



## WELCOME TO Team I

### **A New Metaphor**

Created at JPL in 1997, Team I is a concurrent engineering design environment for the development of scientific instruments, with the bulk being space instruments. Team I is JPL's edge in developing instruments in a shorter amount of time and with within tighter budget constraints. Through combining sound engineering practice with high-end CAD tools, the group creates detailed designs faster than conventional methods. Team I's broad range of engineering services include technical concepts, studies, designs, proposals, reviews and benchtop prototypes. Our products range from illustrative figures and instrument characteristics for proposals and studies, to full designs for rapid first-cut instrument hardware development.

Team I works with principal investigators, program offices, and the JPL community using their science/functional requirements to develop instruments and payloads for mission concepts or technology developments. We also interface with Team X and Team G to pass payload requirements for full mission development.

Payloads, worked on by Team I, can vary from traditional planetary cameras to complex insitu chemistry instruments. Development work has also included earth science remote sensing payloads to origins mission instruments. Team I has covered a wide variety of tasks for the space science community.

As a group of experienced engineers, Team I recognizes orbital, launch vehicle and spacecraft constraints on instrument design. We understand the various analyses—mechanical, thermal, electrical, optical, etc—inherent to remote sensing, in-situ, surface and subsurface instruments. Team I synthesizes the design requirements of these different subsystems to fit specific mission applications.

Subsystem designs & components packaging are developed within mass, power, volume, performance, cost and risk constraints. With this global approach, Team I effectively combines the analysis and designs of these different subsystems to fit defined mission applications.

For customers moving forward with their instrument development beyond the concept and/or proposal phase, Team I can provide continued support beyond pre-phase A all the way to PDR. Project manager must realize that their own team members will populate the Team I crew, thereby guaranteeing best possible usage of the Team I resources and capabilities. The instrument designs and developments would be resident in the Team I database from earlier work. The Team I members, already familiar with your instrument

and represented from all Divisions, can work with your implementation team, using the concurrent design process, to achieve your milestones more effectively.

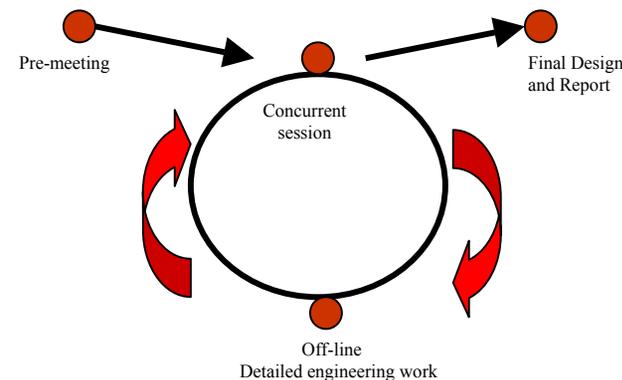
### **The Process**

Team I utilizes a style of engineering that alternates concurrent design sessions with offline work. There are ten engineering stations in the current Team I environment. The Principal Investigator and other key participants sit at the central table with the engineering lead, who conducts the concurrent sessions. (Include graphic of the room layout)

Team I service requests can be made over the web at <http://teami> or by contacting Team I directly (see back panel for contact info). After the initial request has been made, a Pre-Meeting is conducted with the customer to determine product needs, deliverables, and required resources. Once a customer's inputs and schedules have been identified, Team I transitions into the Session activity phase.

During the subsequent sessions, with customer present, product design is visualized using CAD tools projected onto a large screen. Issues and trades are worked at the subsystem level by the key decision-makers. Action items identified during the concurrent session are worked off-session by the team between sessions. This iterative process continues until the design is complete based on customer needs. Ultimately, a Team I package is delivered to the customer. This process can shorten the time for proposal development plus aid in design and fabrication when a project is funded.

Some customers would like to take their instrument designs to the demonstration level. Team I can provide services to help develop your designs to a benchtop prototype.



### **Products**

Once development is complete, Team I provides technical descriptions of instrument and/or payload designs in the form of proposal quality figures, plots, and tables. Depending on the product desired, a report document is generated showing assumptions, requirements, analysis, and specifications.

