

National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001



June 23, 2010

Vice Admiral Joseph W. Dyer, USN (Ret.)
Chair
Aerospace Safety Advisory Panel
National Aeronautics and Space Administration
Washington, DC 20546

Joe
Dear Admiral Dyer:

In response to the Aerospace Safety Advisory Panel 2010 First Quarterly Meeting, NASA's responses to two recommendations are enclosed.

I look forward to receiving continued advice from the ASAP that results from your important fact-finding and quarterly meetings.

Sincerely, *Charles F. Bolden, Jr.*

A handwritten signature in black ink, appearing to read "Charles F. Bolden, Jr.", written in a cursive style.

Charles F. Bolden, Jr.
Administrator

2 Enclosures:

1. NASA Response to 2010-01-04A Integration of Crew Requirements into Design
2. NASA Response to 2010-01-05 Acquisition Strategy and Timeline for Development and Publication of Human Rating Requirements (HRR) for Commercial Activities

Tracking Number 2010-01-04(A)
Research Be Initiated to Establish and Codify Crew Vibration Limits for Various Phases of Flight for Future Space Vehicles

Finding

Ares thrust oscillation design changes have been largely driven by an understood need to limit exposure of the crew to certain vibration levels. To the Panel's knowledge, the underpinnings for these assumed vibration limits have not been rigorously explored. Given the potential for human vibration limits to drive future designs, more research needs to be done on acceptable vibration levels for the crew. Additionally, the difficulties the Panel observed in identifying, validating, and integrating the crew's desires and needs with regard to vibration for Ares I points out a need for improvement in the overall process for crew input to system requirements.

Recommendation

- A) Research be initiated to establish and codify crew vibration limits for various phases of flight for future space vehicles.
- B) Develop and incorporate into the design process a more rigorous process for indentifying, assessing, resolving, and integrating the crew's desires and needs into the system design requirements for future vehicles.

Rationale

- A) It is important that vibration requirements that drive design be properly researched and validated so that unnecessary costs are not incurred and design and development schedules are not unduly impacted, while fully meeting crew safety needs.
- B) It is also critical that a standard method be implemented for properly weighing and implementing the entire class of crew-driven requirements.

NASA Response

NASA concurs. NASA appreciates and recognizes the importance of establishing and codifying crew vibration limits for various phases of flight for future space vehicles. Crew vibration limits have been an important design driver for all the space vehicles NASA has built thus far.

NASA initiated research to codify crew vibration limits and published results of this research in the report **Influence of Combined Whole-Body Vibration Plus G-Loading on Visual Performance**. This is the final report from a Human Research Program study on vibration and G loading that provides initial guidance for evaluating the display readability trade-space between text-font size and vibration amplitude. Additionally, two preliminary reports were delivered to the Constellation Program (CxP) Office for Preliminary Design Review on acoustic, readability and speech under vibration, and three

more study reports are planned this year on speech intelligibility, label recommendations, and display design for vehicles under vibration.

NASA continues to incorporate crew requirements into vehicle design. The Human-Systems Integration Requirements that drive the design of space vehicles, their systems, and equipment with which humans interface are documented in **CxP 70024, Revision C, Constellation Program Human-Systems Integration Requirements**. These requirements ensure that the design of Constellation systems is centered on the needs, capabilities, and limitations of the human. Issues specific to vibration, crew health, and vehicle design are addressed in Section 3.2.5 of document CxP 70024, Rev. C. Additionally requirements for vibration safety are documented in **NASA Technical Standard (NASA-STD) 3001, NASA Space Flight Human-System Standard Volume 2: Human Factors, Habitability, and Environmental Health** which is in final approval. The document is part of the Office of the Chief Health and Medical Officer's Health and Medical Technical Authority. The document will be "booked" with similar other documents by the Chief Engineer.

In parallel with this development, NASA recognizes the benefit of soliciting input from crew representatives using standard processes (e.g., human-in-the-loop) and procedures to ensure that usability and design requirements are met within reasonable costs to NASA.

Tracking Number 2010-01-05
Acquisition Strategy and Timeline for Development and Publication of
Human Rating Requirements (HRR) for Commercial Activities

Finding

The Human Rating Requirement (HRR) issue has been a long running open ended item, and the ASAP is disappointed on the timetable that NASA has thus far demonstrated. The ASAP understands the complexity and difficulty of development of human rating (HR) standards for the commercial realm. The ASAP heard recently that there now must be an acquisition strategy that parallels or precedes the standards. There is no question that an acquisition strategy is fundamental to the development of standards, but NASA should not stop or slow efforts to continue to develop the HR processes that have begun. NASA has issued a statement that before the end of 2010, there will be a promulgation of the HRR for commercial activities. This timetable has the potential to put NASA behind in guiding systems currently under development, rather than ahead.

Recommendation

NASA should take action immediately to develop the acquisition strategy to guide the development of the HR process. The ASAP continues its long standing recommendation that NASA develop the HR process for the commercial sector. The ASAP also recommends a more aggressive timeline for the development and publication of commercially related human requirements.

Rationale

The President's FY2011 Budget Request contains the following direction: "The budget funds NASA to contract with industry to provide astronaut transportation to the International Space Station as soon as possible, reducing the risk of relying solely on foreign crew transport for years to come. A strengthened U.S. commercial space industry will bring needed competition, act as a catalyst for the development of other new businesses capitalizing on the affordable access to space, help create thousands of new jobs, and help reduce the cost of human access to space." This is clear general guidance, but it is important to have an acquisition strategy on how to accomplish this direction as well as a HR process for the commercial sector.

NASA Response

NASA concurs with the ASAP recommendations. NASA has determined that human rating technical requirements will apply to any crew transportation systems used by the Agency to provide transportation to low-Earth orbit. Consistent with the President's budget proposal to "contract with industry to provide astronaut transportation to the International Space Station (ISS) as soon as possible, reducing the risk of relying solely on foreign crew transports..." we are developing guidelines for acquisition and oversight/insight approach and are using American Recovery Reinvestment Act (Public Law 111-5) funds to develop human rating technical requirements in FY 2010. NASA's approach to human-rating a transportation architecture for a specific mission starts with the initial design phase and assumes that all pertinent NASA standards and technical requirements are followed throughout the project. This task will define a

minimum set of human rating requirements using a development team comprised of representatives from NASA's human space flight programs, NASA technical authorities, and the NASA Astronaut Office. In parallel with developing an acquisition strategy and associated validation, verification, and management processes, NASA is seeking the advice of interested industry stakeholders to refine the human rating technical requirements through a Request for Information (RFI) issued May 21, 2010. The RFI asks for industry comments and recommendations to the technical design and process requirements that NASA would most likely flow to a program charged with acquiring an ISS crew transportation and emergency deorbit system. NASA welcomes industry comments on these technical requirements, including suggestions of alternatives that may meet or exceed NASA intent.