

**Statement of  
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**before the**

**Subcommittee on Space  
Committee on Science, Space and Technology  
U. S. House of Representatives**

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss NASA's current efforts in astronaut occupational health and a legislative proposal we have presented to Congress that would allow the Agency to perform annual medical monitoring and provide diagnosis and treatment for active as well as former astronauts throughout their lifetime for medical conditions which are deemed to be associated with human spaceflight. Provision of these services will help NASA gather long-term health data that will lower the risk for future space travelers.

**Background**

Like many industrial and military occupational settings, human spaceflight is associated with occupational environmental exposures, some of which are documented to be harmful to human health and performance. Unlike those fairly well-characterized terrestrial work environments, the spaceflight environment includes hazards/stressors that are unique and whose effects on humans are not well understood, due largely to the limited data set generated during the relatively short time that humans have been flying extended missions in space. During spaceflight missions, astronauts are subjected to hazards that include radiation and microgravity exposure, isolation, and confinement in the closed environment of spacecraft that cause astronauts to experience chronic long-term exposure to elevated carbon dioxide (10-20 times above Earth normal) and low levels of known toxins. These hazards and subsequent exposures drive human health risks for NASA astronauts.

NASA has implemented a systematic approach that gathers evidence to assess and mitigate these risks for both in-mission health and long-term health. NASA's Office of the Chief Health and Medical Officer generates Health Standards to provide requirements for NASA's development and operational programs to mitigate these risks, but these health risks cannot be eliminated entirely with present day knowledge/technology. More data is needed to better understand and mitigate the risks to astronauts.

Clinical findings indicate that astronauts experience increased risk of cataracts, reduced visual acuity, bone strength loss, post-mission renal stones, serious shoulder injuries, and other

orthopedic/musculoskeletal injuries, as a result of spaceflight and/or spaceflight training. Medical experts strongly believe that an association exists between human spaceflight and the increased risk of developing these and other related conditions. Scientific findings indicate that due to spaceflight radiation exposure, astronauts will have a higher incidence of cancer later in life than those not exposed. Several other conditions are believed to be associated with spaceflight, but sufficient evidence has not yet been compiled due to the relatively short history of the “occupation” and the small numbers of “subjects” to prove these associations. Prospective studies and medical research and medical monitoring programs are ongoing to further understand the effect of these exposures. As data emerge with ongoing long-duration spaceflight experience, we believe that other unsuspected medical conditions associated with spaceflight may become evident as well.

The legislation we have proposed to Congress will enhance our ability to safely conduct human spaceflight missions with future generations of space travelers as well as provide equity for the men and women who performed activities unique to United States human spaceflight achievements. It will do so by providing a process of efficient and uniform data gathering, monitoring, and treatment for medical conditions, which exist due to spaceflight.

## **NASA’s Current Efforts in Astronaut Data Gathering and Health Care**

### **Active Astronauts**

NASA currently provides both medical care and treatment for astronauts while they are active members of the astronaut corps. Health care includes routine occupational health and preventive examinations, and customized occupational monitoring based on individual astronaut exposures. The program also involves the ongoing and systematic collection, analysis, and interpretation of physiologic and exposure data to identify, mitigate, and control health risks to the astronaut.

NASA employs many strategies to minimize the impact to astronaut health, and ensures that any astronaut health and performance issues are considered and raised to the highest levels of NASA management when appropriate. These strategies include: standards to select the healthiest individuals, annual health monitoring to ensure fitness, proactive training programs and state of the art training facilities, flight assigned medical standards, and unique mission requirements to help mitigate the human risks for spaceflight. However, these efforts cannot entirely mitigate the hazards of spaceflight that astronauts are exposed to.

### **Former Astronauts**

In the “Lifetime Surveillance of Astronaut Health” (LSAH) Program, former astronauts are invited to voluntarily participate in a surveillance program of astronaut health, which includes limited health status evaluations on an annual basis at the Johnson Space Center Medical Clinic. When these evaluations uncover medical findings or raise questions, NASA is only authorized to encourage the former astronaut to follow up with their personal health care providers.

NASA utilizes the medical data from these surveillance evaluations to further understand the effects of spaceflight on long-term health of the astronauts. This is the core evidence that is

utilized by NASA for understanding the risks of spaceflight and for generating health standards and risk mitigations. Presently, approximately 60% of former astronauts participate in the surveillance program. Given the limited supply of subjects (there are approximately 250 living former astronauts), increasing the rate of participation is important to enable NASA to obtain more health care data/evidence. If the legislation is enacted, the Agency would be able to expand the scope of diagnostic care for former astronauts to include preventive medical exams for early detection and management of occupational disease. It is estimated with this expanded care NASA can increase participation to at least 80%.

