

Cosmic Origins Program Analysis
Group Report
Astrophysics Advisory Committee
Meeting – April 2018

Paul Scowen
(COPAG EC Chair)

COPAG EC Membership

Paul Scowen (Chair, APAC Member)

Lee Armus ~

Misty Bentz #

Suvi Gezari ~

Joseph Lazio *~

Janice Lee #

Paul Lightsey

Tom Megeath

John O'Meara

Claudia Scarlata

Jason Tumlinson #

Sarah Tuttle

Arizona State University

Caltech

Georgia State University

University of Maryland

NASA/JPL

Caltech/IPAC

Ball Aerospace

University of Toledo

St. Michael College

University of Minnesota

STScI

University of Washington

Mario Perez (Executive Secretary, Ex-Officio)

Eric Tollestrup (Ex-Officio)

Susan Neff (COR Program Office, Ex-Officio)

Erin Smith (COR Program Office, Ex-Officio)

NASA HQ

NASA HQ

NASA/GSFC

NASA/GSFC

New members since October APAC Meeting

~ Members rotating off in Fall 2018

* Joe Lazio had agreed to extend by 1 year to facilitate new SIG3 leadership structure

COPAG Activities Since October

- Many COPAG EC members continued to be active contributors to the STDT exercises
- Since October 2017, three new members were added to the Executive Committee: Misty Bentz (GSU), Janice Lee (Caltech/IPAC) and Jason Tumlinson (STScI)
- We bade farewell to retiring members: Matt Greenhouse (NASA GSFC), Mary Beth Kaiser (JHU), and Pam Marcum (NASA Ames)
- The COPAG hosted a series of events at the Winter AAS from the various SIGs and the new TIG, and coordinated efforts with the STDT teams to showcase their efforts (see below)
- The COPAG EC built upon the dialogue we had with Paul Hertz to draft a charter for a new SAG to study and analyze the issue of the Great Observatories and how to ensure their legacy persists – the Charter is included here for the APAC to review

COPAG Activities

- The COPAG EC also acted to solicit input from their community on the question about high risk / high reward proposals leveled by the NAC Science committee – the results of this month-long survey have been delivered to Scott Gaudi for his presentation at this meeting
 - 59 respondents
 - No clear evidence of community dissatisfaction with the process
 - Some invaluable testimonies and suggestions about ways to improve the process
- The COPAG EC has continued to track closely STDT activities through members who are on the respective teams:
 - **OST** - Lee Armus
 - **HabEx** - Paul Scowen
 - **LUVOIR** - John O’Meara
 - **Lynx** – Two EC members are part of SWGs - Joe Lazio and Suvi Gezari

COPAG Activities

- COPAG continues to have no open SAGs – but is proposing a new SAG at this meeting
- COPAG continues to have 3 open SIGs, 1 TIG
- All 3 SIGs and the TIG held community meetings at the January 2018 AAS Meeting in Washington, DC:
 - Mon Jan 8, 9am-12pm – SIG2 community meeting
 - Mon Jan 8, 9am-12pm – SIG3 community meeting
 - Mon Jan 8, 9am-12pm – TIG community meeting
 - Mon Jan 8, 1:30pm - the COPAG co-sponsored a session at the AAS to allow Paul Hertz to address the combined membership of the PAGs
 - Mon Jan 8, 3pm-6pm - the COPAG community meeting included STDT summary talks as well as presentations from all 3 candidate MIDEX teams
 - Tue/Wed Jan 9/10, 12:30-3:30pm – SIG1 community meeting

New COPAG SAG on the Great Observatories

The goal of the proposed SAG would be to analyze and answer the following questions:

