

Aerospace Safety Advisory Panel White Paper

Operation of ISS with Two Crew Members

April 11, 2003

The Aerospace Safety Advisory Panel has reviewed plans for operating the International Space Station (ISS) with two crew members. The Panel sought to understand the potential impact of such operations on crew and ISS safety. This was accomplished by attending major program reviews and holding discussions with the Program Manager and key program personnel. The effort indicated that the ISS Program has effectively identified and analyzed areas of risk, and taken appropriate mitigating action.

Following the loss of Columbia, the grounding of the Shuttle fleet will lead to a shortage of critical consumables aboard ISS. In response, NASA will operate the ISS with two crew members. Understanding that additional risk may be involved, the ISS Program identified potential hazards, analyzed the resulting risks, and restructured on board activities. New procedures and modifications of existing procedures were developed where needed and validated with full participation by the crew office.

Risk areas reviewed by the Panel included emergency EVA, incapacitation of one crew member, consumables, ISS emergencies (fire, penetration, and contamination), equipment failure, crew workload, system maintenance, and Soyuz service life limitations. In each case, concerns were assuaged during the Panel's review.

Current plans are to launch Soyuz 6S to ISS at the end of April with the Expedition 7 two-person crew. In this "parallel" approach, following an overlap period, Soyuz 5S will return with the Expedition 6 three-person crew. If Soyuz 5S were found faulty during crew turnover, Soyuz 6S could be used to return three crew members leaving two crew members with no escape vehicle. The Panel requested a risk analysis to evaluate a "serial" approach where Soyuz 6S would be launched only after successful return of the Expedition 6 crew on Soyuz 5S. Analysis by the Program office indicated that the risk to crew was not significantly different. The risk to ISS, however, was about an order of magnitude worse in the "serial" case due to having ISS uncrewed. Therefore, based on the conclusion that there is no significant reduction in crew risk with the serial approach, there is no apparent reason to change the planned crew exchange process.

The ISS Program office has adequately addressed all concerns raised by ASAP. The Panel finds the analyses performed and the mitigating actions taken reasonable and appropriate.