What is NASA-STD-3001?

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

NASA-STD-3001 Volume 1 covers the requirements needed to support astronaut health and provide medical care while Volume 2 covers human related vehicle design & operations requirements that will maintain astronaut safety and promote performance.

Technical Briefs are available for numerous standards that offer technical data, background and application notes for vehicle developers. These tech briefs integrate content from multiple standards and provide a quick, informative resource to reference when working with NASA-STD-3001. See page 5 for more details.

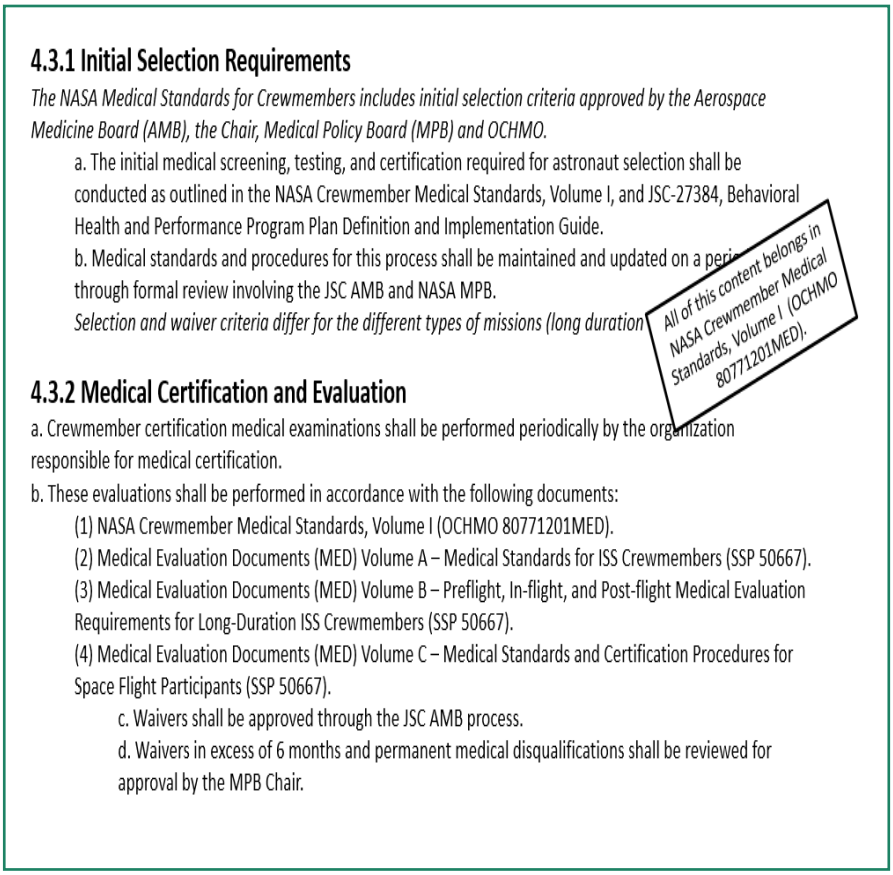
Standards Website

https://www.nasa.gov/offices/ochmo/human_spaceflight/index.html

Health, Medical & Performance Standards Update

NASA-STD-3001 Vol 1 & 2 Merger is Underway!

The OCHMO Standards Team is in the process of working with SMEs to merge content between the Vol 1 Crew Health and Vol 2 Human Factors, Habitability, and Environmental Health. The merged documents will become NASA-STD-3002 and will enhance the usability of both volumes by linking health standards with vehicle/hardware standards (desired health outcomes with vehicle/design requirements). An important part of Volume 1 is policy and medical operations requirements (MORD) that will be captured in a chapter of the 3002 and/or in policy documents and handbooks/technical briefs. See below and the following page for merger examples.



