



# OCHMO Human Spaceflight Standards Newsletter January 2023



## What is NASA-STD-3001?

NASA-STD-3001, NASA Spaceflight Human-System Standard Volumes 1 and 2, establishes Agency technical requirements that enable human spaceflight missions by minimizing health risks, providing vehicle design parameters, and enabling the performance of flight and ground crew. Applicability and tailoring of these technical requirements are determined based on each program's mission profile and procurement strategy.

NASA-STD-3001 Volume 1 covers the technical requirements needed to support astronaut health and Volume 2 covers system design that will maintain astronaut safety and promote performance.

Through partnerships with the programs (e.g., xEMU, Gateway, HLS, etc.), the Human Research Program, and SMEs (internal and external to NASA), the technical requirements are constantly evolving and being reworked to minimize human health and performance risks. The Standards Team works with all NASA Spaceflight Programs to help tailor the technical requirements for their specific missions.

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## What is a Standard?

The majority of NASA-STD-3001 Vols. 1 & 2 are performance technical requirements, meaning they state technical requirements in terms of desired results without stating a method for achieving it. All technical requirements contain a “shall” statement and can be followed by a short, italicized rationale statement. Rationales are intended to provide additional information for the implementation of the technical requirements.

NASA-STD-3001 Standards are overarching and apply to all of NASA’s Spaceflight Programs. These technical requirements are essential pieces used to create program requirements that lead to successful designs and implementations.

## NASA-STD-3001

NASA Standard 3001 Volumes 1 Rev C and Volume 2 Rev D CRs will be released soon

NASA-STD-3001 Volume 1, Crew Health, sets technical requirements for fitness for duty, space permissible radiation exposure limits and permissible outcome limits, health and medical care, medical diagnosis, intervention, treatment and care, and countermeasures.

Major changes to NASA-STD-3001 Volume 1, Rev C includes:

- **Mortality** – New requirements added in response to OCHMO directive to provide direction and clarity regarding plan and actions taken in the event of the death of a crewmember.
- **Radiation** – New requirement added to provide additional clarity regarding Galactic Cosmic Radiation limits in response to comments received during previous NASA Standard 3001 Volume 1 CR review.
- **Introductions** – Introductions added to Human Performance, Training, Medical Operations, and Crew Health Records sections to add detail and improve completeness of the document.
- **Rationales** – Rationales added to Health and Medical Care, Human Performance, Training, Medical Operations, and Crew records requirements for added clarity and detail to improve completeness of the document.

NASA-STD-3001 Volume 2 establishes technical requirements for human-related vehicle system design and operations that maintain astronaut safety and promote performance.

Major changes to NASA-STD-3001 Volume 2, Rev D includes:

- **Atmospheric Pressures** – Additional clarifications added to DCS risk identifications and the total pressure ranges to include transient limits.
- **Artificial Light Exposure (UV)** – New language and tables added for clarity on applicability and compliance.
- **Food Safety** – New technical requirements and additional guidance language added to provide clarification to the needs of food safety during a food system development.
- **Lighting** – New technical requirements added in response to the Artemis program to help provide further details on the needs for exterior lighting, especially to aid with EVAs.
- **Surface Vehicles** – New technical requirements added as a result of working closely with the Lunar Terrain Vehicle (LTV) team to identify gaps between the LTV requirements in response to the Artemis program and the latest revision of NASA-STD-3001 Volume 2.
- **Appendix E** – For consistency within NASA-STD-3001 Vol 2, this applicability guidance is being removed and migrated to future reference materials and documentation. All programs and project applicability reviews going forward should be performed through Appendix D of the document as required.

The 3001 Standards documents CR process will be using a new comment submission process, which will be available on the NASA-STD-3001 [SharePoint Site](#). Reviewers external to NASA that would like to provide feedback can submit a comment through the online [SharePoint Change Suggestions Tool](#) (see page 5 for more info). Please let the Standards team know if you have any questions!





