

# Health Standards for Long Duration and Exploration Spaceflight: Ethics Principles, Responsibilities, and Decision Framework

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For the:

IOM Committee on the

Ethics Principles and Guidelines for Health Standards for Long  
Duration and Exploration Spaceflights



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# Statement of Task Highlights

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- **Examine ethical and policy principles relevant to long duration and exploration spaceflights that are unlikely to meet NASA's existing health standards**
- **Consider the application of existing health standards and the potential development of new health standards**

**The committee was not asked, or comprised, to review existing health limits or to recommend new health limits**

# Timeline

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- *May 2013* – First committee meeting
- *July 2013* – Committee meeting and public workshop on risk, astronaut perspective, ethics framework, decision making, and health standard implementation
- *October 2013* – Committee meeting
- *November 2013* – Committee meeting
- *January to March 2014* – National Academies' Report Review
- *April 2, 2014* - Report release

# Context of Current Health Limits

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**Current Health Limits (NASA Standard 3001 Vol. 1) were developed in an era where space missions were:**

- Routine
- Short duration
- Low Earth orbit

**Exploration Mission concepts may exceed these limits**

**However, current health limits may be inappropriate, given:**

- Significant uncertainties when extrapolating to long duration
- Potential for emerging risks (“unknown unknowns”)
- Precision of the limits exceeds the accuracy of the understanding

# Options Considered

If done simply to permit exploration missions



- Liberalize existing health standards



- Establish more permissive health standards for long duration and exploration class missions



- Grant an exception to existing health standards to allow missions before new mitigation technologies and strategies are available to meet health standards or before health standards can be revised based on new data

If the exceptions are granted in a manner consistent with the proposed ethical framework

# Recommendation 1

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## *Expand on the Policies for Initiating and Revising Health Standards*

**NASA should ensure that its policies regarding health standards:**

- **Detail the conditions or circumstances (and relevant priorities) that initiate development or revision of health standards**
- **Explicitly indicate how these policies are fully consistent with the set of ethics principles outlined in this report**

## Recommendation 2

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### *Apply Ethics Principles to Health Standards Development and Implementation*

NASA should apply the following ethics principles in the development and implementation of its health standards for decisions regarding long duration and exploration spaceflights:

- *Avoid harm*
- *Beneficence*
- *Favorable balance of risk and benefit*
- *Respect for autonomy*
- *Fairness*
- *Fidelity*



## Recommendation 2 – Ethics Principles

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### *Avoid harm –*

- The principle includes the duty to prevent harm, exercise caution, and remove or mitigate harms that occur
- NASA should exhaust all feasible means to minimize risk to astronauts

### *Beneficence –*

- The principle to provide benefit to others
- NASA should weigh a mission's potential benefits, including scientific and technical importance, as well as benefits to current and future astronauts and the public

# Recommendation 2 – Ethics Principles

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## *Favorable balance of risk and benefit –*

- The principle includes the duty to *prevent harm, exercise caution, and remove or mitigate harms* that occur
- NASA should systematically assess risks and benefits and ensure that the benefits sufficiently outweigh the risks

## *Respect for autonomy –*

- The principle to ensure that individuals have both *the right to self-determination* and *processes in place* to exercise that right
- Astronauts' participation should be voluntary
- NASA should keep astronauts *informed of a mission's risks and benefits* before, during, and after the mission

# Recommendation 2 – Ethics Principles

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## *Fairness –*

- The principle requires that *equals be treated equally*, that burdens and benefits be distributed fairly, and that fair processes be created and followed
- NASA should *ensure fairness* in its selection of astronauts and crews, distribution of the risks and benefits, and postflight support of astronauts

## *Fidelity –*

- The principle recognizes that *individual sacrifices* made for the benefit of society may *give rise to societal duties* in return
- NASA should *acknowledge its obligation to astronauts*, who serve at great personal risk, by providing health care and other protections not only during but also after the mission

# Recommendation 3

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## *Implement Ethics Responsibilities*

NASA should adopt policies or processes that formally recognize the following ethics responsibilities related to health standards for long duration and exploration spaceflights

- Fully inform astronauts about the risks of long duration and exploration spaceflights and make certain that the *informed decision-making process* is adequate and appropriate
- Adhere to a *continuous learning strategy* (including health surveillance and data collection) to ensure that health standards evolve and improve over time and are informed by data gained before, during, and after long duration and exploration spaceflights, as well as from other relevant sources

## Recommendation 3 (cont'd)

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### *Implement Ethics Responsibilities*

- Solicit *independent advice* about any decision to allow any specific mission that fails to meet NASA health standards or any decision to modify health standards
- Communicate with all relevant stakeholders (such as astronauts and the public at large) the rationale for, and possible impacts (including type of harm, its severity, and probability estimates) related to any decision about health standards in a *procedurally transparent, fair and timely manner*, providing adequate opportunity for public engagement

## Recommendation 3 (cont'd)

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### *Implement Ethics Responsibilities*

- Provide *equality of opportunity* for participation in long duration and exploration spaceflights to the fullest extent possible
- For example, fairness in crew selection means that NASA should
  - *Accept some group differences in population risk in order to create equality of opportunity* to participate in missions
  - *Accommodate individual variance from population-based risk estimates* to the extent that individual differences do not jeopardize mission operations

## Recommendation 3 (cont'd)

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### *Implement Ethics Responsibilities*

- Provide *preventive long-term health screening and surveillance* of astronauts and *lifetime health care* to protect their health, support ongoing evaluation of health standards, improve mission safety, and reduce risks for current and future astronauts
- Develop and apply policies that appropriately and sufficiently *protect the privacy and confidentiality* of astronaut health data