4.3.1 Initial Selection Requirements

The NASA Medical Standards for Crewmembers includes initial selection criteria approved by the Aerospace Medicine Board (AMB), the Chair, Medical Policy Board (MPB) and OCHMO.

a. The initial medical screening, testing, and certification required for astronaut selection shall be conducted as outlined in the NASA Crewmember Medical Standards, Volume I, and JSC-27384, Behavioral Health and Performance Program Plan Definition and Implementation Guide.

b. Medical standards and procedures for this process shall be maintained and updated on a peri… through formal review involving the JSC AMB and NASA MPB.

Selection and waiver criteria differ for the different types of missions (long duration

All of this content belongs in NASA Crewmember Medical Standards, Volume I (OCHMO 80771201MED).

4.3.2 Medical Certification and Evaluation

a. Crewmember certification medical examinations shall be performed periodically by the organization responsible for medical certification.

b. These evaluations shall be performed in accordance with the following documents:

(1) NASA Crewmember Medical Standards, Volume I (OCHMO 80771201MED).

(2) Medical Evaluation Documents (MED) Volume A – Medical Standards for ISS Crewmembers (SSP 50667).

(3) Medical Evaluation Documents (MED) Volume B – Preflight, In-flight, and Post-flight Medical Evaluation Requirements for Long-Duration ISS Crewmembers (SSP 50667).

(4) Medical Evaluation Documents (MED) Volume C – Medical Standards and Certification Procedures for Space Flight Participants (SSP 50667).

c. Waivers shall be approved through the JSC AMB process.

d. Waivers in excess of 6 months and permanent medical disqualifications shall be reviewed for approval by the MPB Chair.

https://www.nasa.gov/offices/ochmo/human_spaceflight/index.html

What is a standard?

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

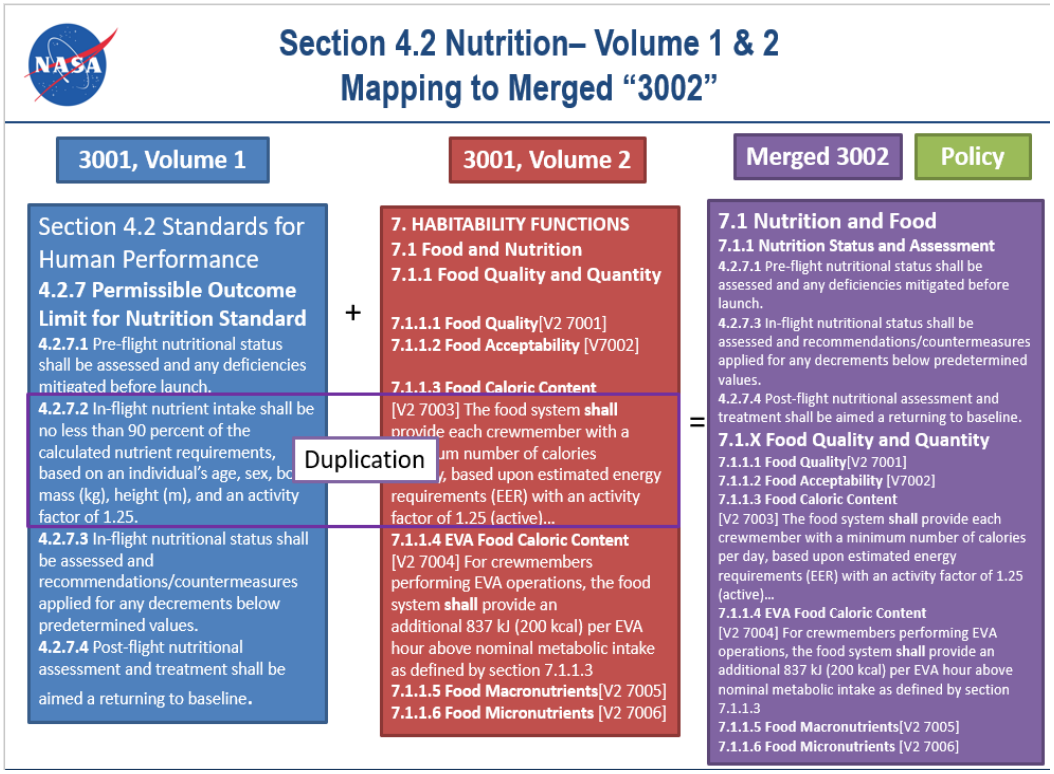
The Standards Team continually works with programs (e.g. Human Research Program, Gateway, Artemis, etc.) to provide the best standards and implementation documentation to minimize development issues. Via partnerships with the programs and industry, the standards are constantly evolving to enable the successful implementation of NASA programs & the commercialization of human spaceflight.