## Language Clarification for Standards vs. Technical Requirements

In an effort provide consistency and clarity to the intent of the technical requirements found in NASA-STD-3001, the language has been updated from “standards” to “technical requirements”. NASA-STD-3001 is a technical standards compendium of technical requirements. These requirements are intended to be applied and tailored appropriately as written, which are vetted and supported by evidence, lessons learned and based on previous NASA experience. These are written so during the tailoring process, the appropriate program requirements can be verified by test, demonstration and/or analysis.

## Maintainability Requirements

Following comments from astronauts about problems that were encountered during their missions, a series of interviews were conducted to draft approximately 170 candidate maintainability requirements. Through a series of reviews, these requirements were brought down to approximately 20 requirements. These candidates were then sent to subject matter experts (SMEs) for review and comments. The final versions of these requirements are being prepared for inclusion in the upcoming NASA-STD-3001 Volume 2, Rev D.

## Radiation Requirements

Updates to existing radiation technical requirements and new requirements are being worked into NASA-STD-3001 Volume 2, Rev D. These changes include the addition of personal radiation exposure monitoring guidelines for individual crewmembers (see table below). The final versions of these requirements are being prepared for inclusion in the upcoming NASA-STD-3001 Volume 2, Rev D.

Space Radiation Monitoring Requirements  
Mission Location vs. Required Monitoring

		Mission Location					
		LEO		BLEO		Celestial Surface	
		Area Monitoring Vehicle/Habitat	Personal Monitoring IVA-EVA	Area Monitoring Vehicle/Habitat	Personal Monitoring IVA-EVA	Area Monitoring Vehicle/Habitat	Personal Monitoring IVA-EVA
Charged Particles*	SPE – solar particle event	For mission exposures projected to be less than 50 mSv** Can be assessed via analysis**		Required	Required	Required	Required
	GCR - galactic cosmic rays	Or Area and/or personal monitors with vehicle analysis can be utilized for IVA and EVA.		Required	Required	Required – environment analysis may be substituted	Required – environment analysis may be substituted
	Trapped Particles	For exposures projected to be greater than 50 mSv** Area and/or personal monitors with vehicle analysis can be utilized for IVA and EVA.*		Required	Required	N/A	N/A
	Neutrons	N/A	N/A	Required – environment analysis may be substituted	Required – environment analysis may be substituted	Required – environment analysis may be substituted	Required – environment analysis may be substituted

\*May be monitored with a single device

\*\* Utilizing the quality factors that are utilized to calculate the NASA effective dose space PEL (refer to Volume 1, Section 4.8)

Rationale: For exposures greater than 50 mSv the uncertainty of the analysis affects the ability to accurately communicate the risk to the crew member. Crew members with multiple missions that exceed 75 mSv of total dose will need additional assessment (actual monitoring vs. analytical assessment) to ensure adequate communication of risk.

NOTE: Currently under review/consideration for NASA-STD-3001 Volume 2, Rev D. Table for reference only.

## NASA-STD-3001 Volume 2, Section 10 Updates

The 3001 Standards Team, in collaboration with SMEs, conducted a comprehensive review of **Volume 2 Section 10: Human Performance and Crew Interfaces** to identify gaps, update existing technical requirements, and streamline current technical requirements to facilitate improved understanding and implementation. This section covers the crew interfaces through which static and dynamic information is exchanged between the crew and the system (primarily through controls and displays). Well-designed crew interfaces are critical for crew safety, optimal human performance, and minimizing training. SMEs and various program integrators have found current technical requirements to be insufficient or unverifiable. New technical requirements were added to Section 10, and others were deleted or merged. New figures, tables, and calculations have also been added to provide the additional guidance needed. The final versions of these requirements are being prepared for inclusion in the upcoming NASA-STD-3001 Volume 2, Rev D.





### Congratulations Artemis-I!

In the early morning hours of November 16th, 2022, NASA's Space Launch System (SLS) along with Orion lifed off from Kennedy Space Center, marking a major milestone in the Artemis program and bringing us closer to returning to the Moon and beyond.



