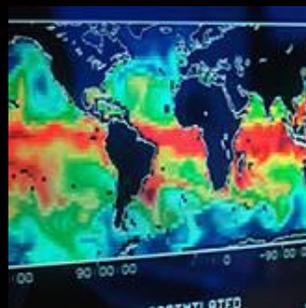
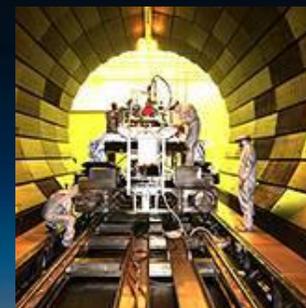




# Space, Mars, and Standards

## NASA Technical Standards Program

August 9, 2016



**Paul Gill**  
Manager, NASA Technical Standards Program  
National Aeronautics & Space Administration



# NASA Installations





# Variety of NASA Missions

## Aeronautics

Pioneers and proves new flight technologies that improve our ability to explore and which have practical applications on Earth

- Next Generation Air Transportation System – increasing safety and managing traffic congestion
- Green aviation – aircraft fuel efficiency and air traffic control improvements



## Human Exploration and Operations

Focuses on International Space Station operations and human exploration beyond low Earth orbit

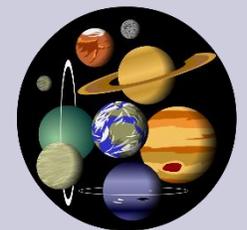
- International Space Station (ISS)
- Multi-Purpose Crewed Vehicle
- Space Launch System (SLS)
- 21st Century Ground Operations



## Science

Exploring Earth, the solar system, and universe beyond; charting routes to discovery; and reaping benefits of Earth, space, and space exploration for society

- Earth: Weather, Carbon Cycle & Ecosystems, Water & Energy Cycles, Climate Variability & Change, Earth Surface & Interior, Atmospheric Composition
- 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