1. What gaps in wavelength coverage and scientific capabilities are anticipated over the next 10-20 years as the Great Observatories age or are decommissioned? What are the corresponding scientific impacts in terms of loss of discovery space and the ability of the community to address key questions, such as those articulated in the 2010 Decadal Survey, in particular those uniquely made possible by coordinated use of a set of space observatories with a powerful and varied suite of instruments? How do these losses affect the ability of the community to address a rapidly changing scientific landscape?
2. What are the options for maintaining, in the next 10-20 years, the multi-wavelength coverage from space now provided by the Great Observatories? Can the anticipated scientific goals be realized with a combination of flagship and smaller missions with broad community access, wide wavelength coverage, and temporal overlap? Should longevity be a key criteria for considering future large missions, such as those outlined in the 2013 NASA Roadmap, “Enduring Quests, Daring Visions”? What is the role of international partnerships in meeting these needs? To what degree can loss of wavelength coverage be partially mitigated through the use of NASA’s existing data archives?

SAG will be run by Lee Armus and Tom Megeath together with reps from both PhysPAG and ExoPAG.

SUMMARY

EIR SIG

The screenshot shows the top of a Nature article page. At the top left is the Nature logo with the tagline 'International journal of science'. Below it, it says 'Access provided by Jet Propulsion Laboratory'. There is an Altmetric score of 1936 and 1 citation, with a 'More detail' link. The article title is 'An absorption profile centred at 78 megahertz in the sky-averaged spectrum' by Judd D. Bowman, Alan E. E. Rogers, Raul A. Monsalve, Thomas J. Mozdzen & Nivedita Mahesh. It is a 'Letter' published in Nature 555, 67-70 (01 March 2018). The article was received on 13 September 2017, accepted on 24 January 2018, and published online on 28 February 2018. It is categorized under 'Astronomical instrumentation', 'Cosmology', and 'Stars'. A diagram of a cylindrical instrument is partially visible at the bottom of the screenshot.

- Significant New Results
 - Simple instrument result at $z \sim 17$
 - If confirmed, potential missions
- Significant Cosmic Dawn s Stars, First Galaxies
- AAS 231 Steering Committee: Discussion of Science white papers into the Decadal Survey
- Strategy is to try to ensure coordination, but not to lead → goal is to ensure completeness

UV-VIS SIG

- AAS 2018 - UV-VIS SIG specific events:
 - GUTS astrophysics subcommittee presentation (K. France)



- The plan is to continue with monthly telecons.

Actions Requested of the APAC

- Request approval of new Great Observatories SAG
- Relevant Questions from the COPAG EC:
 - In light of the JWST delay what is the likely impact on the end-of-life of Spitzer given the continued strong interest from the community (114 proposals in Cycle 14 and a 5:1 oversubscription rate)?
 - What is the impact of the fact that SOFIA will (now) not be part of the next Senior Review - meaning that it has been unreviewed for a long period of time?
 - Is there any estimate of when we can expect a decision from the CAA on the possibility of slipping the 2020 Decadal Review?
 - If a slip is approved, how will this affect all of the ongoing studies and preparations for the Decadal? Do we, for instance, anticipate a need for a so-called “Delta Report” after the Final Reports from the STDTs are submitted?

COPAG Future Activities

- Bi-weekly EC telecons will continue
- Continued dialogue and support of ongoing STDT activities
- TIG preparations for 2018 input to COR office in support of upcoming PATR exercise
- New SAG activity to start with target of completion during 2019 – start of Decadal Survey unclear, but have to work to previous estimate of mid-2019 until we know different
- Work with SIGs and TIG to plan and write white papers to the 2020 Decadal – contingent on Decadal not being delayed
- COPAG EC and the associated science community are available to assist NASA in seeking community feedback and messaging information regarding relevant issues (e.g., JWST delays, WFIRST, Decadal delays, etc)
- Identification of new COPAG EC Chair

BACKUP CHARTS

FIR SIG – Recent Activities

Organized a FIR Astronomy Splinter Session at the 2018 Winter AAS

- Speakers on upcoming missions, and science highlights
- Review/discussion panel
- 60+ attendees
- Plans to write up a short summary for the COPAG newsletter

Responding to the referee reports on the FIR review article for JATIS

- Both referee reports were very favorable
- Anticipate resubmission by mid-April 2018

