



*Ares I PDR Board*  
*September 10, 2008*

**Pre-Board Findings**  
**Neil Otte**



## Pre-Board General Observations/Comments

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- ◆ Detailed and thorough review and presentations.
- ◆ Excellent participation from across the Agency.
- ◆ Presenters and engineering support were knowledgeable of the subject material.
- ◆ Emphasis was placed on the correct areas of the design and project processes.
- ◆ Discussions were open and unconstrained.
- ◆ Neither Thrust Oscillation mitigation designs, or adequacy of resources or schedule, were considered in the pre-board recommendation.
- ◆ The fact that negative comments are being presented against the PDR success criteria, should not eclipse the tremendous achievement of the Ares team in advancing the design to the current status, or the overall soundness of the design.



## Stoplight Definitions for PDR Success Criteria (7123.1A)



### “Stoplight” Definitions for review board self assessment



#### Status is Satisfactory

Right community reviewed the right products which adequately addressed exit criteria, RIDs written and dispositioned, issues resolved or minor in nature, and overall determination that current project state establishes acceptable risk path to next life cycle milestone



#### Status is Cautionary

There are known issues which may compromise project success; however, there are mitigation approaches identified (and formal actions assigned) to address those issues that are **judged to be timely, likely to result in fully satisfying the success criteria, AND** likely to result in a success path to the next life cycle review with **acceptable risk to the project/program/agency.**

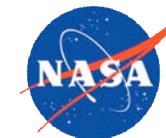


#### Status is Unsatisfactory

There are known issues which will likely preclude project success. Mitigation approaches have either not been identified or the proposed **plans cannot reasonably be judged to meet the “cautionary” standard.** Program/Agency intervention required to adequately mitigate the issue.



## Pre-Board Evaluation of PDR Success Criteria (7123.1A) (1 of 5)



NPR 7123.1A Success Criteria.	Rating	Comments/Concerns
<p>1. The top-level requirements including mission success criteria, TPMs, and any sponsor-imposed constraints are agreed upon, finalized, stated clearly, and consistent with the preliminary design.</p>	Y/G	<ul style="list-style-type: none"> <li>◆ <b>Functional Requirements and design goals flown down to Ares-I are relatively stable with the exception of operability</b></li> <li>◆ <b>Several areas of known disconnects that need to be cleaned up:</b> <ul style="list-style-type: none"> <li>• Inadvertent Separation Destruct System</li> <li>• Command Receiver Decoder Open Loop Test</li> <li>• Common Cause Software Failure Avoidance</li> <li>• Single System Tunnel</li> </ul> </li> </ul>
<p>2. The flow down of verifiable requirements is complete and proper or, if not, an adequate plan exists for timely resolution of open items. Requirements are traceable to mission goals and objectives.</p>	Y	<ul style="list-style-type: none"> <li>◆ <b>Integrated Test Plan is immature. Tests may not have resources allocated, or be adequately planned for.</b> <ul style="list-style-type: none"> <li>• Full Scale Separation Testing</li> <li>• System Integration Laboratory Test Hardware Fidelity</li> </ul> </li> <li>◆ <b>Not all requirements are captured and appropriately documented:</b> <ul style="list-style-type: none"> <li>• Upper Stage Engine requesting more bandwidth to capture high speed dynamic data.</li> <li>• Ground Transportation environments not documented.</li> </ul> </li> </ul>



## Pre-Board Evaluation of PDR Success Criteria (7123.1A) (2 of 5)

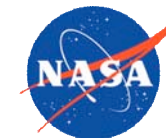


NPR 7123.1A Success Criteria.	Rating	Comments/Concerns
<p>3. The preliminary design is expected to meet the requirements at an acceptable level of risk.</p>	<p>Y/R</p>	<ul style="list-style-type: none"> <li>◆ <b>Current induced environments are high and cause design challenges:</b> <ul style="list-style-type: none"> <li>• Pyro Shock environment on avionics</li> <li>• Acoustic environments on Reaction and Roll Control Systems</li> </ul> </li> <li>◆ <b>Analysis used to verify design meets requirements, yet process for control of models and analysis has not been formalized.</b></li> <li>◆ <b>Some areas of known failure to meet requirements need to be worked:</b> <ul style="list-style-type: none"> <li>• Natural Environments</li> <li>• Liftoff Clearance</li> <li>• Reference Design Requirements Compliance Matrix</li> </ul> </li> <li>◆ <b>Separation event is challenging and one of the highest technical risk. Continued emphasis needs to be placed on understanding the drivers and their sensitivity.</b></li> </ul>