*We supply information in the following areas:*

- Optical, mechanical, thermal, electrical and system design and /or analysis..
- Focal plane, signal chain, data processing and control systems
- Orbital and attitude control systems
- Technical risk evaluations and technology needs

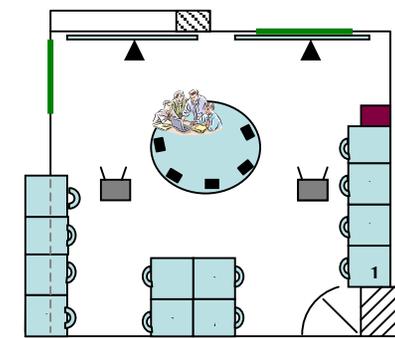
*Team I also provides accurate estimates of instrument resources:*

- Track mass, power, volume and data requirements.
- Cost estimates via two methods—parametric models and grass roots
- Schedule for detailed instrument design and development
- Functional block diagrams for subsystems
- Instrument performance parameters

### **A Unique Environment**

Senior and young engineers work together in this dynamic environment. Senior engineers bring wisdom and flight experience to reviews and instrument studies. Young engineers with solid computer skills are exposed to a wide variety of instrument types and applications in a relatively short time. They bring new ideas to concepts and design activities. By teaming them with senior engineers, they get early exposure to design approaches suitable for flight hardware.

An effective approach to instrument design in a resource constrained environment. This approach maintains an experiment-wide orientation from end to end. The function and cost of the entire instrument is kept in front of the design team at all times. Trades are made to fit feasible engineering solutions and science goals into the resource constraints of the job. A standard design team exists for supporting a variety of design studies, and therefore, working with other concurrent design teams can optimize an entire mission.



## Advantages

The Team I approach to visualization through real-time design files helps identify and solve problems more thoroughly and quickly. A single common CAD database is utilized at all times. This eliminates design errors and wasted time due to incompatible subassembly designs. Real-time design and analysis is possible. Some design changes and trades can be made during the concurrent sessions while the key decision-makers are all present. Integration of instrument to its platform—spacecraft or probe—is routinely included. Beyond this level, simulation analysis of instrument in orbital environment can be included.

Team I also offers flexibility and responsiveness. Management issues are worked in parallel with the technical design. Interface definitions and documentation are a natural part of the design process. Relative roles and interfaces between team members are worked along with the technical solutions. Cost and schedule for hardware can be worked.

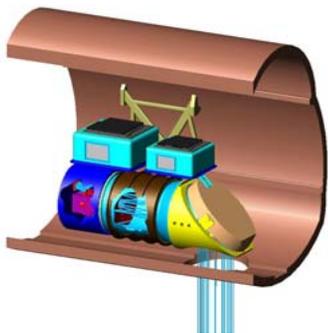
### An Environment for Concurrent Engineering

#### Benefits

- Three fold reduction time vs conventional engineering development methodologies
- Three fold reduction cost vs conventional engineering development methodologies
- Increased number of designs per year
- Able to look at more trade off scenarios
- Improved accuracy vs conventional engineering development methodologies
- Improved communications across engineering disciplines

#### Tools

- Room set up to foster collaborative design
- Workstations networked to server
- Switched video displays
- Specialized and COTS CAD software
- Real time technical support



## Team I Services

**Concept:** Team is briefed on General objectives and then “brain storms” to identify most promising approaches and characteristics. This usually does not involve formal sessions and provides definitions suitable to most effectively initiate a study.

**Study:** The team is briefed on specific concept or technical problem to be addressed. A specific concept is analyzed for practicality and predicted performance. Configurations are developed and result outputs tend to be specifications and block diagrams. Technical problem trades are analyzed for recommended alternatives.

**Design Development:** The team is briefed on study results or a summary of function configuration and design requirements. CAD designs are performed in a concurrent environment and proceeds to the level specified by the customer. Suitable levels can be for a proposal to a PDR or proof of concept presentation to fabrication drawings for prototyping.

**Proposal:** The team is briefed on proposal opportunity and the specific deliverable required. The proposal manager/team describes the instrument/payload requirements and design approach needed. Team I provides a minimum salient engineering details for a selected portion or problem within the proposal, all the way to full proposal support for the technical, management, and cost sections of an instrument or payload proposal.

**Review:** The team is briefed on background objectives and any areas of specific concern relative to the design or proposal to be reviewed. Depending on customer request the design proposal can be reviewed for generic technical feasibility or CAD validation of design performance, specifications, and requirements. Cost, scheduling, and implementation risk assessment can be provided also.

**Prototyping:** The team is briefed about the function or subassembly fabrication design to be prototyped. The testing & validation parameters are also defined if required. The design/drawings are reviewed and facilities identified for the prototype fabrication. The resulting parts are assembled and checked for fit as well as function. Either Team I or the customer can provide for validation testing.

## Contact Info

### Team I

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