Initiated coordination of white papers for the decadal review between the FIR SIG and the OST STDT

Ongoing webinar series covering science/mission topics within infrared astronomy

FIR SIG – Near-term Plans

Complete and resubmit the JATIS review article

Complete the transfer of the FIR SIG website to IPAC

Initiate discussions on plans for the 2019 Winter AAS

Organize white paper writing within the FIR SIG

Expand white paper coordination to the US FIR community

Rollout of the inaugural FIR SIG newsletter

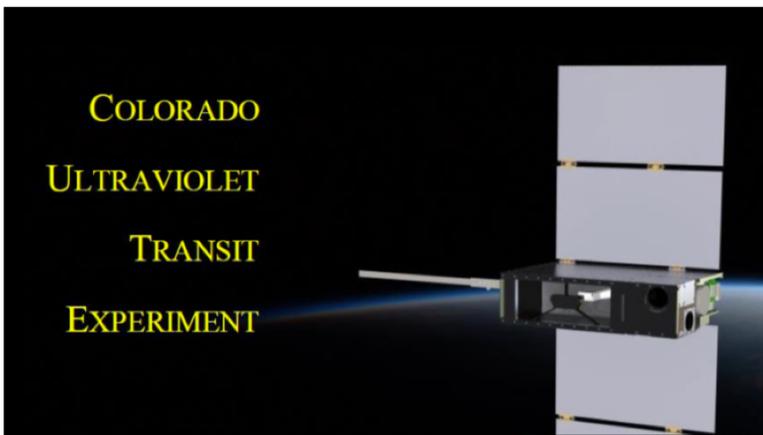
UV-VIS SIG

John O'Meara

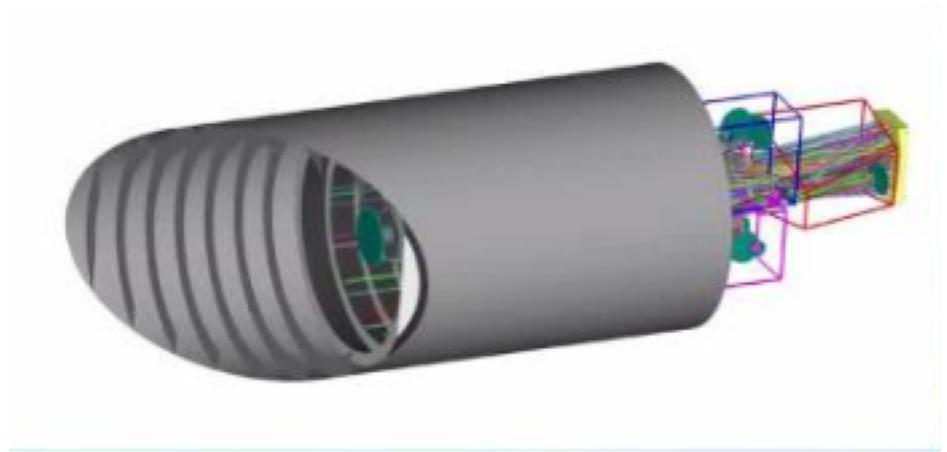
Jason Tumlinson

2018 AAS

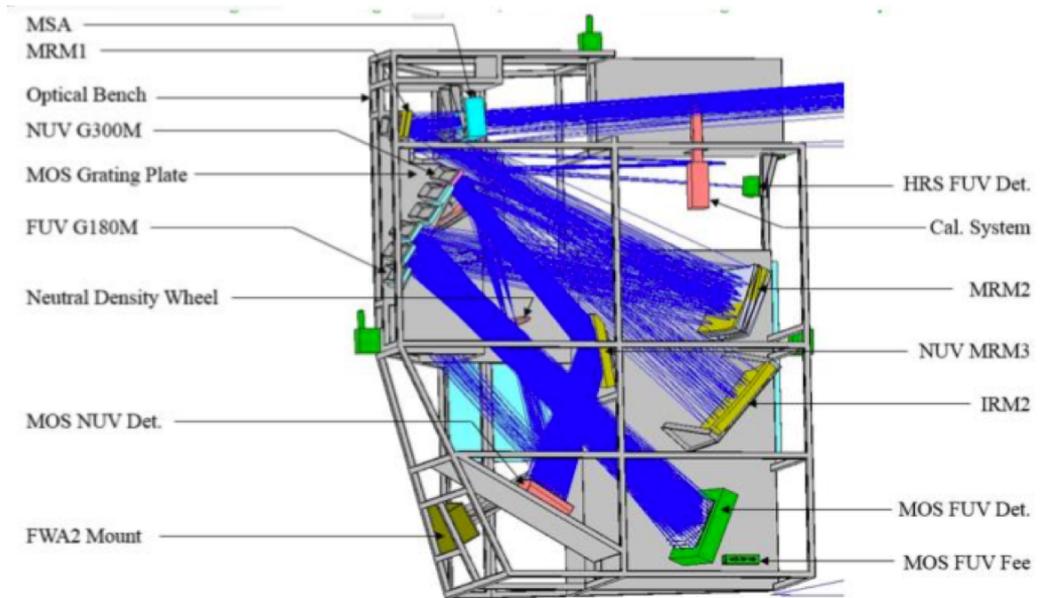
- UV-VIS SIG specific events:
 - CUTE astrophysics cubesat presentation (K. France)
 - SPARCS astrophysics cubesat presentation (E. Shkolnik)
 - CETUS probe mission concept (S. Heap)
 - LUVUOIR LUMOS instrument concept (K. France)
 - HabEX UVS instrument concept (P. Scowen)