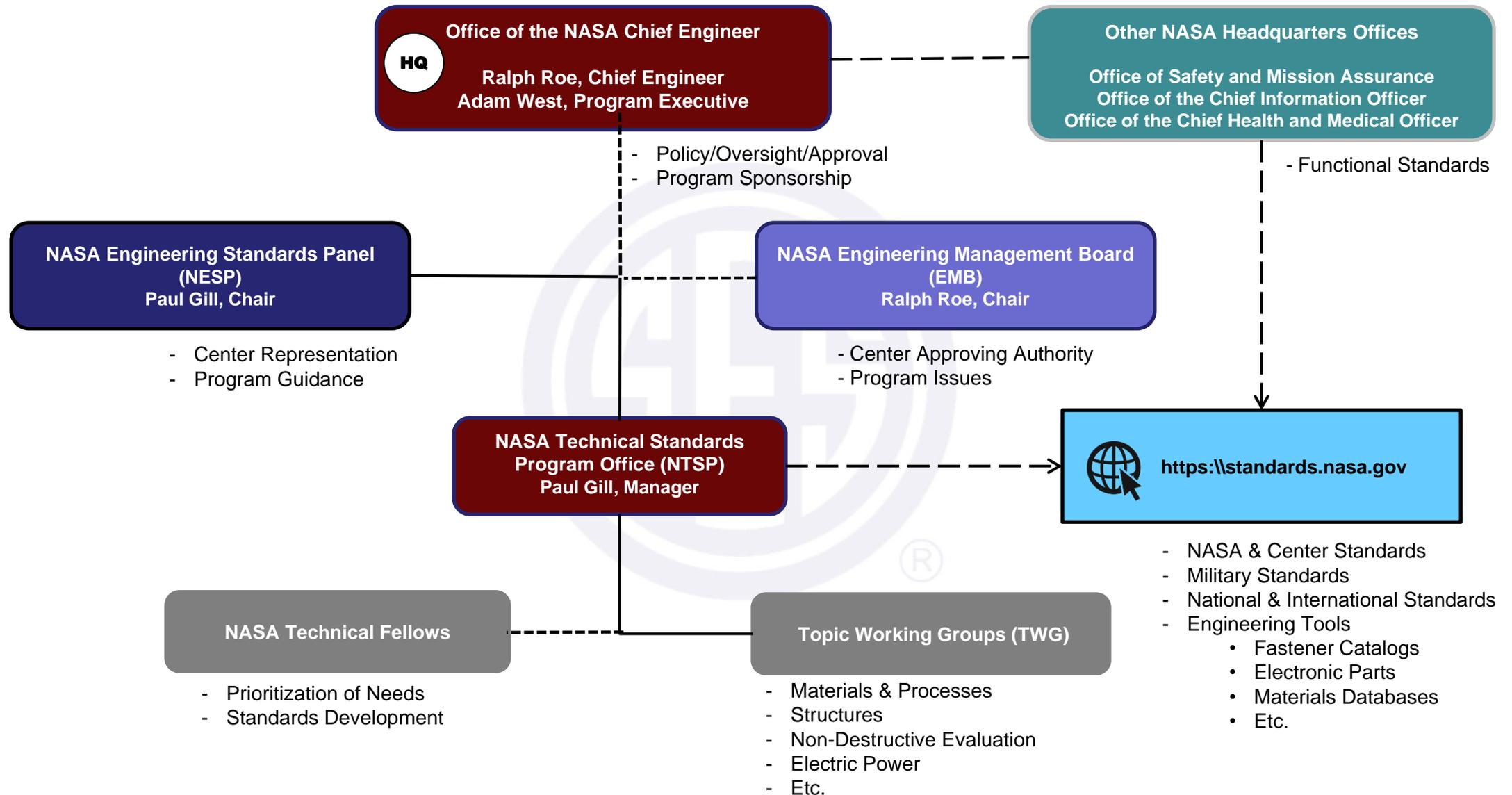
# NASA Technical Standards Program

- ✓ 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





# NASA's Compliance with OMB Circular A-119

*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

- *SAE/EIA-649B, Configuration Management Standard; SAE/EIA-649-2 (replaces NASA-STD-0005)*
- *AIAA S-120, Mass Properties Control for Space Systems Standard (in lieu of developing a NASA standard)*
- *SAWE A-3, Mass Properties Control for Space Systems (Handbook)*
- *AWS D17.1, Specification for Fusion Welding for Aerospace Applications, (replaces NASA Standard)*
- *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)*



# NASA Standards Development Initiative

- 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



# Examples of Voluntary Consensus Standards used on NASA Missions

- 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

 <p><b>Space Launch System</b></p>	 <p><b>Commercial Crew Transportation</b></p>
<p>SLS provides an unprecedented lift capability of 130 metric tons (143 tons) to enable missions even farther into our solar system.</p>	<p>Commercial Crew Transportation involves research and development into private-sector human spaceflight concepts and technologies</p>
 <p><b>International Space Station</b></p>	 <p><b>Crew Transportation</b></p>
<p>ISS is a habitable artificial satellite, in low Earth orbit. Its first component launched into orbit in 1998.</p>	<p>New generation of roving space exploration vehicles which will help future robots and astronauts explore more than ever before.</p>

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

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



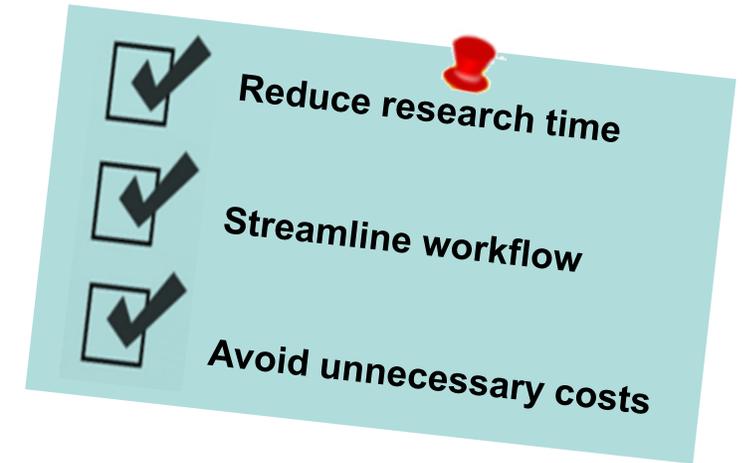
# Applying NASA Technical Standards

- 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.



