Management Challenges of Lunar Prospector

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Lunar Prospector, begun in 1995 at the front end of the Agency's "Faster, Better, Cheaper" push and launched in January of 1998, contrary to conventional wisdom, changed management horses in mid-stream. This story is about that change and the impact of changing one key management team member. Lunar Prospector (LP) was selected in early calendar year 1995 as the first competitively selected Discovery Mission, NASA's Office of Space Science. Unlike all subsequent Discovery missions, LP was deemed sufficiently mature to proceed directly to a Definition Design (Phase B) activity without going through a down selection process, competing with other missions. The six month design-Phase B activity began in April 1995, with a six month definition period, which culminated in an independent review of the project's readiness to proceed to a design and development (Phase C/D) activity in late August of 1995.

LP entered into these activities with a small, relatively well defined management team. The interaction and effectiveness of the management team on all these small, faster, better, cheaper missions is critical. Lunar Prospector, with a cost cap of approximately $63 million dollars, was very tightly constrained. Given a little over two years to complete a full phase C/D, the LP team had to deliver five new science instruments, a spacecraft, and a launch vehicle in time for launch. To meet these objectives required a management team that was compact and efficient. In this particular mission, the Principal Investigator (PI) was an employee of the prime contractor. The core management team evolved to be comprised of two NASA team members (Mission Manager and Deputy Mission Manager) and two contractor team members (PI and Project Manager). This small management team agreed to meet on a weekly basis to assess progress and accomplish problem resolution. A swift and efficient decision making process was critical to meeting scheduled milestones and maintaining budget.

The Concept Definition Phase for LP was rocky. The project was extremely tightly constrained in cost and schedule. As we prepared for the independent review that would allow us to move forward to development, several major design issues remained undecided. Three weeks before that independent review, the contractor, thankfully with the PI's strong concurrence, replaced the project manager. To LP's ultimate benefit, the new project manager was extremely experienced in doing business with NASA.

The change in the LP team dynamics with the change in project manager was nothing short of astounding. The energy and motivation of the contractor team was revitalized in a readily apparent manner. The new manager brought with him, along with a depth of experience, a policy of complete openness between the government and within the entire LP team. All meetings were accessible; all written reports, including the contractor's internal status reports to their management, were available to the government. The independent review was refocused to seek feedback from the outside team on the open design and test program decisions. The openness of the interaction between the LP team and the reviewers convinced the review team that despite the many challenges of delivering Lunar Prospector within the schedule, budget and technical constraints in place; the contractor was sincerely committed to fulfilling their contractual commitment. Based on the independent review team's recommendation, LP moved into development in October 1995. By the end of the calendar year, the invigorated team had a point design to work to, had begun long lead item procurements, and was finalizing the detailed design.

A single change in the management team had turned a project that was struggling into a fully functioning, success oriented team. The improved communication allowed the four person management team to evolve into an efficient, decision making body, that dealt with problems quickly and effectively. The implementation team responded with renewed vigor and clear

direction.

Some of the steps that were implemented by the new project manager were:

¨Establishment of a working relationship with the PI that allowed him to focus his energies on the instrument and science issues that needed his attention.

¨The inclusion of the PI in all aspects of the project in which he was interested without burdening him with every meeting or decision.

¨Weekly individual subsystem reviews that allowed design and interface issues quickly surface and be dealt with immediately.

One day a week was set aside for these reviews. Everyone on the team knew they must be available to be called into subsystem reviews to immediately work problems and resolve issues. This allowed the rest of the team to keep working on assigned tasks, but allowed the project manager to have the entire team on call to resolve problems. The emphasis of the entire project was on informed, timely decision making.
2 hour team meeting each week where the whole team received a status on project accomplishments, key issues and overall project process.

This also allowed coordination to occur for specific meetings or problems with all the parties in the room at once. Cost and schedule concerns were openly and freely discussed, and the project manager sought input from anyone who wanted to either comment or ask questions. An open action item list was statused and updated in that meeting. Information was actively distributed, not hoarded.

¨A task driven system of measuring performance that set at least monthly milestones for each subsystem and major task to assess progress.

This was not a full up performance measurement system, but a method of monitoring progress without the burden often associated with these systems. If milestones began to fall behind, the management team knew it immediately from the Monday subsystem review.

¨Weekly evaluation of charge numbers to determine which organizations were charging to the project and to provide a sanity check regarding the appropriateness and reasonableness of the charges.

Were there tasks ongoing in those shops or groups? Were those skills really being used at that time? In an organization of any significant size, controlling charge numbers is critical to controlling costs. There is a great temptation on the part of some support organizations in large companies to try and generate a fixed level of income on a weekly basis from every charge number they can identify. Such issues were dealt with on the same day, and parties were required to support specific charges for that week or remove them.

¨Make or buy decisions based on cost, expertise and speed.

The project manager made an assessment on what tasks should be contracted out. Certain organizations within the company were not to be used due to backlogs, efficiency (or lack thereof) and/or cost. If subcontractors could provide a given effort more quickly, then extra cost for that specific item was traded off against the "marching army" cost.

¨Subsystems level Preliminary Design Reviews (PDR's) and Critical Design Reviews (CDR's).

Subsystems were allowed to go through individual PDR/CDR and allowed to move ahead if there were deemed to be no implications to the rest of the system. This allowed portions of the project to move ahead if they were ready to proceed. This practice helped control cost and minimize potential schedule slips.
Focus for the entire management team was on timely, informed decision making. The entire contractor team was empowered in this process, and the energy and effectiveness of the team was evident. The subsystem reviews allowed the project manager to manage each particular subsystem in a manner, which was effective for the individuals involved and for the issues, related to that specific element of the project. Some individuals and subsystems required more direction than others, but this was managed in a manner that was both efficient and transparent to the rest of the team.

The weekly management team meetings became a forum for open discussion of issues and an efficient distribution of the management team's effort. This paved the way for better communication and reporting with the NASA Program Office.

The change of one key individual in the management team completely changed the dynamics in the group. The outlook of the entire Lunar Prospector team, both NASA and contractor was affected by the new team member's approach. The success of the mission is the biggest demonstration of the results of the changes that were made. LP was launched successfully from the Cape in January 1998. The one year primary mission was completed in January of 1999 and the six month extended mission ended with the deorbit of Lunar Prospector into the area of the lunar South Pole at the end of July 1999.

My Lunar Prospector experience was an extremely valuable one for me. I learned an incredible amount about building hardware, managing missions and people and participated in the process with some incredibly talented managers and engineers both within NASA and at the contractor's facility. The opportunity to participate in a project where the approach was focused on the best way to assure mission success for LP rather than an exercise in the way that things have always been done proved to me that there are many things we can do differently. The challenge is to tailor the management and technical approach to the complexity and risks of that mission, without compromising mission success.