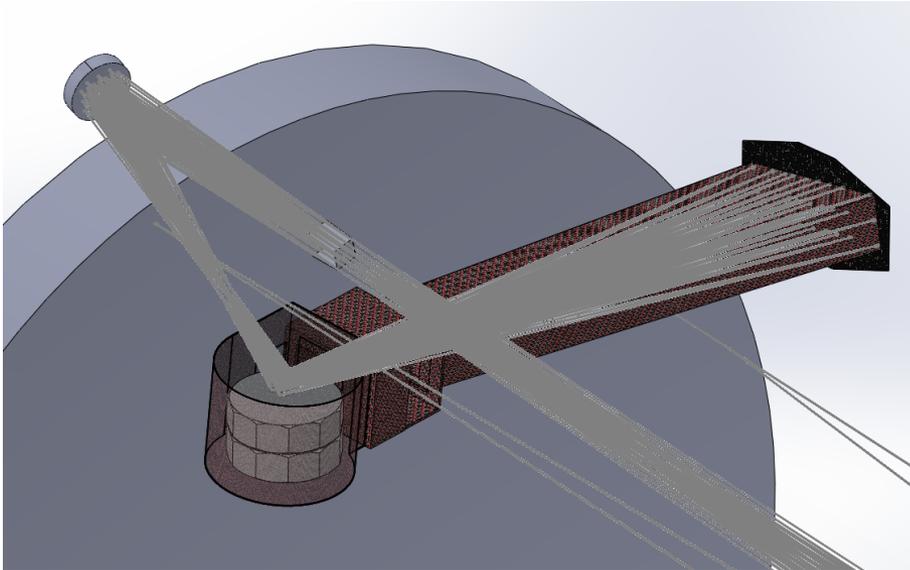
CUTE



CETUS

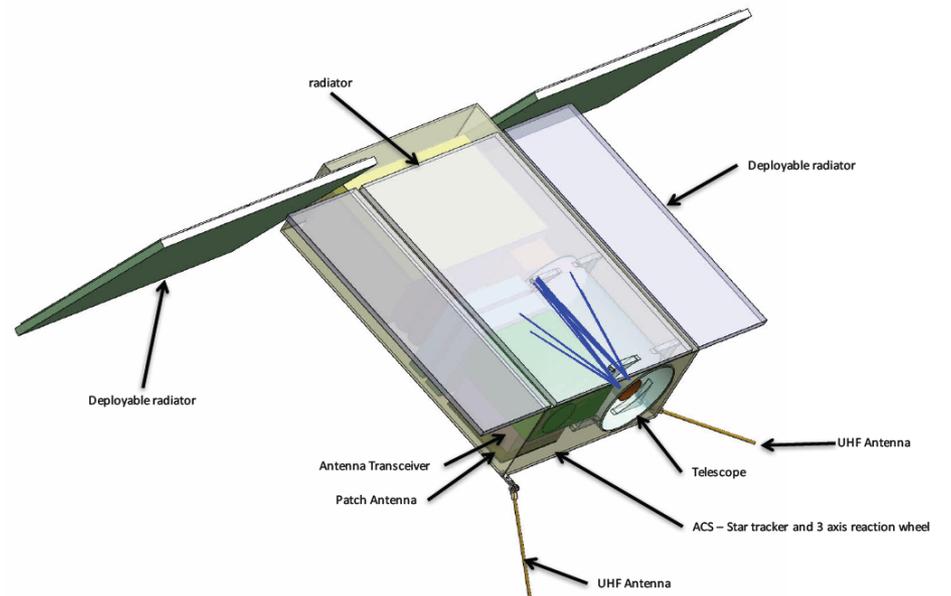


LUVUOIR - LUMOS



HabEx - UVS

SPARCS



SIG leadership change

- UV-VIS SIG presentation by P. Scowen at AAS:
 - SIG leadership model change:
 - Movement from a single chair to a leadership council (~7 members)
 - Interested parties solicited
 - In the process of defining goals, primarily with a focus on SIG input to decadal
 - Possible webinar series and workshop (TBD)
 - Much depends on decadal timing and large mission/probe mission concepts



Jet Propulsion Laboratory
California Institute of Technology

Cosmic Dawn Science Interest Group

Joseph Lazio