# NASA Technical Standards System

- 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





# Snapshot of NASA Technical Standards System

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<a href="#">NASA-STD-2804</a> <a href="#">Details</a>   <a href="#">History</a>	Active	05/31/2016	MINIMUM INTEROPERABILITY SOFTWARE SUITE - Spring 2016	<a href="#">Favorites (Add)</a> <a href="#">Watch List (Add)</a> <a href="#">Note (Add)</a>
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<a href="#">NASA-STD-2818 VER 4.0</a> <a href="#">Details</a>   <a href="#">History</a>	Active	06/10/2015	DIGITAL TELEVISION STANDARDS for NASA	<a href="#">Favorites (Add)</a> <a href="#">Watch List (Add)</a> <a href="#">Note (Add)</a>
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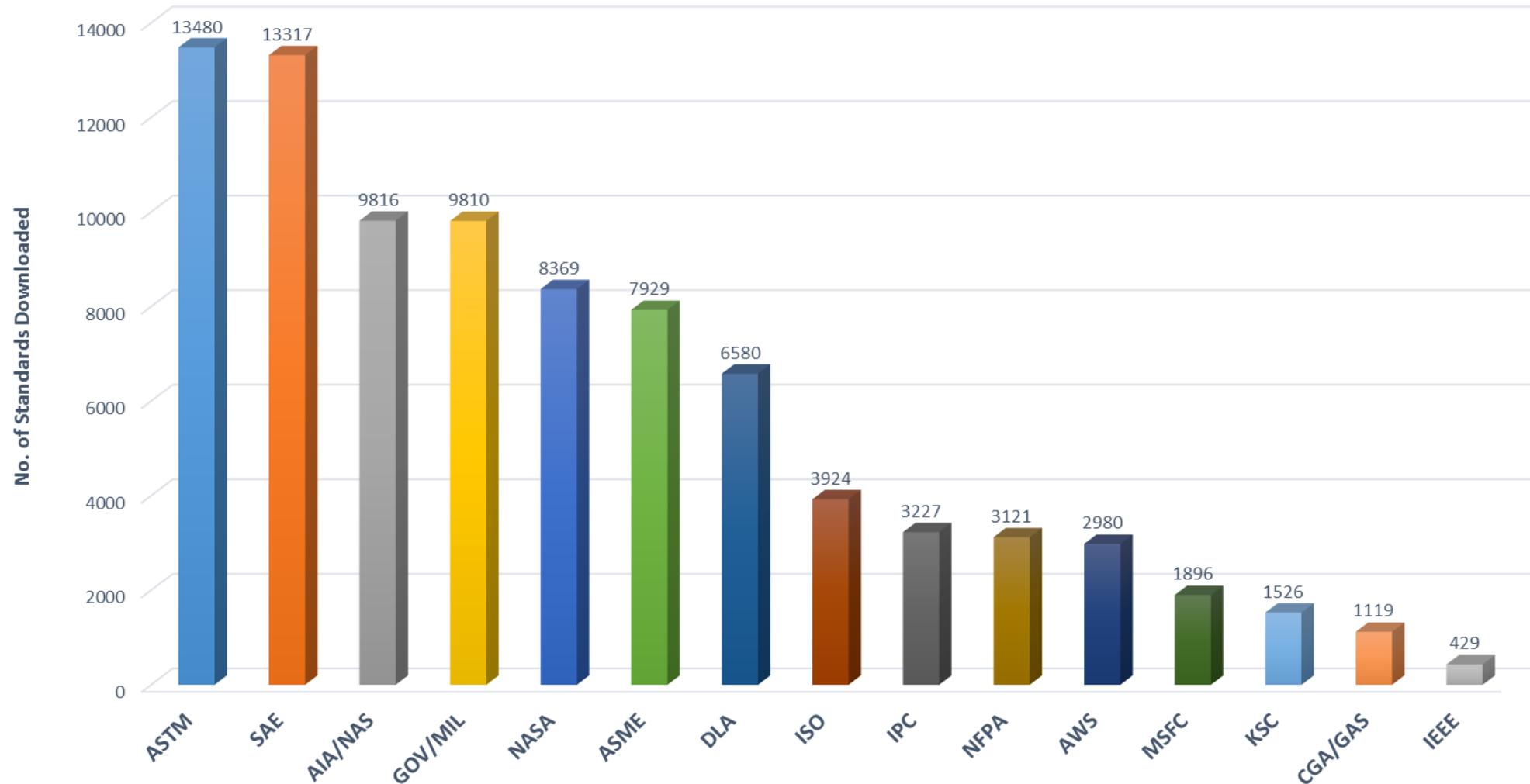
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# NASA Technical Standards System – Value

## Standards Downloaded from Top 15 SDOs

May 2015 - May 2016





# 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**