[Read more about NASA's Artemis program.](#)

### OCHMO Collaboration with SPARC

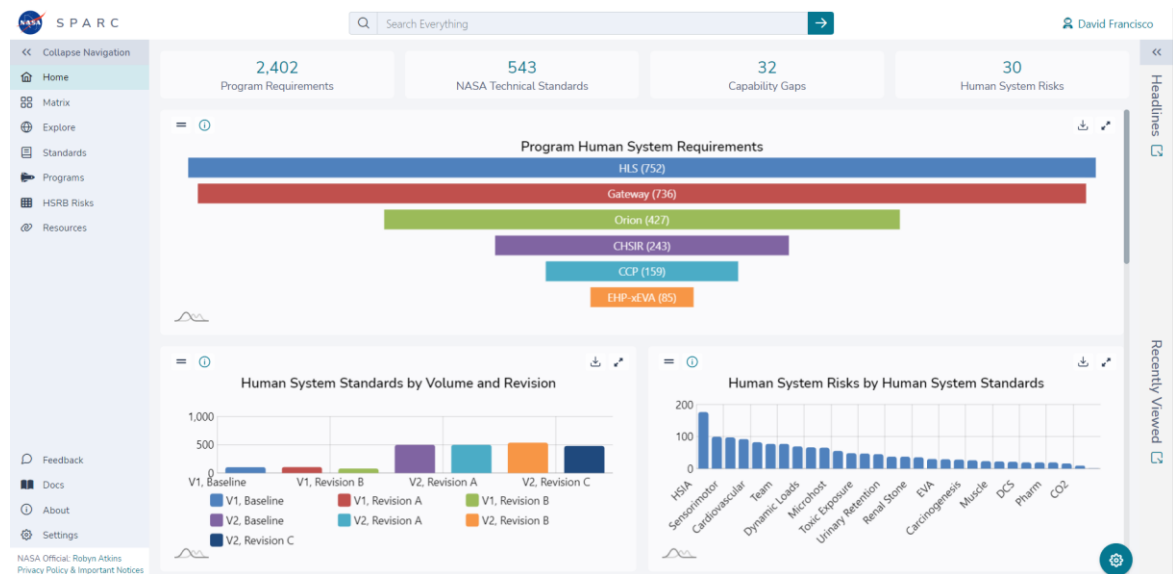
The concept for the Systems Platform for Aggregating and Relating Capabilities (SPARC) was formulated over the summer of 2021 as a way to clearly articulate NASA capabilities required for safe and healthy human exploration missions cross-referenced with the specific needs of current and planned human exploration programs. Over the last year, the OCHMO Standards team has been working with the SPARC team to not only incorporate the current and previous versions of NASA-STD-3001, but to help with tracing the agency level technical requirements to various program requirements. Additionally, the association of these technical requirements have been linked to the 30 risks as managed by the Human System Risk Board (HSRB).

In the past, one of the challenges of reviewing previous program requirements or the legacy versions of the NASA-STD-3001, is that the information is captured in many different sources and formats. SPARC seeks to automate that information gathering from existing sources into one, visually engaging, user-friendly, and accessible solution that meets a variety of use cases across NASA. For example, if a Chief Health and Performance Officer (CHPO) in a human exploration program wants to see what another program is doing to meet the NASA human system standards, SPARC brings together existing relationships between program requirements and NASA-STD-3001 in a graphical, dynamic, and logical design to readily compare and contrast that information from their own program's requirements.

We invite you to explore this program and to review the many capabilities that are in store. It is expected that there is still much to be added, especially with older programs and documents, but the team appreciates any feedback and suggestions to help further support or improve this application.

<https://sparc.ndc.nasa.gov/>

SPARC is now available internally to NASA.





### Team Updates

Earlier this month, the 3001 Standards Team said farewell to Tara Williams, who served as an outstanding team lead for over 2 years. While we are sad to see her go, we wish her the best in her exciting new role as the Human Landing System (HLS) HHPC team lead!

