Memo

To:	Lockheed Martin Spacecraft Design Team
From:	▮▮▮▮▮▮▮ Project Systems Engineer
CC:	Lisa Guerra, NASA HQ
Date:	January 5, 2006
Subject:	Design Strategy for Discovery Program Announcement of Opportunity

[handwritten margin note: good format and tone of memo]

Objectives

First off, I hope you are all excited to be a part of this design effort in response to the 2006 Discovery AO. ✓
It is a remarkable opportunity, and I am proud to serve as your systems engineer. Before our official kick-off meeting next week, I would like to outline my strategy for successfully designing the spacecraft in order to produce a winning proposal. Please read this document and come to our kick-off meeting prepared with any questions you may have.

Starting the design process: Mission Scope

✓ As you may know, the mission scope has partially been determined by the PI and science team. The needs, goals and objectives handed down to our team must drive all of our work from day one through proposal submission. We will reference these guidelines throughout the design process to gauge our progress and correct our design course.

Our first task is to review and become familiar with the needs, goals, and objectives. Every team member must have a clear understanding of these guiding principles and agree on their meaning. If the documents have errors or vague wording, they must be fixed at the start of the design process. At our first meeting we will discuss the needs, goals, and objectives to make sure everyone is on the same page.

[handwritten margin note: es, you ud to gwe eam homework efore first ttg (like ead AO, scope) look @ heritage mission? etc.]

After the mission set forth by the PI and science team is understood, we must set out to complete the mission scope, which will drive the rest of the design process. Adding to the needs, goals, and objectives already written and reviewed, our team will list the assumptions, constraints, and develop a detailed ConOps. The announcement of opportunity will be a primary reference for this task. The completed scope will set limits on our design by telling us when to stop. Writing the scope will also ensure that each member of the team has a clear understanding up front of the mission we are designing.

A framework for design: System Architecture

The next step for the team will be to create the system architecture as a framework for the design process. The major items in the systems architecture are the system hierarchy or product breakdown structure (PBS) and work breakdown structure (WBS).

The PBS will break the mission into more manageable portions from the top down. Our goal is to map all products needed down to the level that a cognizant engineer or manager can take responsibility for each product. The PBS will also show how the elements of our project will be integrated. Because of the cross-disciplinary knowledge needed for creating the system hierarchy, the project management team will first create a top-level PBS, which the group leads will approve. Then each group will integrate their additions

to the PBS down to the subsystem level as much as possible for a first iteration. Upon submission of all system hierarchy additions from the separate disciplines, a baseline system hierarchy will be integrated by the system engineering team, which will be submitted for approval by the group leads.

As an augmentation of the PBS, a work breakdown structure will organize the tasks in the design process. Similar to the PBS, the project management team will create the top levels of the WBS and request submissions from the group leads for the lower levels. Creating the WBS will consist of adding the service elements necessary for each level of the PBS until all known work necessary to complete the project is outlined. The PBS and WBS will be updated as the design progresses.

Requirements

As most of you know from experience, requirements development is a very important step in the design process. The quality of the requirements we write will have a dramatic effect on the overall outcome of our project, so it is important that the entire team take this step very seriously. Using the PBS as a guide for organization and numbering, the project management team will derive the top level requirements from the mission scope. Each work group will then write an initial set of requirements for their portion of the mission or spacecraft and integrate them into the overall requirements document, still using the PBS as a guide. Refer to the design team standards for requirements writing guidelines.

yes, but also from AO that specifies LV which sets mass/ volume reqts

After the preliminary requirements have been written, they must be validated. Multiple meetings will be held to discuss and review requirements until agreement is reached that the requirements set is complete for that stage in the design process and that the requirements match the original intent of the mission.

Selecting Candidate Solutions

This section would be the focus of attention

With a baseline set of requirements to refer to, the design can move into the next phase of selecting several candidate solutions. This process consists of deciding figures of merit, reviewing heritage designs, and formulating candidate solutions.

Before deciding on the candidate solutions to the design problem, it is necessary for the team to determine the relative importance of the different spacecraft attributes we are designing for. These figures of merit are or measures of effectiveness will guide our choice of the best candidate solutions.

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Every spacecraft mission has some similarities to previous spacecraft that have been designed or flown. Our task at this phase will be to spend several days to review previous spacecraft designs both in-house and externally to determine any technology reusability. Heritage review also will help to spark new ideas for candidate solutions by improving on previous designs.

Using the figures of merit and heritage research as measures, a small number of candidate solutions that meet the requirements will be selected by the project management team with input from all levels of the design team. These candidate solutions will progress to the next stage of the design process to select a final design solution.

Selecting the Design Solution

To assist in the selection of the design solution the Analytical Hierarchy Process (AHP) will be utilized. The design team will be split into several multidisciplinary groups, each assigned to a different candidate solution. These groups will then use the figures of merit selected previously to rate the candidate solution characteristics and fill the AHP matrix. Compiling the results for each candidate solution in the final AHP matrix, the systems engineering team will validate the AHP process and confirm the selection of a the design solution.

Detailed Design

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With a final design solution chosen, the design team will next perform the detailed design work to meet all the requirements originally set forth. We will work in our respective design groups, and the group leads convene with the system engineering team for regular meetings to update on progress and schedule. As the design progresses, more detailed requirements may be written, and as more information is gathered, old requirements may be changed. This process will continue iteratively until the final proposal submission on April 5th.

Concluding Remarks

Thank you for your cooperation in implementing this design strategy. I look forward to working with each of you in the coming months. Feel free to stop by my office anytime.

Not quite. The iteration would probably stop a month before the proposal would be due.
Need to do cost estimate; write proposal; red team review; and get management approval

You could have also included reference to the next mtg and what you expect as deliverables by then.