Space, Mars, and Standards
NASA Technical Standards Program
August 9, 2016

Paul Gill
Manager, NASA Technical Standards Program
National Aeronautics & Space Administration
# Variety of NASA Missions

<table>
<thead>
<tr>
<th>Aeronautics</th>
<th>Human Exploration and Operations</th>
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<tr>
<td>Pioneers and proves new flight technologies that improve our ability to explore and which have practical applications on Earth</td>
<td>Focuses on International Space Station operations and human exploration beyond low Earth orbit</td>
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<tr>
<td>• Next Generation Air Transportation System – increasing safety and managing traffic congestion</td>
<td>• International Space Station (ISS)</td>
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<td>• Green aviation – aircraft fuel efficiency and air traffic control improvements</td>
<td>• Multi-Purpose Crewed Vehicle</td>
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<td>• Space Launch System (SLS)</td>
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<td>• 21st Century Ground Operations</td>
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## Science
Exploring Earth, the solar system, and universe beyond; charting routes to discovery; and reaping benefits of Earth, space, and space exploration for society

- Heliophysics: Heliosphere, magnetospheres, Space Environment
- Planets: Inner Solar System, Outer Solar System, Small Bodies
- Astrophysics: Stars, Galaxies, black holes, the big bang, dark energy, dark matter, planets around other suns
Promotes technical excellence and furthers mission success through standardization.

Facilitates participation in development of voluntary consensus standards.

Manages development of NASA Technical Standards Products to meet NASA’s unique needs.

Provides NASA users access to essential Standards products from a single access point.
NASA Technical Standards Program Structure

Office of the NASA Chief Engineer
Ralph Roe, Chief Engineer
Adam West, Program Executive

- Policy/Oversight/Approval
- Program Sponsorship

NASA Engineering Standards Panel (NESP)
Paul Gill, Chair
- Center Representation
- Program Guidance

NASA Engineering Management Board (EMB)
Ralph Roe, Chair
- Center Approving Authority
- Program Issues

NASA Technical Standards Program Office (NTSP)
Paul Gill, Manager

Topic Working Groups (TWG)
- Materials & Processes
- Structures
- Non-Destructive Evaluation
- Electric Power
- Etc.

NASA Technical Fellows
- Prioritization of Needs
- Standards Development

Other NASA Headquarters Offices
Office of Safety and Mission Assurance
Office of the Chief Information Officer
Office of the Chief Health and Medical Officer
- Functional Standards

https://standards.nasa.gov
- NASA & Center Standards
- Military Standards
- National & International Standards
- Engineering Tools
  - Fastener Catalogs
  - Electronic Parts
  - Materials Databases
  - Etc.
All federal agencies must use voluntary consensus standards in lieu of government-unique standards in their procurement and regulatory activities, except where inconsistent with law or otherwise impractical.

NASA participants are most technically experienced and report participation annually to the NTSP.

For FY2015, 58 NASA employees participated in development of 143 Voluntary Consensus Standards.

Examples where NASA is leading development/maintenance of a VCS

- AWS D17.3, Specification for Friction Stir Welding of Aluminum Alloys for Aerospace Applications
- ISO 14624-1, Space systems—Safety and compatibility of materials (replaces sections of NASA-STD-6001B)
Per A-119, the NASA Standards development process requires an assessment if there is a comparable VCS that can be used or tailored in lieu of developing a NASA Standard.

NASA encourages its employees to submit a request to the NTSP to do any of the following:
- Participate in the development of a new VCS Standard
- Participate in the revision of an existing VCS Standard
- Develop a new NASA Technical Standard (if no VCS)
- Revise an existing NASA Technical Standard

As of July 2016, 70+ NASA Engineering Standards were available in the following discipline areas:
- 0000 - Documentation and Configuration
- 1000 - Systems Engineering and Integration, Aerospace Environments, Celestial Mechanics
- 2000 - Computer Systems, Software, Information Systems
- 3000 - Human Factors and Health
- 4000 - Electrical and Electronics Systems, Avionics/Control Systems, Optics
- 5000 - Structures/Mechanical Systems, Fluid Dynamics, Thermal, Propulsion, Aerodynamics
- 6000 - Materials and Processes, Parts
- 7000 - System and Subsystem Test, Analysis, Modeling, Evaluation
- 8000 - Safety, Quality, Reliability, Maintainability
- 9000 - Operations, Command, Control, Telemetry/Data Systems, Communications
The New Era of the Space Race has arrived, with an increased need to standardize Design, Test, and Operation procedures in support of these missions.

