Early System Strategies and A-Team Instrumentation Catalog

At the NASA Jet Propulsion Laboratory

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The Innovation Foundry Architecture Team, "A-Team", develops new mission and study concepts at NASA's Jet Propulsion Laboratory (JPL). The A-Team holds workshops in which subject matter experts are brought together to mature ideas from early ideas into concepts by evaluating the relevant trade space. Missions closer to operation may be engineered by a group called Team-X. Team-X quickly assembles mission proposals using a team of specialists. The instrumentation catalog is a convenient tool available to A-Team members to reference information about JPL-lead Space-borne instruments as background in future missions.

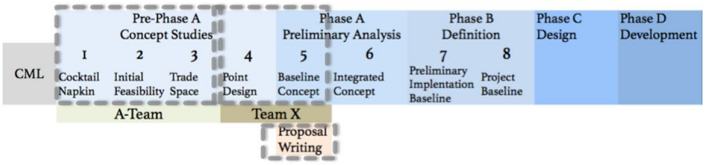
CONCEPT MATURITY

For an idea to make it into space at NASA's Jet Propulsion Laboratory (JPL) it must be diligently planned and carefully operated. The pros and cons of possible features of studies and missions must be evaluated and optimized in order to be competitive projects that receive NASA funding. This type of evaluation is a study of what is called the trade space.

To do this type of trade space analysis, scientists, engineers, and systems engineers work together. At JPL, some of those collaboration platforms include working in teams such as in the Innovation Foundry Architecture Team, which calls itself the "A-Team," as well as in Team-X.

Mission phases are outlined by NASA in pre-phase A, followed by phases A through F. Concept maturity happens in pre-phase A. While JPL follows these guidelines, JPL has subdivided some of the earlier steps into Concept Maturity Levels (CML) through phase B. These stages are broken down in table 1 through stage D, along with were the work of the A-Team, Team-X and proposal writing fit in. Phase E is the operation and data collection of the missions and phase F is the closeout stage where data is archived and missions are decommissioned.

Table 1: Mission Development Phases



A-Team clients include scientists and engineers throughout JPL and Caltech, the University that founded JPL. A-Team clients come to evaluate the trade space of both future missions and studies. Background information, session summaries and presentations, as well as final reports are compiled, produced and provided to all workshop participants.

A-Team study participants meet in a dedicated space called “Left Field.” In Left Field, new and sometimes wild ideas are encouraged and tools such as seemingly endless whiteboards and crafty toys are available to spark and portray various creative idea contributions.

A-Team works with studies and missions starting with the “Cocktail Napkin” phase. At this point, an idea could literally be drawn out on a cocktail napkin (CML 1), hence the name. This is where scientists and engineers just began spelling out their idea.

Subsequently the reality of their idea would be worked out in an “Initial Feasibility” stage, (CML 2), and finally the collaboration of A-Team session participants work together to sort out the best tactic for the client to start a more detailed plan of their concept in CML 3.

In Team-X, missions are planned into proposals. Team-X sessions are held in a room much like a control room where specialists hold their unique stations to be on hand and in the same room as the rest of their team. In Team-X, clients are usually a group that includes primary mission participants such as the Principle Investigator, project scientists and system engineers.

Both A-Team and Team-X sessions take place over approximately one to three days at half to full day blocks with closely regimented schedules to encompass the necessary work.

INSTRUMENTATION CATALOG

My work involved participation in two A-Team studies as well as the production of an instrumentation catalog of JPL-led space borne instruments. This catalog will serve as one of the background tools available through the A-Team to study participant and A-Team members. The catalog resides in A-Team’s internal wiki, which was first launched in 2014. The instrumentation catalog uniformly presents instrumentation information making finding specific data on included instruments quicker and easier than the previous method of searching articles about.

Much of the included information was drawn from the NASA Instrument Cost Model (NICM) VI. NICM VI is the sixth edition of a cost model that utilized a great amount of detail about NASA-wide instruments to project estimated fiscal impact of future instruments. Other instrumentation information was obtained from articles, papers, websites and presentations by the Principle Investigators of those instruments.

FUTURE INSTRUMENTATION CATALOG DEVELOPMENT

As this catalog resides in the A-Team wiki, the plan is that it will grow to encompass more entries and tools by its users. Some hopeful future tools include instrument comparison diagrams. For example, if session participants were to question how launched mass spectrometers changed weight or power consumption over time, such a plot could be produced. In addition, if they were to question how much do launched mass spectrometers typically weigh? Then rather than searching a few mass spectrometer entries, such a diagram could be generated. Very early diagrams have been posted, but no such tools exist yet. In the future, I hope that NICM data and this catalog could sync to keep the latest information available with least amount of input work. Users could then add information not in NICM as required.

CONCLUSION

I observed two A-Team studies, one of which I was a participant and one Team-X study. While I cannot discuss the details of these studies, their efficiency was fascinating and the process was incredibly focused. This experience opened me up to systems engineering as a potential career path in the future and allowed me to see different facets of work at JPL.

ACKNOWLEDGMENTS

Witnessing an idea make its way into a mission and a study was a fantastic experience that I feel incredibly fortunate to have. This process allowed me to see the distinction between scientists, engineers and technologist while they all work together.

For this opportunity, I am incredibly thankful to my teachers who have helped me learn some of the early information I needed to keep up with these discussions, namely my physics professor Dr. Kiley. For giving me the opportunity to get my foot in the door and for guiding me throughout these amazing opportunities, I thank my co-mentors, Michael Mercury and Ernesto Diaz. For organizing this internship opportunity fabulously, I thank Paul McCudden.

REFERNCES

[1] *NASA SPACE FLIGHT PROGRAM AND PROJECT MANAGEMENT REQUIREMENTS*, NASA, 12 Dec. 2012. PDF.