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The Mars Climate Orbiter Mishap Investigation Board's Report on Project Management in NASA

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Good afternoon Mr. Chairman and members of the committee. Thank you for the opportunity to discuss the Mars Climate Orbiter Mishap Investigation Board's "Report on Project Management in NASA." I am speaking today on behalf of the Board members. It is our hope this report will significantly help those involved in project management at NASA and within the aerospace industry to successfully manage their projects during an era of limited resources. We believe that mission success can be achieved under the "Faster, Better, Cheaper" paradigm but the approach to project management must be carefully managed with strict attention to four distinct areas:

1. Selection and training of the right **people**
2. Use of proven project management **processes** with a new emphasis on risk management
3. Disciplined **execution** of the project
4. Use of new but adequately matured **technology**

Our initial report in November 1999 addressed the root cause of the loss of the Mars Climate Orbiter mission as the "failure to use metric units in the coding of ground software 'Small Forces' used in trajectory modeling." This failure led to the navigators not fully understanding the trajectory of the spacecraft. This, in turn, led to errors in the trajectory correction propulsive maneuvers, and thus the spacecraft approached Mars too low for spacecraft survival.

The Board recognizes that mistakes and deficiencies occur on all spacecraft projects. It is imperative that spacecraft projects have sufficient processes in place to catch mistakes before they become detrimental to mission success.
Unfortunately for the Mars Climate Orbiter, the processes in place on the project did

not catch the root cause. Nor did these processes enable the contributing causes -- which we pointed out in our November report -- to catch and correct this mistake.

Following the loss of the Mars Polar Lander, Dr. Ed Weiler, NASA's Associate Administrator for Space Science, amended our Board's charter to develop recommendations based on an examination of recent spacecraft failures.

Our "Report on Project Management in NASA" provides the following:

Observations and lessons learned from the Mars Climate Orbiter mission
A description of a well-run "Faster, Better, Cheaper" project
An assessment of NASA's current project management guidelines and procedures
Recommendations for improved project management

Let me summarize the most significant findings and recommendations documented in this report:

Some projects have gone too far in emphasizing the importance of meeting cost and schedule, thereby introducing too much risk into the project. Project management, as well as NASA and industry senior managers, must be willing to push back and ask for more people and dollar resources in order to keep risk levels in check. Or, an alternative might be to reduce project scope. However, if neither additional resources nor a reduction in project scope is achievable, then project management should recommend cancellation rather than proceed with a project that carries too much risk.

Within the eight failure investigations we examined, six reported that failure could be attributed to inadequate technical reviews, inadequate risk management, and/or insufficient testing, analysis, and simulations. Our Board recommends that reviews must be conducted with the right, highly qualified reviewers, including strong representation from functional line management. We recommend that Risk Management be raised in importance on NASA projects to a level equal to that traditionally given to Cost, Schedule, and Project Scope. In effect, this would make Risk Management the "fourth" element in project management. Clearly, on some projects we have cut corners in testing, analysis, and simulations. We must not give in to cutting corners when schedule and cost are tight.

Communication on any team effort is key. We found inadequate communications in five of the eight failure investigations we looked into. Projects must have disciplined

processes in place to enable communications. This is not new to successful project management – it has just been shortchanged under the pressure to do more with less.

Adequate staffing is another area that was sometimes shortchanged because of the limited resources. We must make sure that not only is the staffing adequate, but also that the people are the right ones and work well together.

Lastly, let me say that technology is key to the "Faster, Better, Cheaper" strategy. We must have adequate funding to provide a pipeline of enabling technology to feed the daring missions we undertake. "Cheaper" does not mean just cutting cost. Cheaper missions result from the use of better technology. One needs only to look for a moment at the information revolution we are experiencing. Technology is the key to it.

Our board believes mission success is achievable on what I have called daring projects if we do these things. Sure, we will experience failures -- but that is because we are challenging the unknown and we must learn as we go. Space exploration is inherently difficult.

There is not a lot that is new in these suggestions – we are underlining the need for execution of the fundamentals of project management but without a return to the old ways of excessive government oversight. "Faster, Better, Cheaper" is a great, innovative approach – it does not mean throwing out the fundamentals of project management. It means using improved processes and improved technology in a disciplined way.

Thank you for the opportunity to share this report with you today. I believe our efforts -- along with all those asked to review the recent mission failures -- will help us better address current and future projects.