



October 9, 2009

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 2008-04-01 from the 2008 Fourth Quarterly Meeting of the Aerospace Safety Advisory panel (ASAP). Please do not hesitate to contact me if the Panel 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,

Charles F. Bolden, Jr.
Administrator

Enclosure

JOE - I'm trying to find a way to make the next ASAP meeting at AESS, but it's becoming problematic because of a commitment to the von Braun DLR in Huntsville on 21 Oct followed by a non-executive medical procedure. PLEASE LET ME KNOW IF YOU NEED REPRESENTATION FROM THE 9TH FLOOR AND I'll WORK IT.

Tracking Number 2008-04-01
Ares I Thrust Oscillation Agency-wide Understanding

Recommendation

The ASAP notes that there is not a consistent Agency-wide understanding of the technical concerns associated with thrust oscillation for the Ares vehicle, especially with respect to the impact on crew performance due to the immediate and residual effects of launch vibration and acceleration. The ASAP therefore recommends that NASA ensure that all concerns are appropriately evaluated and communicated to stakeholders and that a consensus exists on the rationale for the solutions ultimately adopted.

NASA Response

NASA concurs. NASA realizes the need to ensure that stakeholders are aware of the Ares I thrust oscillation issues and participate in the resolution. The following steps were taken to ensure that stakeholders are knowledgeable of the issues and have a forum to discuss concerns and design solutions.

1. Thrust oscillations captured as a Top Program risk

A Top Program risk for First Stage Thrust Oscillations was created and documented in the Constellation Integrated Risk Management Application to ensure stakeholder visibility and document the mitigation steps necessary to bring thrust oscillations issues to a successful resolution. Key stakeholders involved in actively working mitigation steps include the Constellation Program and Project, Ares I design engineers, Crew Office, Office of the Chief Engineer, the Office of Safety and Mission Assurance, the Chief Medical Office, and the Human Research Program.

2. Periodic briefings to maintain visibility

Thrust oscillations status is briefed at monthly project and program risk reviews to ensure visibility. Thrust oscillation status and progress are briefed at the Exploration Systems Mission Directorate's quarterly reviews and reported to senior Agency management at venues such as the Agency Program Management Council (APMC) to ensure visibility across the Agency. Additionally, NASA briefs representatives from the Office of Management and Budget, as well as members of Congress, on an ongoing basis to ensure that all stakeholders understand NASA's thrust oscillations plans as we move forward.

3. Formal decision meetings

NASA has targeted a passive dampening system to address the thrust oscillations. Key decision points for design baseline will be assessed later this year. While the goal is to reach all key decisions by consensus, NASA has a process for dissenting opinions to be heard. Per NASA policy, even after a decision is made, dissenting opinions can be appealed to the next higher level until resolved.

Enclosure

Objective evidence of progress

A Thrust Oscillation Focus Team (TOFT) comprised of Agency experts was chartered on November 13, 2007, to ensure Agency attention on thrust oscillation resolution. On January 16, 2008, the team described the plan for thrust oscillation impact assessment and mitigation strategy. TOFT recommendations were provided during the Ares I PDR checkpoint on March 14, 2008. On April 29, 2008, the TOFT reported findings and the decision to focus on Ares mitigation to the NASA APMC. On May 23, 2008, the team provided the status of mitigation options to the Constellation Program Office. At the Ares PDR Readiness Review, held June 25, 2008, the team provided concept down-select results. On August 8, 2008, the recommendation for thrust oscillation Point of Departure was provided to the Constellation Program Control Board. Thrust oscillation mitigation handoff from the TOFT to the Ares Project occurred on August 8, 2008.

Thrust oscillation mitigation strategies were reviewed during the Ares I PDR and at the PDR +90-day review, December 1-2, 2008, with the project and program baseline passive thrust oscillation mitigation options based on extensive analysis and testing. A thrust oscillation technical interchange meeting was held on April 7-9, 2009. A second thrust oscillation technical interchange meeting, held June 1-3, 2009, reviewed development progress of mitigation options and integrated vehicle analysis. During the technical interchange meeting, the team baselined pursuing dual-plan isolation with two isolator rings to de-tune the vehicle, one located at the interstage/frustum interface and another between Orion and the Ares upper stage (mounted on the forward end of the Ares I instrument unit). The team also concluded that thrust oscillation impacts the entire vehicle and should be solved by an integrated team of Ares and Orion. The Constellation Program established an integrated Thrust Oscillation Baseline Formulation Team composed of program, Orion, Ares, and subject matter experts from the NASA engineering community. On September 11, 2009 the team presented technical and programmatic details of the mitigation options to the Constellation Systems Integration Panel. The outcome of the review was to continue with the current Dual Plane Isolation configuration as the primary mitigation design and further mature a Liquid Oxygen (LOX) damper as an alternate option. Progress on the LOX damper will be reviewed in December to determine if the program baseline should be re-evaluated. The current program baseline solution, dual-plane, will be integrated into the Constellation PDR scheduled to begin early next year. The Office of the Chief Engineer and the Office of Safety and Mission Assurance are active participants of project, program boards, panels, and the APMC where thrust oscillation mitigation decisions were made throughout the process.

In addition to the development and integrated vehicle analysis outlined above, the Ares team has begun development testing of the five segment solid rocket motor. On September 10, 2009, the first full-scale flight hardware, a five segment solid rocket motor, in the development of the Ares I was static fired. While data is still being analyzed, one key data point has resulted. Initial data indicates that the peak pressure oscillation data was below the predictions but within the expected range. This data gives confidence that the model predictions are reasonable and current mitigation designs are on the right tract. However, this is only one data point and the variation from motor to motor must be understood before data can influence mitigation decisions. After data confidence increases, decisions will be made formally with an integrated team and with the same rigor the program has implemented to date to ensure communication to stakeholders.