Links

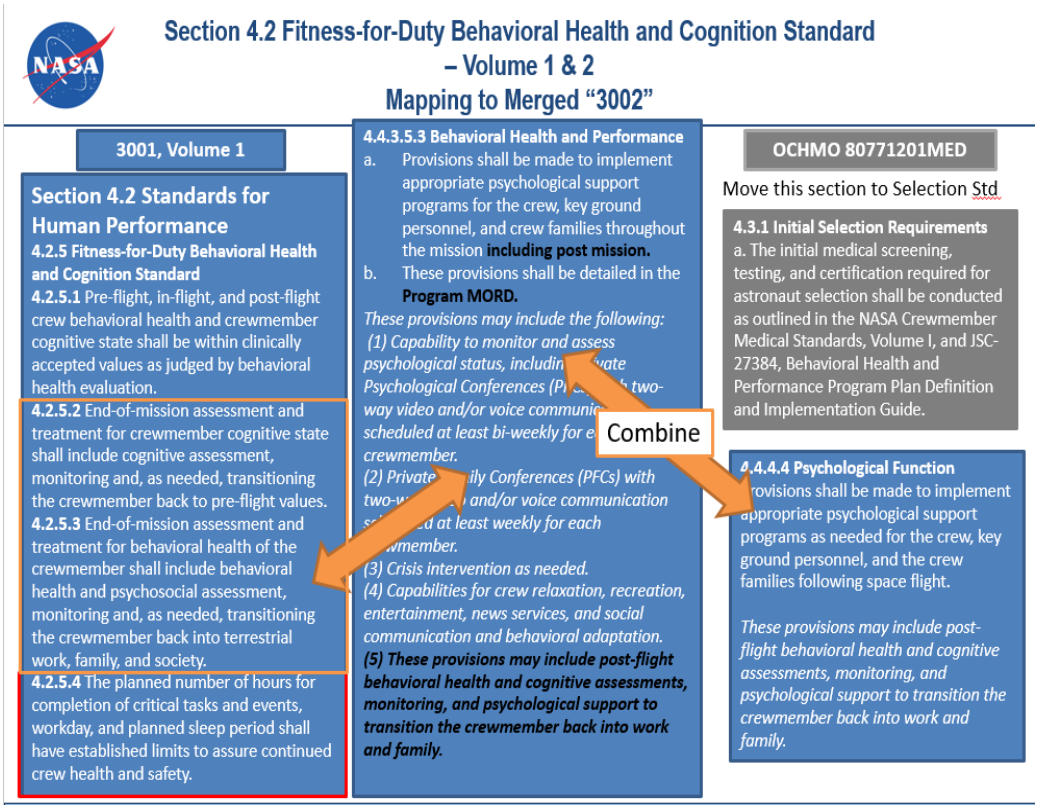
The NASA-STD-3001 SharePoint (including where to submit recommendations for changes to the standards, links to standards documents, and SME lists) can be found at the link below or you can contact us directly (see next page):

https://sashare.sp.jsc.nasa.gov/Teams/NASA-STD-3001/SitePages/Home.aspx

Example #1



Example#2



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Contact Us

The OCHMO Human Spaceflight Standards Team specializes in NASA-STD-3001 content. They have experience with the document and all standards, as well as the requirements that flow from them. They are willing to meet for consultations in order to ensure the understanding of the technical standards, provide clarification for the intent of specific standards, or further describe the formation of standards from risks.

They can be contacted via e-mail:

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Radiation Standard review

The OCHMO Standards Team have been working diligently to continually review and refine our standards and requirements to assure they remain evidence-based and represent a reasonable approach to risk.