The team has also welcomed several new members in the past several months, including Emma Hwang, who helps with human system standard tool development, and Harrison Otto, our newest full-time Human System Standard Integrator.

Additionally, the team is excited to have Erin Connell and Doug Ebert join us part-time to provide their knowledge and expertise in a wide variety of areas.

[Meet the Team](#)

### SharePoint Change Suggestions Tool

The [NASA Space Flight Human Systems Standards Team](#) is open to feedback from the NASA community on updates and changes to the NASA-STD-3001 Volume 1, NASA-STD-3001 Volume 2, Human Integration Design Handbook (HIDH), Human Integration Design Processes (HIDP), Technical Briefs, and/or other Standards related documents. During agency-wide change requests (CRs) on the Standards documents, an established process is used for soliciting, collecting, and dispositioning comments. Any other time, when agency CRs are not in process, the NASA community can submit suggestions for changes to the Standards related documents by completing the [Suggest Document Change form](#). For questions about using the [Suggest Document Change form](#), please contact a member of the [Standards Team](#).

#### Example of completed Suggest Document Change form

**NASA Standards Documents Suggested Changes Form**

<b>Commenter Name<sup>^</sup></b> <input type="text" value="Sarah Childress"/>	<b>Commenter Email<sup>^</sup></b> <input type="text" value="sdchildr@ndc.nasa.gov"/>	<b>Phone Number</b> <input type="text" value="281.549.9735"/>	<b>NASA Center</b> <input type="text" value="JSC"/>	<b>Org Code</b> <input type="text" value="QA000"/>
<sup>^</sup> Update Commenter Name and Email as needed				
<b>Document for Suggested Change<sup>^^</sup></b> <input type="text" value="3001 Vol 2"/>	<b>Section Number and/or Title</b> <input type="text" value="Section X.X. Very Important Stuff"/>	<b>Comment Subject and/or Standard Number</b> <input type="text" value="[V2 ####] The Most Important Stuff"/>		
<sup>^^</sup> if Other selected, provide details in Notes field below				
<b>From</b> <input style="width: 100%;" type="text" value="We shall do it this way because of X."/>		<b>To</b> <input style="width: 100%;" type="text" value="We shall do it this way because of Y."/>		
<b>Rationale for Suggested Change</b> <input style="width: 100%;" type="text" value="As written, creates a problem with integrating in program due to the highlighted language above."/>				
<b>Additional Comments or Notes: Include where issue was identified; add name of SMEs or others to follow up with this comment</b> <input style="width: 100%;" type="text" value="Issue identified during recent program integration meeting. Contact Jane Smith (jane.a.smith@nasa.gov) for additional information."/>				

Required fields

- ❖ View the [Revision Process for NASA Space Flight Human-System Standards and Human Integration Design Handbooks](#) work instructions.
- ❖ View the [Development and Revision Process for OCHMO Standards and Handbooks](#) graphic.





Contact Us

The OCHMO Standards Team, led by NASA Technical Standards Manager Dave Francisco, has experience working with the NASA-STD-3001 documents as well as the program requirements that flow from them. They are willing to meet for consultations to clear any confusion regarding technical standards, provide clarification for the intent of specific standards, or further describe the formation of standards from risks.

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Human Integration Design Handbook (HIDH)
Revisions Underway!

The HIDH is a companion document to NASA-STD-3001 Volume 2, and is a compendium of human space flight history, lessons learned, and design information for a wide variety of disciplines, providing background information on the rationale for human-system design standards.

- The Standards Team continues to work at reviewing and revising the HIDH.

In order to make the HIDH easier to read, utilize, and share, we are dividing it into individual handbooks, which will be published to the OCHMO website. By following this strategy, each handbook can also be individually revised and updated as needed in the future so that the content presented remains current and relevant.

Current and future volumes of the HIDH will be as follows:

- OCHMO-HB-004: Anthropometry, Biomechanics, and Strength (revised edition now available at the website! Link: OCHMO-HB-004)
Human Performance Capabilities
Natural and Induced Environments
Habitability Functions
Architecture
Hardware and Equipment
Crew Interfaces
Extravehicular Activity (EVA)

Please contact Sarah Childress, Kristin Coffey, or Harrison Otto from the Standards Team with any questions regarding the HIDH revision.