on behalf of the COPAG EC



Significant New Results

 **nature**
International journal of science

Access provided by Jet Propulsion Laboratory

  Altmetric: 1936 Citations: 1 [More detail >>](#)

Letter

An absorption profile centred at 78 megahertz in the sky-averaged spectrum

Judd D. Bowman , Alan E. E. Rogers, Raul A. Monsalve, Thomas J. Mozdzen & Nivedita Mahesh

Nature **555**, 67–70 (01 March 2018)
doi:10.1038/nature25792
[Download Citation](#)

[Astronomical instrumentation](#) [Cosmology](#)
[Stars](#)

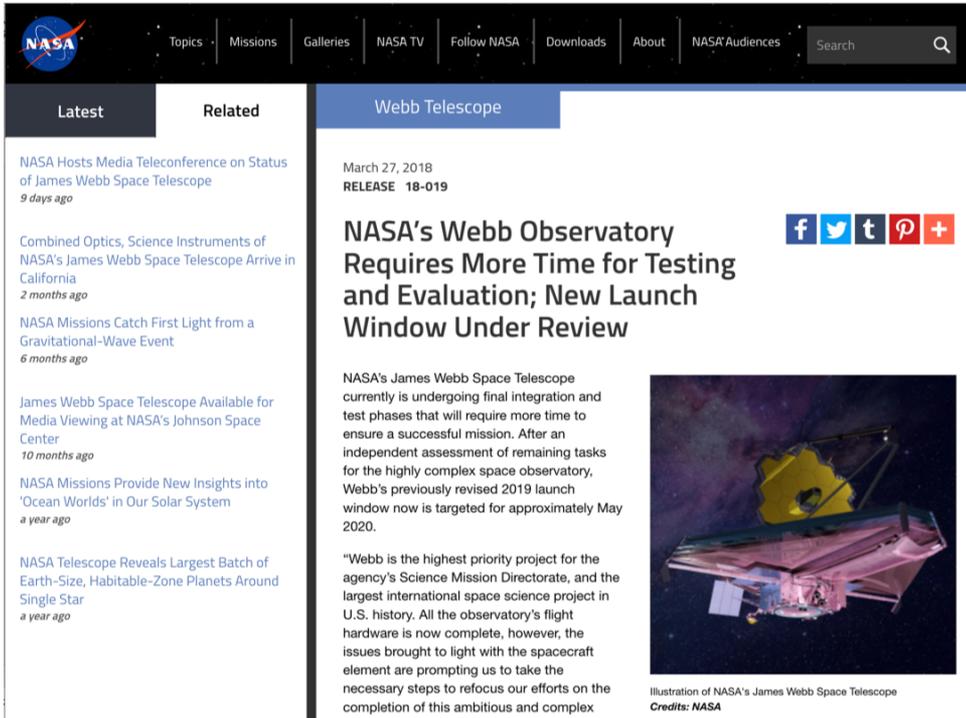
Received: 13 September 2017
Accepted: 24 January 2018
Published online: 28 February 2018