The radiation standard has not been re-evaluated since its original implementation and is currently under review. As part of the revision process, we are in the process of reaching out to experts to provide input on radiation risk characterization and how the standard may be aligned in context with the other clinical risks. The goal is to have a re-evaluated standard review at the OCHMO Management Board this year and if required, have National Academies review any proposed changes.

"Rev C" Updates

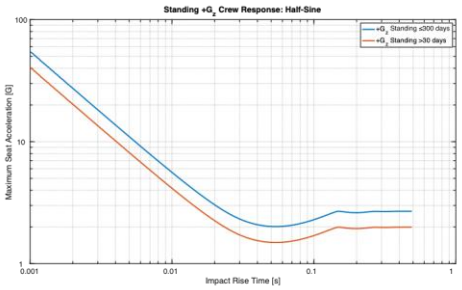
In early 2019, the Standards Team began a comprehensive review of Vol 2 Rev B to update the Standard for lunar and extraterrestrial missions, evaluate forward work from Rev B, develop standards for any identified gaps and streamline existing standards to facilitate improved understanding. These "Rev C" updates will go out as part of the Agency Change Request (CR) for the new NASA-STD-3002.

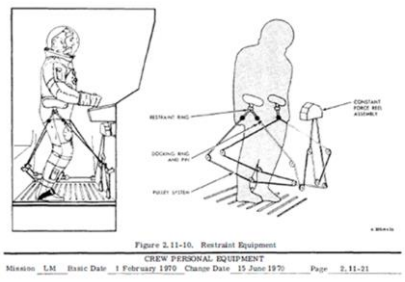
Lunar Landing Dynamic Loads & Transient Acceleration Standards

As part of this review process, SMEs recognized the need for dynamic and transient standards for landing on the lunar surface for both a sitting and standing position. A team of external experts was engaged to review Apollo data and research data to develop the standards. This process yielded two new standards that were added to the Artemis requirements prior to releasing of the contract solicitation.

Table 15: Dynamic Response Limits for crew in a standing posture shall be used with proper restraint

Reduced Gravity duration prior to dynamic loads	$+G_x$	$-G_x$	$\pm G_y$	$+G_z$	$-G_z$
≤30 days	5.4	-4.3	±2.3	2.7	0
>30 days	5.4	-4.3	±1.7	2.0	0





https://www.nasa.gov/offices/ochmo/human_spaceflight/index.html

Rev C Metrics

"Rev C" Updates Metrics

Status of changes as of 02.26.2020

"Rev C" Updates continued

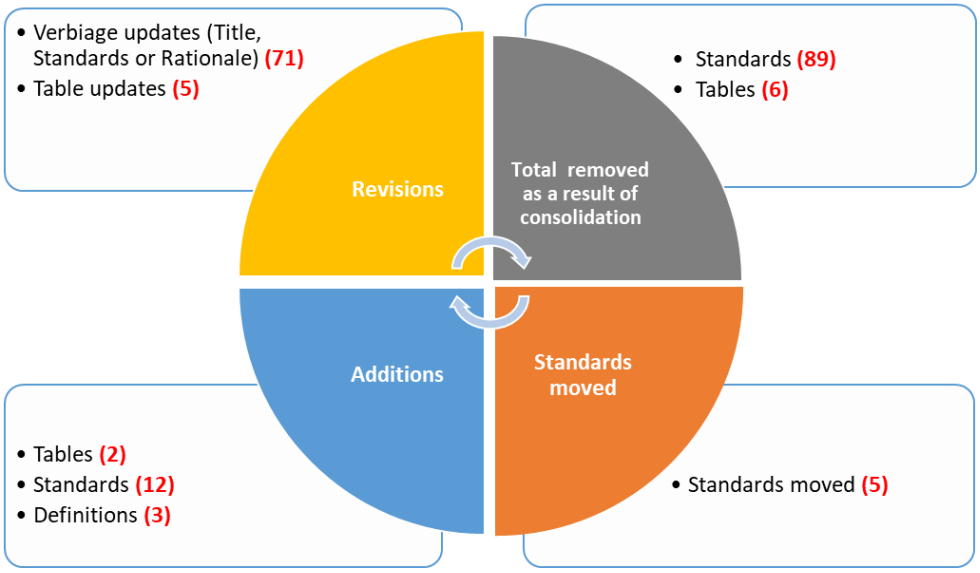
Example of Proposed Standards Streamlining:

