



Large Mission Concept Studies for the 2020 Decadal Survey

Discussion Items

October 2016



Re-cap: Objectives

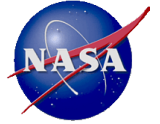


- **Prime objective**
 - Achieve a better understanding of technical, cost-risk trades and the impacts on the large concepts
- **Approach for achieving the prime objective**
 - Help study teams to understand cost and risk implications of their mission architecture choices
 - Help study teams to better distinguish between areas for deeper engineering and areas where rules of thumb can suffice
 - Aerospace Corporation to provide independent guidance and suggestions to the study teams for consideration in reducing the technical and cost risk of the engineering elements.
 - Allow Aerospace to better understand mission concepts, technology requirements and technology maturity as the studies progress, without commenting on the science merits and without creating a conflict of interest situation with National Academies
 - The support will be provided in two phases as described in the following charts
- **The cost of this support is provided through the PCOS/COR Program Office and individual study funds will not be used for this support**



Aerospace Tasks:

Phase 1: August 2016 – June 2017



- **Risk and Cost Driver Identification**
 - It is anticipated that each concept team will have a range of technical options to best determine the desired cost or budget target for the desired science goals. Aerospace will attend meetings of the SDT teams to understand key science requirements and potential impact on the concept design.
 - Aerospace will offer periodic assessments, as appropriate, of top technical and programmatic risks and identify key cost drivers.



Aerospace Tasks:

Phase 2: June 2017 – Dec 2018



- **Trade Study Support**
 - Focus on trade studies for a baseline concept design
 - Support the tailoring of the CML4 for each study team
 - Offer specialists for more in-depth review at suggested “deep-dive” sessions in top technical risk areas and assist in trade studies to provide focus in development of more mature point designs.
 - Additional deep dive meetings will also be supported where technology must be matured for the mission concept.
- **Some of these activities may be pulled forward depending on the needs of the team**

Recent Activities

- **Aerospace has had a series of initial meetings with each of the four teams**
 - LUVVOIR, HabEx, XRS, Origins Space Telescope (OST) (formerly Far-IR)
- **Each team has sought additional guidance on rules of engagement, ways to seek Aerospace consultation, frequency of engagements, as well as budget**
- **Aerospace has agreed that it is necessary to provide the teams with additional guidance**
 - Developed a list of consultation activities
 - Also recommending list of meetings, deliverables
 - Revisiting the task funding profile in light of these items



Consultation Activities – Phase 1 & 2



- **Discuss the CATE - what it is - at the PAL and November F2F meetings**
- **F2F meetings and presentations (~3 per year)**
 - Pause & Learn Meeting at HQ – October 20th (Bob Bitten/Angie Bukley)
 - Aerospace Briefing on CATE process -- November F2F
 - OST F2F – Boulder, CO on 2-3 November (Bob/Angie)
 - LUVOR and HabEx F2Fs the week of 09-11 November in New Haven, CT (Bob/Tiara)
 - X-Ray Surveyor F2F - Washington DC on 14-15 November (Bret/Tiara)
 - March F2F; June F2F, Sept F2F participation activities and products TBD
- **Cost and Risk Coaching (at key decision point milestones for each team)**
 - Review technical items that are technology development drivers
 - Assess risk drivers
 - LV vehicle feedback
 - Feedback on trade studies for a baseline concept design
 - Support the tailoring of the CML4 for each study team
 - Assessment of requirements that are driving the cost/design choices
 - Cost implications of choices - key cost drivers



Consultation Activities – Phase 1 & 2 (cont.)

- **Aerospace Initial Observations Review, Working Meetings & Briefing – February or as add-on to March F2F**
 - Cost-risk feedback, technology development feedback
 - Feedback prior to or/at the March F2F
- **Products/Assessments:**
 - Frequently Asked Questions (FAQ) Document
 - Initial FAQ by 1 December, “living” FAQ guidance document
 - Includes Margin Guidance
 - Includes Examples of Technical parameters needed
 - Initial Observations Briefing – February/March
 - Cost and Risk Coaching (at Key decision Points and/or to inform key trades)
 - Independent Technology readiness level assessment and/or engineering/manufacturability readiness assessments