## Recommendation 4

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### *Adopt an Ethics-Based Decision Framework*

NASA should apply the relevant ethics principles and fulfill the concomitant responsibilities through a three-level, ethics-based decision framework that examines:

- **Level 1:** Decisions about allowing risk to astronaut health and safety in excess of that permitted by health standards
- **Level 2:** Decisions about undertaking specific missions
- **Level 3:** Decisions concerning individual astronaut participation and crew composition



# Level 1: Decisions about Missions that Fail to Meet Health Standards

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## *Decision Points:*

- *Should NASA conduct space missions that will*
  - *Fail to meet health standards*
  - *Involve significant risks where there are **no applicable standards***
  - *Involve such **great uncertainty** that NASA cannot exclude the possibility of a or b*
- *If so, what criteria should be used to determine whether exceptions for specific missions are allowable*

## **Level 2: Decisions about Specific Missions**

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***Given authorization for missions that will likely fail to meet existing health standards, is a specific long duration and/or exploration mission ethically acceptable?***

## **Level 3: Decisions About Crew Selection and Individual Astronaut Participation**

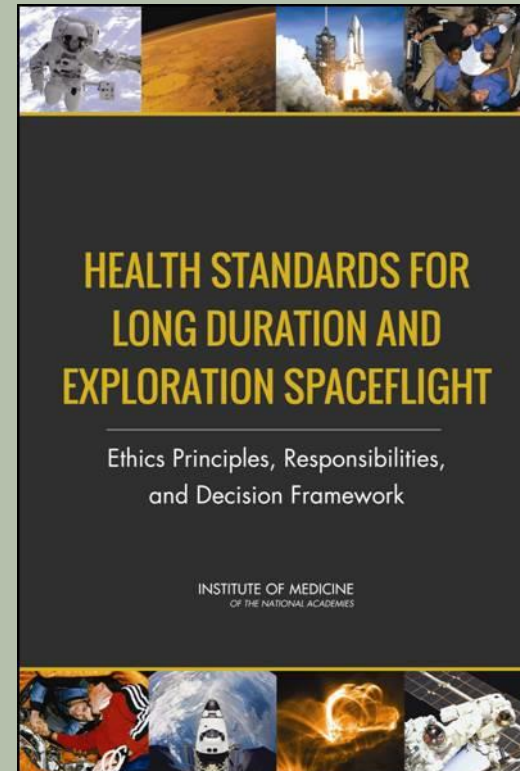
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*What factors should be considered as NASA and individual astronauts make informed decisions about crew selection and individual astronaut participation for a given mission?*

# For More Information

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- **Public release: April 2, 2014**
- **Free PDFs of the report are available:**



[www.iom.edu/LongDurationSpaceflight](http://www.iom.edu/LongDurationSpaceflight)

# Backup Slides

# Level 1: Decisions about Missions that Fail to Meet Health Standards

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## ***Decision Points:***

- *Should NASA conduct space missions that will a) fail to meet health standards, b) involve significant risks where there are no applicable standards, and/or c) involve such great uncertainty that NASA cannot exclude the possibility of a or b?*
- *If so, what criteria should be used to determine whether exceptions for specific missions are allowable?*

## ***Examples of ethics responsibilities:***

- Ensure all feasible means are taken to reduce astronaut risks to the lowest achievable levels
- Examine all approaches to minimizing risk, including alternate approaches to meeting the mission's objectives
- Assess and communicate the benefits
- Determine and communicate the time urgency to conduct the mission
- Thoroughly monitor and conduct research on health impacts during and after spaceflight to inform current and future missions
- Commit to the future health of current and future astronauts by ensuring access to health care, longitudinal follow-up, and preventive screenings

## Level 2: Decisions about Specific Missions

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*Decision points: Given authorization for missions that will likely fail to meet existing health standards, is a specific long duration and/or exploration mission ethically acceptable?*

*Examples of ethics responsibilities:*

- Adherence to criteria that are established and transparent
- Share risk escalation decisions and strategies
- Continue independent input to standards development and refinement
- Implement a robust program of occupational health monitoring and data collection during and after the mission
- Demonstrate that standards cannot be met despite having taken all feasible measures to reduce risks to the lowest achievable level

## Level 3: Decisions About Crew Selection and Individual Astronaut Participation

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*Decision points: What factors should be considered as NASA and individual astronauts make informed decisions about crew selection and individual astronaut participation for a given mission?*

*Examples of ethics responsibilities:*

- Thorough sharing of risk data with astronauts
- Transparent and fair processes and policies on decision making
- Astronaut responsibilities to participate in data collection and health monitoring during and after spaceflights to inform current and future crews
- Selecting crew members in a manner that ensures fairness among groups and considers risk susceptibilities in general and for individuals in a way that allows inclusion, individual decision making within a range of risk that is prudent for the welfare of all astronauts during the mission



# Process and Criteria for Granting Exceptions

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The selection of the process and criteria to grant exceptions to existing health standards should be evidence-based and should reflect policies that encourage independent advice and transparency of process.

Based on the ethics principles identified, criteria for reviewing exception requests could include requirements that the proposed mission:

- be expected to have exceptionally great social value,
- have great time urgency,
- have expected benefits that would be widely shared,
- be justified over alternate approaches to meeting the mission's objectives,
- establish that existing health and safety standards cannot be met,
- be committed to minimizing harm and continuous learning,
- have a rigorous process to assure that astronauts are fully informed about risks and unknowns, their decisions meet standards of informed decision making, and that they are making a voluntary decision, and
- provide health care and health monitoring for astronauts before, during, and after flight and for the astronaut's lifetime.