To improve understanding of numerous physical data set standards that must be considered together when designing a vehicle, **Section 4.1 Physical Data Sets** was consolidated into one-revised standard requiring programs to use datasets provided by NASA. This minimizes the number of verifications while still providing the required information.

- V2 4001 Data Sets
- V2 4002 Data Set Characteristics
- V2 4003 Population Definition
- V2 4004 Data Set Assumptions
- V2 4005 Body Length Data
- V2 4006 Changes in Body Length
- V2 4007 Range of Motion Data
- V2 4008 Reach Data
- V2 4009 Body Surface Area Data
- V2 4010 Body Volume Data
- V2 4011 Body Mass Data
- V2 4012 Strength Data

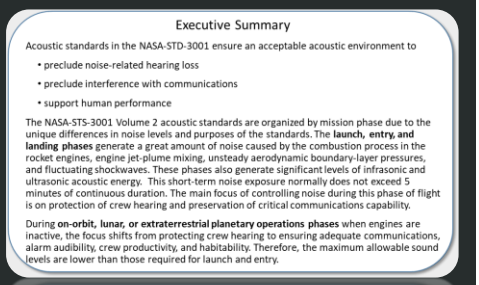
- Propose to consolidate 12 Physical Data Set standards into one revised standard requiring programs to use datasets provided by NASA
- **Proposed Standard V2 4001**: The program shall design systems to accommodate the physical characteristics and capabilities as defined in the NASA-provided datasets which represent the NASA astronaut population.
- **Proposed Rationale:** A system designed for human use or habitation must accommodate the range of human characteristics and capabilities relevant to the system and operating environment for the NASA-defined crew population. Datasets include characteristics and capabilities such as, anthropometric dimensions, body joint/segment range of motion, strength (minimum & maximum), mass, volume, and surface area. Factors that affect human characteristics and capabilities, such as sex, age, physical condition, environment (e.g., reduced gravity, posture, pressurized suit), etc., are identified and included in the datasets. Based on task analysis definition of task-affecting parameters, design parameters (e.g., minimum design force, range of hip breadth, etc.) are to be selected from NASA datasets.

Summary of Changes as of 02.26.2020



Technical Briefs Content

Executive Summaries:


Executive Summary

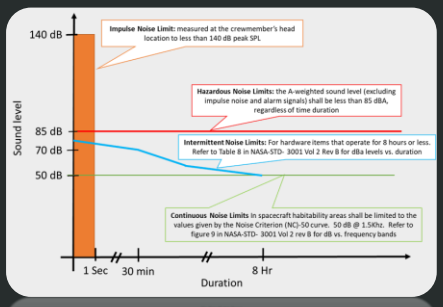
Acoustic standards in the NASA-STD-3001 ensure an acceptable acoustic environment to

- preclude noise-related hearing loss
- preclude interference with communications
- support human performance

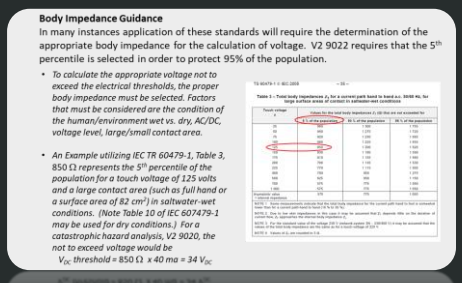
The NASA-STS-3001 Volume 2 acoustic standards are organized by mission phase due to the unique differences in noise levels and purposes of the standards. The **launch, entry, and landing phases** generate a great amount of noise caused by the combustion process in the rocket engines, engine jet-plume mixing, unsteady aerodynamic boundary-layer pressures, and fluctuating shockwaves. These phases also generate significant levels of infrasonic and ultrasonic acoustic energy. This short-term noise exposure normally does not exceed 5 minutes of continuous duration. The main focus of controlling noise during this phase of flight is on protection of crew hearing and preservation of critical communications capability.

