enables an exchange of information between Space and Missile Systems Center, Los Angeles Air Force Base, and the contractor community on ways to prevent problems and minimize schedule and cost impacts on space programs.

- **Space Parts Working Group**
  - The Space Parts Working Group is an unclassified, international forum to disseminate information to the aerospace industry and to resolve problems with high-reliability electronic piece parts needed for space applications.
Alerts, Warnings, Advice, Resolutions, and Experience (AWARE)
### List Problems

Select the advisory number of the problem that you wish to view. The problem list can be sorted (ascending or descending) by clicking the text in each column heading.

<table>
<thead>
<tr>
<th>PUMPS Advisory Number</th>
<th>Other Advisory Numbers</th>
<th>Problem Summary</th>
<th>Type</th>
<th>Last Updated</th>
</tr>
</thead>
</table>

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In addition to PMP, AWARE now contains Cyber, Software, and SCRM.
• Enterprise Initiatives Essential To Mission Assurance
  – Space is a niche market
• Trusted Systems/Cyber Practices Evolving
  – Supply Chain Risk Management (SCRM)/Counterfeit
• Fragile aspects of Space Industrial Base
• Radiation Hardened Electronics challenges
  – Technology nodes/trusted foundries
• Increased frequency of CFIUS Cases in recent years
“Airpower begins 22,000 miles up in space”