## Pre-Board Evaluation of PDR Success Criteria (7123.1A) (3 of 5)



NPR 7123.1A Success Criteria.	Rating	Comments/Concerns
4. Definition of the technical I/Fs is consistent with the overall technical maturity & provides an acceptable level of risk.	Y/R	<ul style="list-style-type: none"> <li>◆ <b>Process for producing, and resolving issues with, Level II and Level III IRD's/ICD's is unclear:</b> <ul style="list-style-type: none"> <li>• Roles and Responsibilities of Level II Book Managers and Level III Integrators</li> <li>• Approval process for baseline and changes</li> </ul> </li> <li>◆ <b>Known disconnects and numerous TBD/TBR's exist in IRD's.</b> <ul style="list-style-type: none"> <li>• Eight inch height delta between First Stage and Ground Systems</li> <li>• Extended Nozzle incorporated in performance, but First Stage and Ground Systems not working configuration.</li> <li>• Reference Design Requirements Compliance Matrix</li> </ul> </li> <li>◆ <b>Performance of trades across the interfaces difficult to initiate and conduct.</b></li> </ul>
5. Adequate technical interfaces are consistent with the overall technical maturity and provide an acceptable level of risk.	Y/R	<ul style="list-style-type: none"> <li>◆ <b>Combine with criteria #4</b></li> </ul>
6. Adequate technical margins exist with respect to TPMs.	Y	<ul style="list-style-type: none"> <li>◆ <b>Technical Performance Margins need to be linked from Level II to Level IV.</b></li> <li>◆ <b>Process for control of bandwidth and power margins need to be put in place and exercised.</b></li> </ul>



## Pre-Board Evaluation of PDR Success Criteria (7123.1A) (4 of 5)



NPR 7123.1A Success Criteria.	Rating	Comments/Concerns
<p>7. Any required new technology has been developed to an adequate state of readiness, or backup options exist and are supported to make them a viable alternative.</p>	G/Y	<p>◆ <b>Gigabit Ethernet development is seen as potential schedule risk</b></p>
<p>8. The project risks have been credibly assessed, and plans, a process, and resources exist to effectively manage them.</p>	Y	<p>◆ <b>Risk system to date has been used to primarily convey programmatic risks</b></p> <p>◆ <b>Coming out of PDR, system needs to shift emphasis onto identification and mitigation of technical risks.</b></p> <p>◆ <b>Mitigation plans need to be formulated and resources procured:</b></p> <ul style="list-style-type: none"> <li>• Slosh Testing</li> <li>• Development tests being reduced in Upper Stage</li> </ul> <p>----- <b>Resources were not considered in scoring this criteria</b> -----</p>
<p>9. Safety and mission assurance (e.g., safety, reliability, maintainability, quality, and EEE parts) have been adequately addressed in preliminary designs and any applicable S&amp;MA products (e.g., PRA, system safety analysis, and failure modes and effects analysis) have been approved</p>	G	<p>◆ <b>Excellent job of incorporating safety emphasis into the early requirements and design phase.</b></p>



## Pre-Board Evaluation of PDR Success Criteria (7123.1A) (5 of 5)



NPR 7123.1A Success Criteria.	Rating	Comments/Concerns
10. The operational concept is technically sound, includes (where appropriate) human factors, and includes the flow down of requirements for its execution.	Y	<ul style="list-style-type: none"> <li>◆ <b>Incorporation of operability into the design activity needs to be enhanced.</b> <ul style="list-style-type: none"> <li>• Need to develop, or identify, tools and processes that can be used by the elements and designers to maintain appropriate emphasis on operability.</li> </ul> </li> <li>◆ <b>Feasibility of operability proposals need to be assessed.</b></li> </ul>





## Pre-Board Summary

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- ◆ **Excellent support and participation for the review from across the Agency**
- ◆ **Significant progress has been made from System Design Review to Preliminary Design Review**
- ◆ **Areas for increased emphasis exist:**
  - Design challenges remain in areas of environments and staging events.
  - Processes for control of analysis and models, and IRD's/ICD's need to be clearly established and practiced.
  - Maturation of integrated test planning and resources required.
  - Identification of technical risks and formulation of approved mitigation plans.
  - Process and tools to enhance incorporation of operability into the design activities.
- ◆ **Areas of significant progress have been noted:**
  - Requirements and their flowdown are stabilizing.
  - Excellent incorporation of safety and mission assurance tools and processes early in the design life cycle

**Pre Board Recommendation:  
The Ares I Project has demonstrated readiness to  
proceed to detailed design\***

\* Upon completion of delta PDR and assigned actions