During **on-orbit, lunar, or extraterrestrial planetary operations phases** when engines are inactive, the focus shifts from protecting crew hearing to ensuring adequate communications, alarm audibility, crew productivity, and habitability. Therefore, the maximum allowable sound levels are lower than those required for launch and entry.

Summary Graphs



Application Notes, Design Guidance and Reference Tables


Body Impedance Guidance

In many instances application of these standards will require the determination of the appropriate body impedance for the calculation of voltage. V2 9022 requires that the 5th percentile is selected in order to protect 95% of the population.

- *To calculate the appropriate voltage not to exceed the electrical thresholds, the proper body impedance must be selected. Factors that must be considered are the condition of the human/environment wet vs. dry, AC/DC, voltage level, large/small contact area.*
- *An Example utilizing IEC TR 60479-1, Table 3, 850 Ω represents the 5th percentile of the population for a touch voltage of 125 volts and a large contact area (such as full hand or a surface area of 82 cm²) in saltwater-wet conditions. (Note Table 10 of IEC 607479-1 may be used for dry conditions.) For a catastrophic hazard analysis, V2 9020, the not to exceed voltage would be* V_{DC} *threshold = 850 Ω x 40 ma = 34* V_{DC}

Technical Briefs

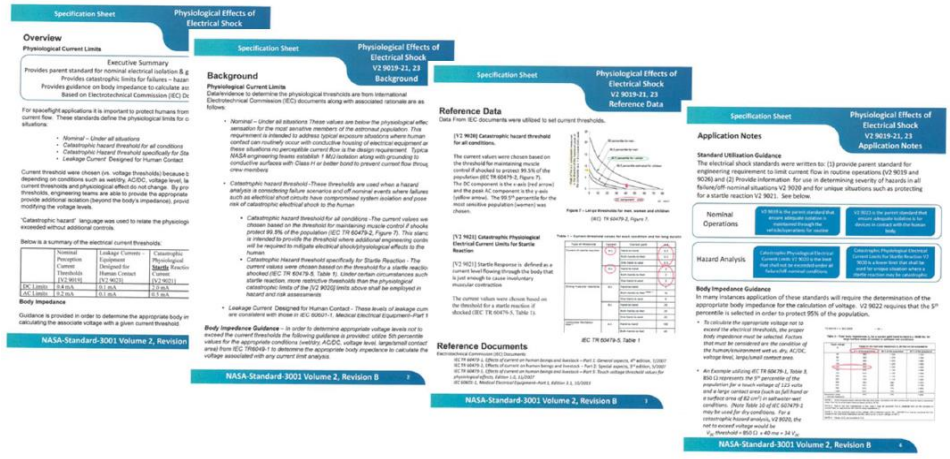
Technical Briefs are available for numerous standards that offer technical data from research and operations, background and application notes for vehicle developers and the aerospace medical community. These technical briefs integrate content from multiple standards to provide a quick, informative resource to reference when working with NASA-STD-3001. The first set of technical briefs include content on:

- Acceleration Technical Brief
- Acoustics Technical Brief
- Behavioral Health Technical Brief
- Bone Loss Technical Brief
- DCS Technical Brief
- Electrical Shock Technical Brief
- EVA Mishaps and Associated Standards Technical Brief
- Food and Nutrition Technical Brief
- Health Stabilization Program Technical Brief
- Lighting Design Technical Brief
- Longitudinal Surveillance Technical Brief
- Orthostatic Intolerance Technical Brief
- Radiation Protection Technical Brief
- Spaceflight Experience and Medical Care Technical Brief
- Waste Management Technical Brief

They can be found at OCHMO Standards website:

https://www.nasa.gov/offices/ochmo/human_spaceflight/index.html

Additional technical briefs are under development and will be added in the near future including specific topics related to Artemis.