- Simple instrument, small team, potentially exciting result at $z \sim 17$
- If confirmed, potential for higher redshift space missions



James Webb Space Telescope

First Stars, First Galaxies



The screenshot shows the NASA website's news section. At the top, there is a navigation bar with the NASA logo and links for Topics, Missions, Galleries, NASA TV, Follow NASA, Downloads, About, and NASA Audiences. A search bar is also present. Below the navigation bar, there are two columns of news items. The left column is titled 'Latest' and the right column is titled 'Related'. The main article is titled 'NASA's Webb Observatory Requires More Time for Testing and Evaluation; New Launch Window Under Review' and is dated March 27, 2018. The article text discusses the final integration and test phases of the telescope and mentions a revised launch window for May 2020. An illustration of the telescope is shown to the right of the text. Social media sharing icons for Facebook, Twitter, Tumblr, and Pinterest are located above the illustration. The caption below the illustration reads 'Illustration of NASA's James Webb Space Telescope Credits: NASA'.

Latest **Related**

Webb Telescope

March 27, 2018
RELEASE 18-019

NASA's Webb Observatory Requires More Time for Testing and Evaluation; New Launch Window Under Review

NASA's James Webb Space Telescope currently is undergoing final integration and test phases that will require more time to ensure a successful mission. After an independent assessment of remaining tasks for the highly complex space observatory, Webb's previously revised 2019 launch window now is targeted for approximately May 2020.

"Webb is the highest priority project for the agency's Science Mission Directorate, and the largest international space science project in U.S. history. All the observatory's flight hardware is now complete, however, the issues brought to light with the spacecraft element are prompting us to take the necessary steps to refocus our efforts on the completion of this ambitious and complex

Illustration of NASA's James Webb Space Telescope
Credits: NASA

Significant Cosmic Dawn science to result from JWST

AAS 231 and Steering Committee

- **Discussion of Science white papers into the Decadal Survey**
- **Strategy is to try to ensure coordination, but not to lead → goal is to ensure completeness**

Cosmic Dawn SIG

Cosmic Origins PAG

“We have learned much in recent years about the history of the universe, from the big bang to the present day. A great mystery now confronts us: When and how did the first galaxies form out of cold clumps of hydrogen gas and start to shine---when was our ‘cosmic dawn’?”

New Worlds, New Horizons

SIG focusses on science cases, observations, and technology development needed to address this "great mystery" of Cosmic Origins.

- **Membership is open to all.**

To be added to the mailing list, please contact Joseph Lazio (Joseph.Lazio@jpl.nasa.gov)

- **Website established**

<http://cd-sig.jpl.nasa.gov/>

COPAG

Technical Interest Group

Q1 2018 Report

2018.03.27

Paul Lightsey, Sarah Tuttle

TIG Activities

- Met during the AAS 231 meeting in January
 - Reviewed the TIG charter
 - Bridge between the science user and the technology provider
 - Reviewed support to COR Program Office in preparing PATR
 - COR technology gap review
 - Proposed Task for group to work on
 - Develop Mission vs. technology matrix for past and future missions
 - Tease out subtleties of TRL assessments
 - For each mission, identify first the broad categories:
 - Orbit
 - Sensor system
 - Observatory support
 - Ground support
 - AI&V support
 - Each broad category will have sub-level detailed categories
 - The goal is to clearly identify the nature of existing technology that has flown (TRL=9) and understand the regression for those technologies as applied to future missions
- Followed up on proposed task to develop mission vs. technology matrix with telecon on Monday, March 26.
- The plan is to continue with monthly telecons.

