

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



April 25, 2011

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

~~Joe~~  
Dear Admiral Dyer:

Enclosed is NASA's response to Recommendation 2010-04-02(a) from the 2010 Fourth Quarterly Meeting of the Aerospace Safety Advisory Panel (ASAP). Please do not hesitate to contact me if the ASAP would like further background on the information provided in the enclosure.

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

Sincerely,

A handwritten signature in black ink, appearing to read "C. Bolden, Jr.", with a long horizontal flourish extending to the right.

Charles F. Bolden, Jr.  
Administrator

Enclosure

**Tracking Number 2010-04-02(a)**  
**Expression of Loss of Crew (LOC) Limits**

**Finding**

NASA has published some LOC requirements and given them to industry. The key number is LOC on the overall mission, which is 1/270--the same number that was to have been applied to Constellation. NASA is looking at a threshold LOC number for a 210-day mission to the International Space Station (ISS) as 1/150. Beyond that requirement, the Agency proposed to adopt a goal for eventual reliability (1/750).

**Recommendation**

NASA should publish threshold limits, objective limits, and goal limits to let commercial providers know what the ultimate number is. The goal limit should be put into the contract documents and agreements.

**Rationale**

It would be helpful to the design team to know what the threshold, objective, and goal limits are when safety factors are being chosen.

**NASA Response**

NASA agrees with the recommendation with amplification, as described in the following paragraphs:

Loss of Crew Design Requirements: As stated in the Finding, NASA has published LOC requirements for the design of ISS crew transportation systems, releasing them to the public in the form of "Commercial Crew Transportation System (CCTS) Certification Requirements for NASA Low Earth Orbit (LEO) Missions, ESMD-CCTSCR-12.1, Revision-Basic." The requirements in this Directorate-level document are: 1/270 combined risk for a 210-day ISS mission; 1/1000 for ascent; and 1/1000 for entry. These numbers are the same as those the Agency required of the Constellation Program (Cx) for the ISS mission design, and the Agency will verify compliance by use of NASA standard Probabilistic Risk Assessment tools and procedures with appropriate attention to assumptions, uncertainties, and peer review.

In order to support certification of a crew transportation system for the specific mission of ISS transport, NASA is in the process of flowing requirements from the Exploration Systems Mission Directorate document into program level "1100 series" requirements documents. The ascent and entry LOC requirements will be the same as those in the Directorate-level document.

Agency Level Loss of Crew Design Threshold: As of the August 2010, Program Management Council (PMC), the Agency will hold future human transport system development programs to an acquisition threshold LOC to be determined separately for each particular mission. This process will formally establish the Agency's safety risk tolerance for each design for each mission. The threshold should be thought of as an acquisition decision trigger. If, at a key milestone review, the Government analysis shows the predicted safety risk level to be higher

Enclosure

than the Agency threshold, then the program must propose cancellation or defend continuation before the Administrator. This threshold shall not apply directly to any contractor per se. Program Managers are expected to hold their design teams to LOC requirements that provide reasonable margin against the Agency threshold. The Commercial Crew Program (CCP) will communicate relevant Agency and Directorate-level requirements, goals, and objectives (LOC threshold included) to its contractors as information, but will hold the design teams to the stricter program design requirements through appropriate contractual language.

Agency-Level Continuous Safety Improvement Requirement: In that same August 2010, PMC, the Administrator decided to require all future human spaceflight systems acquired by NASA to include a life-cycle continuous safety improvement element. The ultimate goal of the continuous safety improvement activity will be stated as an LOC goal. For CCP, that goal is 1/750 for the combined ISS mission risk (same as Cx). This requirement has yet to be defined in enough detail to be included in the program's 1100 series documentation, but it will be an important discussion item at the program's acquisition strategy meeting and will be added to the program's documentation once the details of scope, roles, resources, and procurement approach are decided.