Mission concept planning: Flagships and probes

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ExoPAG #5

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Purpose of this talk

- Describe ExEP notional plans to:
  - Carry out the “New Worlds” (flaghsip) mission concept development called for in Astro2010.
  - Mitigate the risk that a mission as envisioned in Astro2010 (large flagship) may be unaffordable, even in the next decade, by carrying some “Probe-scale” mission concepts in the portfolio.

- Discuss the role of community and ExoPAG in these plans, and enlist participation.

- CAVEAT: the budget environment is unstable and unpredictable. Our plans are notional pending budget developments.

Background

- Astro2010 called for development of enabling technology and mission concept for a New Worlds (Flagship) habitable planet direct detection and characterization mission for 2020 Decadal Survey. Plans for those activities were discussed with ExoPAG in January and June 2011.

- ExEP identified a program-level risk that even with a sound concept and technology, NASA might be unable to fund such a mission in the decade of the '20's. ExEP adopted a mitigation plan to develop parallel Probe-scale concepts as fall-back options.

- This approach was presented to APS in September, and endorsement of the approach and involvement of ExoPAG (and new SAG) in its execution was received.

ExEP Plans to Implement NWNH Recommendation (repeat from ExoPAG #3)

- Continue technology program to prepare NW for 2020 Decadal.
- Continue precursor science in exoplanet census and exozodi/disk environments: (Kepler, LBTI in ExEP; Explorer)
- Develop NW mission concepts for leading technologies (2-3).
- Submit for mid-decade review.
- Mature NW mission concept(s) for 2020 Decadal Review.
- Parallel activities:
  - Continue work with Cosmic Origins for potential joint UVO mission.
  - Possible precursor science may be done with small competed missions and ground observing.

(Notional) Planning Framework Adopted by ExoPAG-3

Present - Spring 2012

- ExoPAG define minimum NW science requirements for top Astro2020 rating – *almost done*.
- ExoPAG complete analysis of Exozodi measurements required – *almost done*.
- ExoPAG and COPAG coordinate combined exoplanet/UVO mission option - *underway*.

Summer 2012

- NASA Headquarters issues solicitation for participation in Interim Science Working Groups (ISWG) to conduct (funded) concept studies; membership of working groups selected by end of 2012.

Jan. 2013

- Concept studies begin, with support from Program office, and analysis/costing with Team-X.

Jan. 2014

- Concept study reports completed and submitted to NASA

Summer 2014

- Senior Review-style evaluation of the concept study reports conducted.
  - Organized by NASA HQ
  - ISWGs present the results of their study in a face-to-face meeting with review panel, discuss any issues/questions with the panel.

December 2014

- Review panel submits report to NASA summarizing their findings and recommendations for the New Worlds mission architecture.

2015

- Report and resultant NASA decisions fed into NRC DSIAC. *(CAA)*

Risk: Flagship-only Portfolio

- Risk: Availability of funding for a New Worlds flagship mission in 2020's.
  - Overall national budget priorities.
  - Competing demands within the Astrophysics Division budget

- Impact: Another 10+ year delay in significant NASA Exoplanet science advancement, with negative impacts on health of the community and the field.

- Mitigation: Initiate activities to develop alternate mission concepts in the $350M-1B and $1-2B cost categories ("Probe-scale") in preparation for the 2020 Decadal (while still maturing flagship mission concepts and technologies as articulated in the NWNH decadal) as fall-back positions.

(Notional) Probe Class Mission Concept Process

Winter 2012

- NASA issue RFI for probe-scale concepts – responses in Winter 2012.

Spring - Summer 2012

- SAG for probe class missions analyzes: – by end of summer 2012:
  - RFI responses to develop set of concept categories for further study (grouping individual concepts where appropriate for affordability)
  - Probe Objectives Table, including:
    - Science Questions
    - Measurements required
    - Key performance requirements

Fall 2012

- Solicit Community Science Teams (CST) for each concept type to develop a Design Reference Mission (DRM) for costing, working with Program Office and Team-X. - to begin work by January 2013.

December 2014 – report study results to NASA.

2015

- Present Probe DRMs (along with Flagship DRMs) to NRC mid-decade review for guidance.

2015 – 2020: Prepare concepts and technology for Decadal review.

ExoPAG Role in Probe-class Roadmap

- Continue on-going work of existing SAGs to completion, including Flagship Requirements and Characteristics analysis.

- Charter a SAG to:
  - Analyze what science would be compelling yet achievable at the $350 – 650M and $1 – 2B price categories.
  - Analyze RFI responses to bin them by cost category and architecture.
  - Develop science questions, measurements and performance characteristics for each type of concept, to guide further study. (Measurement types not limited to imaging and direct spectroscopy, but may include transits, transit spectroscopy, astrometry, etc.)

- Draft charter
  - This group will analyze science questions that would be compelling in the 2020's, to develop a set of measurements and performance requirements that would be achievable through Probe-scale missions at specified price points. NASA's progress in this work will be presented to the Decadal Survey Implementation Advisory Committee (DSIAC) in 2015, and eventually will be presented to the Astrophysics Decadal Survey in 2020. The SAG will work from high-level ExEP Program science objectives and the goals stated in the RFI responses to assemble science questions, measurements and performance requirements which should be considered to guide the development of the mission concepts. The SAG will analyze the responses to the Exoplanet RFI to determine a minimum set of concept categories that span the high-value science measurements, for possible future study.