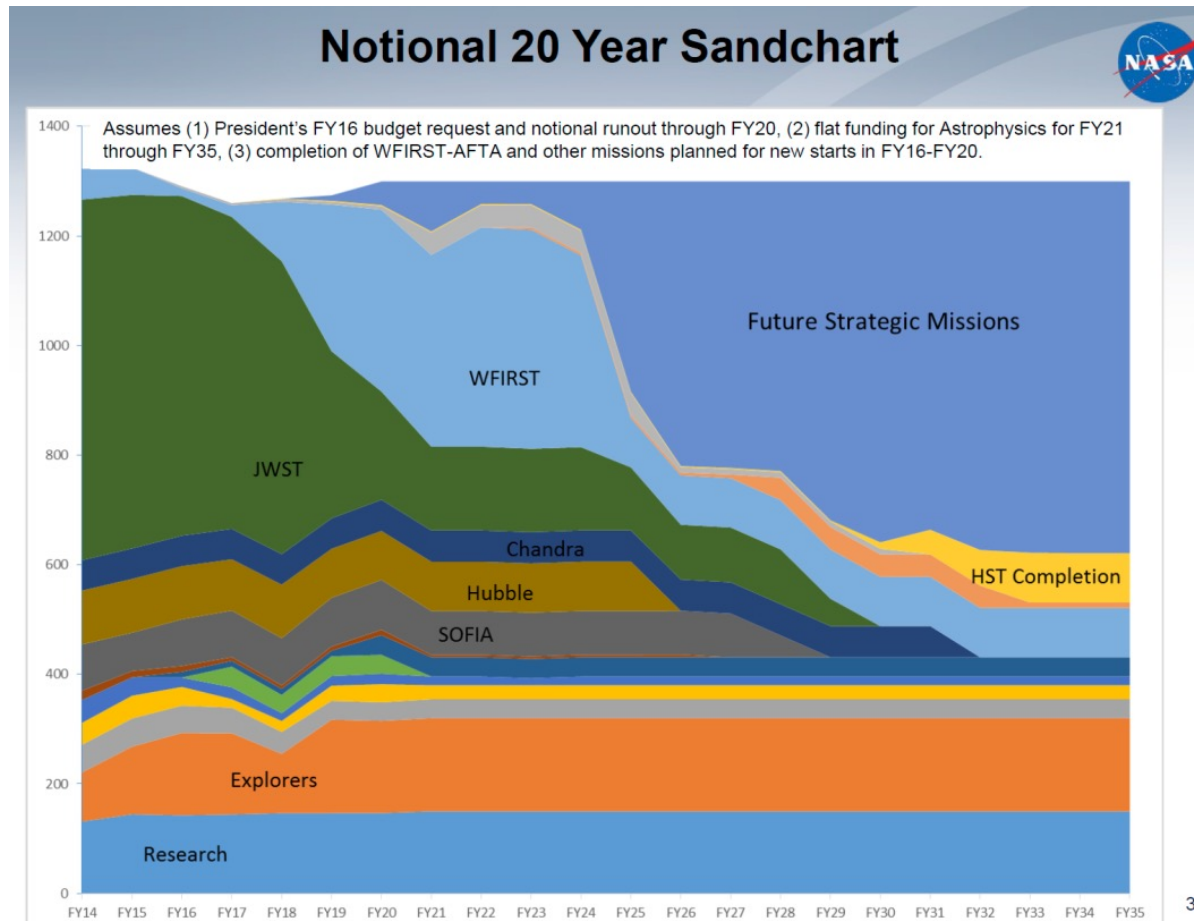
Considerations for Trades & Costing



- **Launch Vehicle**
 - May want to look at trade of maximizing science on existing launch vehicles as well as trades beyond current state of the art vehicles
- **On-orbit Servicing**
 - Development cost of including provisions for on-orbit servicing will be part of cost of mission
 - Cost of future operational servicing would be outside of budget
- **International Partners**
 - Missions will be costed as a complete project and elements will be subtracted as international partnership is acknowledged

Budget Considerations

- **Consider Potential Available Funding***
 - \$400M - \$500M could be made available annually in FY25 and beyond which would require 10 years to fund a \$5B mission



* Note: As taken from slide 37 of NASA Townhall Meeting, AAS 227th Meeting, Jan 2016, as presented by Paul Hertz

- **Concept Descriptions**
 - MEL & PEL at spacecraft/instrument subsystem level
 - Technical performance characteristics of spacecraft subsystem (e.g. pointing accuracy, BOL array power, downlink data rate, etc.) and instrument (e.g. field of view, spectral resolution, peak & average power and data rate, etc.)
 - “Ideal” list of parameters can be provided for guidance if helpful
- **Project risks**
 - Standard 5x5 matrix with description of risk
 - Ideally, rationale for both likelihood and consequence values

Initial Observations Deliverable

- **Aerospace will conduct an “initial observations” activity to provide an initial assessment of cost risk**
- **Initial observations briefing will consist of:**
 - Summary of our understanding of the concept
 - Assessment relative to available launch vehicles
 - Top technical risks and concerns
 - Other potential risks and concerns
 - Cost considerations/recommendations
 - Comments on project’s own cost estimate (if available)
 - Remaining challenges
 - Recommendations on how to potentially address risks or other challenges



Guidelines for Engaging Aerospace



- **Study teams to include designated Aerospace representative on the mailing list for STDT and Engineering team meetings**
- **Study teams may make direct contact with Aerospace to arrange a consultation, as per the scope described on previous pages; contact Debra Emmons, e-mail: debra.l.emmons@aero.org or Zigmond Leszczynski, e-mail: zigmond.v.leszczynski@aero.org**
- **Study teams must inform DSMT (through the Astrophysics Program Scientist) whenever a consultation is arranged with Aerospace**
- **DSMT reserves the right to disallow a consultation if**
 - The consultation purpose is out of scope of Aerospace task
 - The consultation topic will create a conflict of interest situation for Aerospace with National Academies
 - Aerospace is evaluating creation of a separate CATE team firewalled from these NASA commissioned study activities
 - The consultation will exceed the allocated budget for Aerospace task