OCHMO Technical Briefs

The OCHMO Technical Briefs are receiving a fresh, new look as well as being reviewed and updated to ensure that the content meets the goals of the tech briefs, which is to provide information on the development of 3001 standards, data interpretation and generation of technical requirements, and application/guidance on how to implement the requirements.

New and upcoming tech briefs include:

- Sensorimotor
Touch Temperature
Fire Protection
Crew Mortality
Automation and Robotics
Mission Duration
Environmental Control and Life Support System (ECLSS)
Habitable Atmosphere
Extraterrestrial Surface Transport Vehicles (Rovers)





The 3001 Standards Team will be presenting at the upcoming annual Human Research Program Investigator's Workshop (IWS) being held in Galveston, Texas February 7-9, 2023.

The workshop's goal is to provide an informal, collegial atmosphere for cross-disciplinary interaction. Scientific sessions featuring presentations by principal investigators will be organized and scheduled according to Human Research Program disciplines:

- Exploration Medical Capability (ExMC)
- Human Factors and Behavioral Performance (HFBP)
- Human Health Countermeasures (HHC)
- Research Operations and Integration (ROI)
- Space Radiation (SR)
- Space Biology
- Translational Research Institute for Space Health (TRISH)
- Other

Visit the event [website](#) for additional information and register at the link [here](#).

### OCHMO Standards Training

The OCHMO Health and Medical Technical Authority (HMTA) Team has initiated a set of modules for training to help provide background on the HMTA organization, authority, roles and responsibilities, and information on the NASA-STD-3001 technical requirements. These modules will further support an upcoming HMTA Summit that is to take place at Kennedy Space Center in early 2023.

## Health & Medical Standards Background

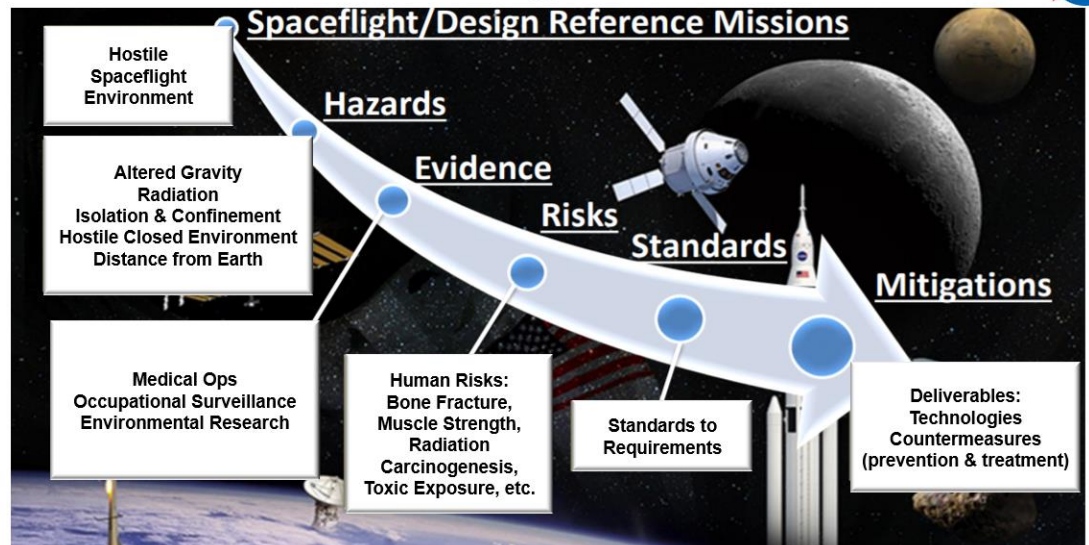


Image Source: <https://www.slideshare.net/mtnadmin/can-humans-survive-1000-days-in-space>

