TESTIMONY ON NASA FBC TASK

BEFORE THE SUBCOMMITTEE ON SCIENCE, TECHNOLOGY, AND SPACE

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March 22, 2000

Mr. Chairman and members of the Subcommittee thank you for this opportunity to summarize the NASA FBC Task results. I was asked by the NASA Administrator, Dan Goldin, to undertake this study of the Agency's implementation of Faster, Better, Cheaper (FBC) in mid 1999.

The FBC Task was conducted from July 1999 through February 2000, during which I incorporated my personal experience on the Mars Pathfinder Mission with the results of a series of interviews and workshops with representatives from NASA Headquarters, the NASA Centers, other Government Agencies, Industry, and Academia. This has led to the conclusions presented here.

· INTRODUCTION

For most of my career, 1962 to 1998, I worked on Deep Space Missions at the Jet Propulsion Labs, JPL, in Pasadena Ca. I retired from JPL in 1998.

In 1992, I was asked to plan and implement Pathfinder, challenged not only to land on Mars, but to "invent a new way of doing business at JPL."

I was to treat cost and schedule as importantly as technical and to develop and operate the mission under a cost cap of $265 million, including the lander, rover Sojourner, flight operations and launch vehicle. Project development from start to launch took a little over three years.

· SUMMARY FBC TASK CONCLUSIONS

First let me answer a question often asked:

After the Mars 1998 Lander failure and during the final stages of this Task, I was asked: Why the Mars 1998 Lander did not use the Pathfinder airbags?

In Pathfinder development, there was concern over our airbag landing approach, and we were only midway through its development when the Mars 1998 Project needed to make their landing approach decision. Since we had not completed a credible design yet, the Mars 1998

Project choose a derivative of the proven Viking landing approach—a prudent decision under the circumstances at that time.

HOW TO GET INTO THE FBC MODE—"FBC Rules of Engagement"

Some of the key elements of Pathfinder's success form the basis for the "FBC Rules of Engagement" developed in this Task:

- We were given latitude to adjust mission scope to fit within the cost cap and initiated the project with adequate reserves to handle uncertainty.
- Requirements did not change, and funds were provided at the right time.
- Team members were extracted from their institutional home base at JPL and co-located in one big room around out test bed. We sought out the best expertise inside and outside of JPL. Our team was Nationwide.
- We formed an excellent team comprised of a few old timers scarred with experience, but with mostly bright energetic youth bringing enthusiasm and new methods. Our Team is the major reason for our success.
- Each team member reporting directly to the project, removing layers of management in between, was truly empowered with cost and schedule as well as technical responsibility for their project element.
- We accomplished thorough mission, system and subsystem engineering and strict project planning, monitoring, and control.
- Open and candid communication was important inside the Team and outside as well to management, the press and public. We agreed to place our data immediately on the Internet and to have CNN show our landing to the world.
- We continuously assessed and mitigated risk throughout development and operations, and did not think for a second we could fail because we were experimenting with new ways.
- We emphasized testing and training and followed through on details.
- And, very importantly, we subjected ourselves to extensive peer review, informal interactions with experts outside the project on all important project events—the best check and balance for FBC projects.

Not surprisingly, other successful FBC Teams throughout NASA, other Agencies, industry and academia reported similar findings as to what made FBC work, especially the importance of people, teaming and good communication.

And after much debate on just what is FBC, its definition, we concluded that FBC is simply attempting to continuously improve performance through efficiency and innovation.

But in addition, there is a "Teaming Spirit" associated with doing FBC which distinguishes FBC Teams, this intangible element was made a part of the definition. On Pathfinder, all vendors,

NASA Centers and other Agencies in support of Pathfinder also got into the FBC Spirit.

And FBC equates to all of NASA, applying to all missions and work in support of missions. Other Government Agencies, industry and academia are at it too. All realize we must improve to compete in the 21st Century information age and world economy. Of all the hundreds of people interviewed during this Task, no one said we should go back to the old way. All said we need to gain from our lessons learned and improve our FBC approach.

SOME MAJOR CHALLENGES FOR FBC

- In our zeal to do FBC, we have gone too far in challenging projects to cut cost. We need to slow down some, move from a fixation on cost and near term gain, and do more careful planning.

For the 1st generation of FBC Missions, including Clementine, Near Earth Rendezvous, Lunar Prospector, Mars Global Surveyor, and Mars Pathfinder, scope fit well within cost and schedule caps. However, for some of the 2nd generation missions, the challenge bar was raised too high. The cost cuts were too much.

- FBC precipitated a major transition within NASA from few to many missions requiring many more project managers, teams, and institutional support including review teams. Management attention has become diluted across these many missions. At the same time, there is a talent drain due to retirements, downsizing, and loss to industry.

Before with fewer missions, project managers worked up through the ranks for many years with "on the job training" to gain significant experience before they became project managers. Now with many missions this is not always possible, making training, mentoring, and peer review even more important.

FUTURE FOR FBC

To take FBC to the next level will require much dedication and teaming among NASA Headquarters, the NASA Centers and its industry and academia partners. It's one thing to do FBC projects experiments, it's another thing to institutional it.

Future FBC equates to PEOPLE, TECHNOLOGY, METHODS.

On people: We must place a higher priority on acquisition, motivation, training. We must

develop incentives to attract good people and well-respected leaders to come to work for NASA. Generating interest in NASA must start early in the schools. While there is good work here, it needs higher priority. There is nothing better than involving students in real live missions, with some managed by students, with strong, encouraging assistance and mentoring by NASA expertise to give them a better chance to succeed. Let them navigate rovers on the Moon and Mars.

The results of this FBC Task need to be combined with those of the two Mars Investigations to derive a common set of FBC lessons learned and principles to form the basis for FBC Training of newly formed project teams.

On technology: Advanced technology is the "Better" in FBC and we have not scratched the surface yet on its potential. Soon projects, who now develop their communications links with their spacecraft, will be provided proven, advanced, multi-mission communications and data systems with "bug free" software—this will be like not having to build your own telephone every time you call home.

Advanced tailor-able, multi-mission micro-electronics with intelligent systems will bring the cost of small, but powerful, reliable, automatic spacecraft matched to automated, Internet driven ground support systems down to a few $ million so that universities, developing countries and companies can explore space, have their own Mars mission.

An accompanying reduction in launch vehicle costs is necessary and must be a National priority if we are to remain a world leader in space. Combined with the low cost spacecraft above, this will lead to an major move into space.

This is what NASA in the FBC mode must be about—paving the way for others to do space exploration by accomplishing high risk, but high payoff, enabling advanced developments.

On methods: Methods involves expanding the institution's multi-mission support infrastructure in support of FBC project teams.

Core FBC project teams with less project unique systems to build and aided with larger base of multi-mission support can become smaller in size. They will be supported by:

- Multi-missions pools of technical and managerial expertise and peer review experts.
- Advanced computer aided tools, processes, templates, model based design techniques, management standards and checklists, risk evaluation tools and training.
- Readably available lessons learned data bases.
- Powerful electronic information links among NASA Headquarters, NASA Centers and their industry and university partners; graphic visualization tools for virtual spacecraft design and for display of mission results.

As well as:

- The advanced, multi-mission technology mentioned above

The future for NASA is bright-- looking for life “out there” and in building the bridge for humans to space. Dan Goldin is right on with his FBC thrust. He has set the stage, created the proper environment. Now all we need to do is follow through on better implementation of the exciting roadmaps and visions that have been generated. The key word is implementation. Getting it right.