Minutes from TIG March telecon

- The TIG had a telecon on Monday, March 26. Attendees were: Jim Breckinridge, Chuck Lillie, Don Figer, John Vallerga, Mike Effinger, Sarah Tuttle, Paul Lightsey.
- We reviewed the plan to build a reference repository for technologies flown on space Missions. The charts from the AAS Jan. meeting were reviewed to revisit the structure, and the initial Excel spreadsheet was provided. The initial spreadsheet has the NASA missions identified under the category “universe missions”. Discussion noted that many of the missions were quite old. The intent is that we will prioritize cells to capture more relevant technologies, and not all cells need to be populated. However, for historical perspective, if some of the older technology information is available, we can include it for interest.
- Those online were requested to go through the spread sheet and provide areas of interest that they would be willing to add info.
- Brian Fleming was not able to attend but did volunteer to provide info on UV missions. Chuck Lillie also said he would send a similar compilation spreadsheet to Paul to transfer info into the master spreadsheet.
- We also mentioned that where possible, having links to web information is desired. But the comment was also made that the links to the mission names discusses the science mission with limited information on technology.
- The suggestion was also made that we should include helio-physics missions in addition to the universe missions, especially for relevant technologies for coronagraphy.
- We will be looking to set up recurring meetings on a one-month cadence. Please advise on times of availability. We will attempt to stagger the times each month so that over a period of 2 to 3 months, everybody has the opportunity to participate without conflicts with other obligations.

Develop Mission vs. Technology matrix for past and future missions

- Develop Mission vs. technology matrix for past and future missions
- Tease out subtleties of TRL assessments
- For each mission, identify first the broad categories:
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Orbit selection drives supporting technology

- Launch vehicle
- Launch sites/facilities
- Orbit Insertion Navigation & Station Keeping
 - Tracking/ephemeris determination
 - Propulsion system
- Communications
 - Data rates
 - Link requirements (BER & EIRP)
 - Spacecraft
 - Transmitter power
 - Antenna size and technology
 - Frequency domain (rf bands, lasercom, etc.)
 - Data rates
 - Intermediate infrastructure
 - For example, DSN, TDRS, single or multiple dedicated ground stations
 - Ground station
 - Antenna
 - Receiver sensitivities
 - Data rates

Sensor system technologies

- Telescope technologies
 - Optical design
 - Materials
 - Coatings
 - Active/adaptive controls
- Instruments
 - Instrument type
 - (e.g. imager, spectroscopy, photometer, polarimeter)
 - Bench/support technology
 - Component technology
 - Detector technology
- Command & Data Handling
 - Signal conditioning
 - Signal Processing (how much done on board)
 - Data rates
 - Storage capacity

Observatory functional support

- Attitude Control & Navigation
- Communications
- Command & Data Handling
- Electrical Power Systems
- Thermal control
 - Passive
 - Active
- Dynamics control or mitigation

Ground system support

- Intermediate infrastructure
 - TDRS
 - DSN
- Ground station(s) technology
 - Receiver technology
 - Tracking technology
 - Data relay from Ground Station to Mission Control and Science Operations Center

AI&T support

- Integration facilities
- Dynamics verification
 - Integrated modeling
 - Dynamics test facilities
 - Acoustic test facilities
- Thermal verification
 - Thermal-Vacuum facilities
 - Cryogenic support
- Performance verification
 - Test facilities
 - Integrated Modeling
- EMI/EMC verification
- Contamination Controls
 - Monitoring
 - Modeling

So what are the missions to include?

- How far back?
- How to handle future mission concepts as they develop