

## Cost Control

Better cost control is a must in the future on NASA's programs. The International Space Station (ISS) is under fire because of cost overruns. There are a lot of legitimate reasons for cost overruns but none are viewed as acceptable. As a result of overruns on the ISS, our Research Program is being cut significantly. Overruns can often result in programs being canceled and great disappointment to all concerned.

I suggest that we at MSFC look hard at how we run our programs and apply good management processes to attack this issue. As we start the Space Launch Initiative (SLI) contracts, it is imperative that we use good cost-control methodology.

First of all, cost overruns can come from many sources. One cannot just have great cost control processes in place and expect things to go well. The best cost-control process cannot overcome poor design or poor systems trades that lead to the wrong approach. Therefore, the first thing in cost control is to do the whole job right from the start.

Let me share what I think we need to do on projects:

1. Start with the premise that good project management addresses all aspects of a project. All four elements of a project must be properly addressed: technical, schedule, cost, and risk. All four must be addressed on a regular basis or overruns can and will occur.

Risk in the Mars Climate Orbiter (MCO) report was called the fourth dimension of project management. Risk must be addressed throughout the project life, and it must address the other three elements. Thus, on day one and every day thereafter, a project addresses risk from a technical, schedule, and cost basis. Risks must be identified, tracked, and mitigated. "What are you going to do about risk?" is a constant question that must be asked.

2. Good systems engineering processes must be used throughout the project life cycle. Good, well-run projects start with rigorous attention to the mission success criteria coming up with the minimum statement that would be considered success. The top requirements on the project, along with the mission success criteria, are then agreed to by the "stake holders." Then the project team works the system trades to find the best system approach using rigorous trades study methodology like the Keptner Trago. Jumping to a point design is a very risky method too often used in NASA. Requirements are flowed down from the top requirements to the lowest level. The verification of these requirements is then determined starting with the lowest level and working back up to the top requirements.
3. Technical Performance Parameters (TPMs) are tracked monthly throughout the life of the project. TPMs are a set of parameters that are the drivers on the project. On a flight project, weight and power typically appear as TPMs but other parameters are

needed to make sure the end result is met based on the specific project. It is worth the time to develop good TPMs. The expected TPMs are projected in time across the project schedule. When the TPMs exceed expectations, actions are taken to get them back in line.

4. Successful project management addresses Planning, Organizing, Staffing, Directing and Controlling (POSDC).
  - a. Planning - Detailed planning is key on a project. Planning involves schedules but also what documentation is required and when. What is the expected content of the documents? What is the staffing plan? Who and when? What reviews are planned, the contents, the review team makeup, and when will they be held?
  - b. Organizing - What is the team makeup and who reports to whom? Is the approach to use an Integrated Product Team (IPT)? Will the Government and contractor be working together on the same IPT?
  - c. Staffing - What are the positions needed and what qualifications/level of experience are acceptable? Do we have the right people on the Government side? Do we agree with the selection of key people by the contractor? Does the contractor have the proper bench strength? What training and team building are needed, and what is the plan to get it?
  - d. Directing - What are the lines of communication? What process is in place for management at all levels to engage - institutional as well as direct? How are concerns raised and documented on the project (e.g., the navigator on MCO)? What independent or nonadvocate reviews are planned from the start and accounted for in the schedules so the team is not feeling put upon?
  - e. Control - What controls are in place on the project to control changes (Change Control Board)? Is configuration management in place and tracking along? What is the process for controlling cost?
5. Let me now address cost control specifically. Once one has in place the four items above and cost risk is being addressed on a monthly basis, then we can talk about cost-control methods.
  - a. Controlling cost on a project starts with the need for having the right cost/price in the first place and then incentivizing the contractor to make the right decisions on the project as the project is performed.
    - Do we have the right contract type (cost plus, fixed price)?
    - Do we have the right incentives on cost (profit sharing, award fee)?
    - How was the contractor price derived? Bottoms up? Top down?

- What Cost Estimating Relationships (CERs) were used and why are they the right ones?
  - How often will the contractor provide an Estimate At Completion (EAC)?
  - How rigorous is the change-control process to be monitored?
  - Has the contractor cost been rigorously analyzed by NASA? Do we agree with the contractor analysis - have we run our own "should-cost" analysis?
- b. Regarding scheduling - Do we have the right process in place? Is the contractor held to a "rolling wave" accountability on detailed near-term schedules? It is good to have nice master milestone schedules but they do not work in holding the contractor or Government accountable for progress on a monthly basis. "Rolling wave" means that there are very detailed schedules for near-term activities (say the next 3 or 4 months). These schedules have "inch stones" not milestones. The performer is held to report how many milestones were met in a given month vs. how many were planned. With this type of inch stone planning and tracking it is readily apparent as to how well the project is being executed. Every 2 months the next 4 months are planned in detail - thus the "rolling wave" concept.

When issues arise, detailed plans are put in place with detailed schedules to resolve the issue. These plans might include parallel paths to success. If one option does not work, others are brought along in parallel to increase the likelihood of success. This is, of course, a question of how much one can afford vs. the risk of going down a blind alley and impacting schedule.

The use of Program Evaluation and Review Technique (PERT) charts that show inter-relationships is a good method if there is a lot of interaction.

- c. Tiger teams to resolve issues are often a good approach. - What is the philosophy of the project regarding tiger teams?
- d. In my opinion, earned-value reporting is a must to control cost. The cost may be tracking; however, if the technical issues are not being resolved and or the schedule is slipping, the project cost is in an overrun situation but not acknowledged by the team. Put a form of earned-value tracking on every project.
- e. Headcount control is the best method for controlling cost. Plan the staffing level vs. time, and then track it every month. If problems arise and more staff is needed to resolve the issue, know the staffing plan must be revised and that the cost will increase accordingly. No project should run without headcount tracking. Planned vs. actuals on a weekly basis is needed, but if not weekly at least monthly. No contractor can do business

- without having a financial system that gives them weekly cost and headcount tracking.
- f. Cost estimating and tracking tools are essential. Do you have the right tools?
  - g. Is the reserve adequate and how do you intend to manage reserve? The reserve must be in the hands of those who can make timely decisions to deal with risk mitigation effectively, but not too low in the organization such that the reserve is expended without considerable care.
  - h. Who on the project is going to be the Ruthless Cost Czar - the Mal Peterson of the project? Every project needs someone who has cost high on their priority list and can ask hard questions. This can be the project manager but does not have to be. Someone needs to do "search and destroy" with regard to cost.
6. Have you read the MCO, Mars Polar Lander (MPL), Faster, Better, Cheaper, and NIAT reports - lessons learned? Every project manager and team member on a project needs to read about how things went wrong and make sure the lessons are being applied on their project.
  7. Senior Management at NASA and the contractors need to be more involved in cost control if we are to improve. Like everything else, what senior management emphasizes the workers emphasize. Senior management review on a regular basis must be accomplished. The red, yellow, green stoplight charts are one way to communicate to management the status. Getting the senior management of the contractors to a quarterly review can do wonders for improving the emphasis on cost control.
  8. Lastly, I would like to make the case for a checklist - a la the MCO report. A pilot does not take off without going through the checklist and it does not matter how many times he/she has taken off. Why don't we apply the same discipline to project management as it applies to cost control but in a larger sense to all of project management?