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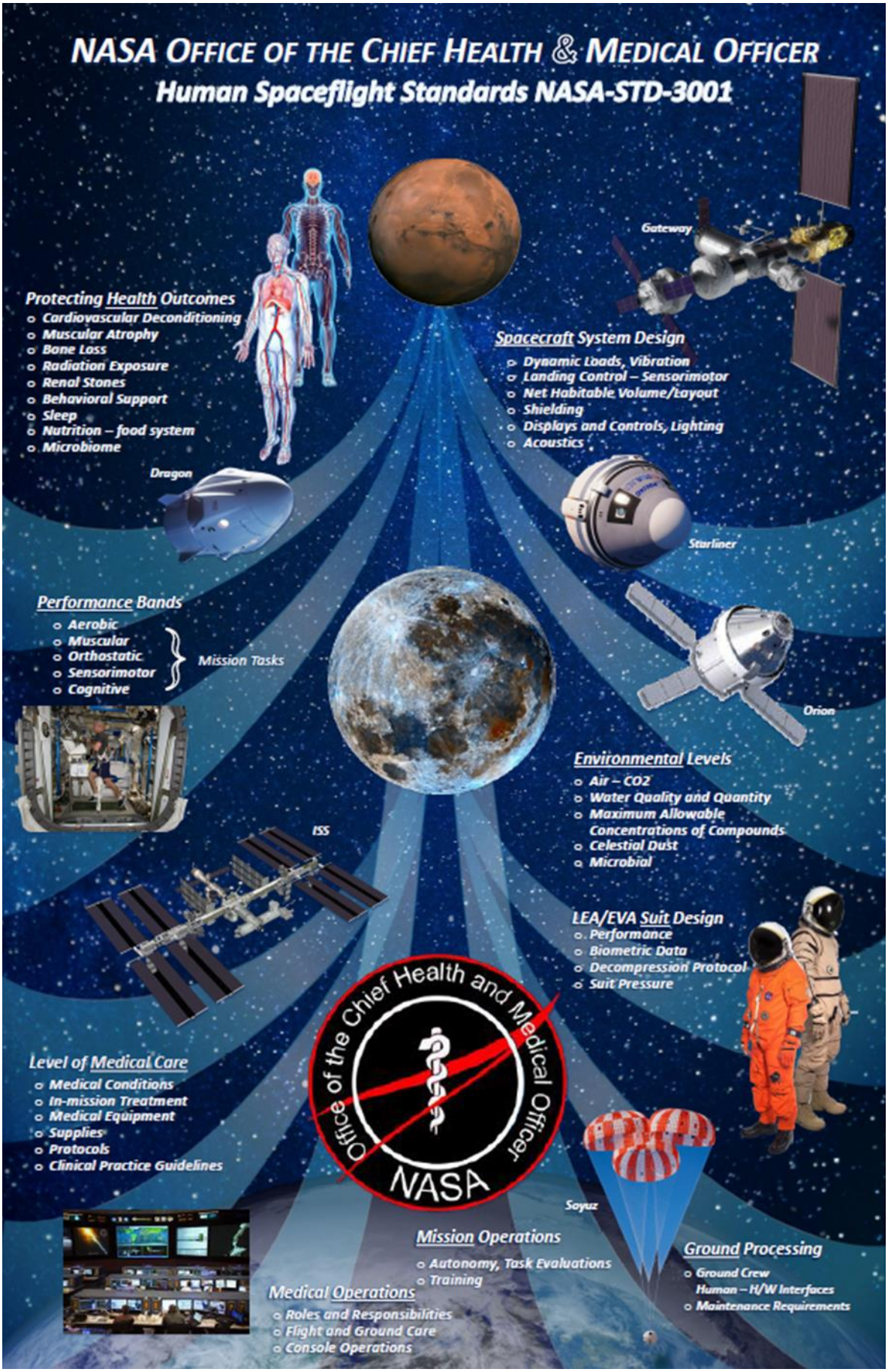

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