Examples of Voluntary Consensus Standards used on NASA Missions

A sample of the VCS Standards products by SDO's used for these missions in addition to Government Standards:

- AIA
- ASA
- ANSI
- AIAA
- ASTM
- AWS
- GEIA
- IEC
- IPC
- ISO
- MIL-STD
- NASA
- SAE
- Etc.

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<th>Space Launch System</th>
<th>Commercial Crew Transportation</th>
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<td>SLS provides an unprecedented lift capability of 130 metric tons (143 tons) to enable missions even farther into our solar system.</td>
<td>Commercial Crew Transportation involves research and development into private-sector human spaceflight concepts and technologies.</td>
</tr>
<tr>
<td>International Space Station</td>
<td>Crew Transportation</td>
</tr>
<tr>
<td>ISS is a habitable artificial satellite, in low Earth orbit. Its first component launched into orbit in 1998.</td>
<td>New generation of roving space exploration vehicles which will help future robots and astronauts explore more than ever before.</td>
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• Technical Discipline Experts evaluate and select specs/standards for application to requirements specified on a program/project.
  – NASA recognizes that each program or project has unique aspects that must be accommodated to achieve mission success in an efficient and economical manner.

• Programs/projects propose tailoring for approval through the Technical Authority and implement selected standards with approved tailoring.

• **Technical Authority** is part of NASA’s system of checks and balances:
  – Goal: Provide independent oversight of programs and projects in support of safety and mission success.
  – Selection of specific individuals, called Technical Authorities, with delegated levels of authority.
  – Specific technical/operational matters involving safety and mission success residual risk, formal concurrence by the designated Technical Authorities is required (i.e., Engineering, Safety and Mission Assurance, and/or Health and Medical)

• To facilitate selection, tailoring, and verification of requirements by NASA programs/projects and addressing of requirements by NASA contractors:
  – Each requirement in NASA Technical Standards and Specifications is uniquely numbered.
  – Rationale for why the requirement is necessary may be included.
  – Requirements Compliance Matrix is included as an appendix.
• Exclusive access to **over 1.9 million** standards, specifications, codes, regulations, and related documents from government, military, and commercial sources

• Single-point access to current versions of NASA Technical Standards, Handbooks, Specifications, and subscription to 45 SDOs, along with Pay-by-Doc capabilities for non-subscription SDO’s

• Access to 215+ Lessons Learned associated with 95+ Technical Standards (NASA & Industry)

• Exclusive NASA licenses for databases containing data and templates for:
  - Parts and Logistics Information
  - Bills of Material
  - Electronic Components

[https://standards.nasa.gov](https://standards.nasa.gov)
Standards Downloaded from Top 15 SDOs
May 2015 - May 2016

No. of Standards Downloaded

- ASTM: 13480
- SAE: 13317
- AIA/NAS: 9816
- GOV/MIL: 9810
- NASA: 8369
- ASME: 7929
- DLA: 6580
- ISO: 3924
- IPC: 3227
- NFPA: 3121
- AWS: 2980
- MSC: 1896
- KSC: 1526
- CGA/GAS: 1119
- IEEE: 429
Takeaways
for efficient implementation of Design Standards & Practices

• Successfully:
  – Established Criteria and formalized processes for development of standards
  – Documented development and maintenance processes
  – Availability of Standards
  – Established Recommended Standards and practices i.e., Endorsed Standards (VCS, and Gov’t)

• Place further emphasis to:
  – Educate, inform, and guide our programs and projects
  – Drive consistency of standard usage across the organization
  – Continue infusion of Lessons Learned into Standards
  – Identify and make available “application” of Standards for benefit to other users, i.e., programs and projects
On behalf of NASA
Thank You!
My appreciation for the SES invitation
And this opportunity to participate with
such an esteemed group