## External Reviews

The Institute of Medicine (IOM), part of the National Academies of Sciences, Engineering, and Medicine, has reviewed NASA's astronaut health care numerous times over the past two decades. At each review, the IOM has consistently emphasized the need for NASA to adopt a comprehensive health care program for all its astronauts. In 2001, the Institute of Medicine released a report entitled "Safe Passage: Astronaut Care for Exploration Missions," in which it recommended that "NASA should develop a comprehensive health care system for astronauts for the purpose of collecting and analyzing data while providing the full continuum of health care to ensure astronaut health." In 2004, the Institute of Medicine released another report entitled "A Review of NASA's Longitudinal Study of Astronaut Health." In this publication, the IOM recommended that NASA convert to an Occupational Surveillance program in addition to their research program, and specifically cited the Department of Energy (DOE), Department of Veteran's Affairs, and Department of Defense as examples of successful government occupational surveillance programs. Specific input from the IOM reviews include:

- *"...the committee believes that the National Aeronautics and Space Administration (NASA) should have a policy addressing the practical consequences of discovering that a career as an astronaut, or the experience of space travel, leaves astronauts at increased risk for an adverse health effect.*
- *Of particular concern is the case in which the effect, ...does not become obvious during or immediately after a space flight but instead develops sometime after the astronaut leaves active duty and is no longer provided medical care by NASA.*
- *What is NASA's ethical responsibility in this circumstance? It seems evident that the federal government should take full responsibility for health care needs in the case of a disease or disorder unique to space travel or the training required for space travel."*

The Institute of Medicine's most recent report (2014) entitled "Health Standards for Long Duration and Exploration Spaceflight: Ethics Principles, Responsibilities, and Decision Framework" states that NASA has an ethical and moral imperative to ensure access to health care, longitudinal follow up, and preventive long-term health screening of current and former astronauts.

## **Proposed Legislative Content**

The new legislation would provide the NASA Administrator authority to allow the Agency to expand annual medical monitoring and provide diagnosis and treatment for former crew members throughout their lifetime for medical conditions which are deemed by NASA to be associated with human spaceflight.

Medical monitoring will focus on early detection of health conditions that may be related to occupational exposures incurred during spaceflight or spaceflight training. Targeted surveillance strategies could include monitoring for cancers, cataracts, visual changes associated with elevated intracranial pressure, injuries resulting from training or spaceflight, and reduced bone strength and fracture associated with loss of bone mineral. An individualized monitoring plan would also be implemented based on each astronaut's occupational exposure. Medical treatment would be provided for conditions which, as deemed by NASA, may not have occurred absent spaceflight or may have been exacerbated by spaceflight. Records of medical monitoring, diagnosis, and treatment would be provided to NASA.

Access to these records would further enable NASA to establish an evidence base to guide diagnosis and treatment for latent occupationally related conditions in a similar manner to Federal models such as the DOE's Former Worker Medical Screening Program. The expanded data acquired would be used to tailor treatments, inform the development and refinement of spaceflight health standards, inform requirements for new spaceflight medical hardware, and develop exposure controls in order to prevent disease occurrence in the astronaut corps.

## **Implementation**

NASA has the ability to administer this new activity via the existing infrastructure within the Office of the Chief Health and Medical Officer at NASA Headquarters and the Johnson Space Center (JSC) Flight Medical Clinic. These competencies/capabilities include physicians, epidemiologists, health care competencies, and management oversight capability. NASA's existing health care management structure can easily support the review and controls necessary to implement this legislation. In the event that a former astronaut who qualifies for Federal Employees' Compensation Act (FECA) needs extended medical care or experiences disability, we will work closely with our agency partners at the Department of Labor in coordinating with the FECA program. NASA is not seeking to remove itself from the FECA program or create its own workers' compensation system.

## **Conclusion**

This new legislation would provide the Administrator authority to allow NASA to meet the moral and ethical obligations to protect our current and former astronauts by performing annual medical monitoring and providing diagnostic services and treatment for former astronauts, in addition to active ones. These services would be conducted throughout the astronauts' lifetimes for medical conditions which are deemed to be associated with human spaceflight. The comprehensive preventive screening would help minimize catastrophic issues and the additional

data acquired would enable NASA to better understand the risks of spaceflight, minimize these risks, and enable future long duration missions to Mars and beyond.

Mr. Chairman, I would be happy to respond to any questions you or the other Members of the Subcommittee may have.