In-Space Assembled Telescope (iSAT) Study

Study Initial Conditions and Assumptions

– **Activity 1a**: Design and architect a modularizable 20 m UV/O/NIR space telescope

Document authors:

Nick Siegler, NASA ExEP, Jet Propulsion Laboratory, California Institute of Technology

Harley Thronson, NASA PCOS/COR, NASA Goddard Space Flight Center

Rudra Mukherjee, Jet Propulsion Laboratory, California Institute of Technology

Study Initial Conditions
(Activity 1a)

1. **Modularized telescope design enables both exoplanet science <u>and</u> general astrophysics.**

2. **20-meter, filled-aperture, non-cryogenic telescope operating at UV/V/NIR**
   - *We will examine parameterized designs so that we can also explore smaller apertures*

3. **Off-axis secondary mirror, f/(≥ 2) to assist coronagraph throughput, polarization, and performance**
   - *Can diverge from this condition if clear benefits to telescope modularization and therefore in-space assembly are shown*

4. **A high-contrast coronagraph will be an observatory instrument tasked to directly image and spectrally characterize exoplanets**
   - *The coronagraph will have the capability to actively sense and control input light wavefront errors due to all reasonable disturbance sources.*

5. **Operational environment destination is Sun-Earth L2**

Study Assumptions

1. **The Observatory must provide the stability requirements associated with coronagraphy of exo-planets**
   - *These are expected to be on order of 10s of pm wavefront error stability over time periods of ~ 10 minutes.*
   - *At the end of the telescope modularization activity (Activity 1a) we may assess what would have been the impact if the coronagraph was not assumed but rather a starshade. A starshade would significantly reduce the stability requirements on the telescope as well as eliminate almost all of the active optics. In Kepner-Tregoe speak, this is an Opportunity.*

2. **Astronaut- and robotic-enabled assembly/servicing is available**

3. **ISS is available until 2028 (TBD)**

4. **The following missions can be assumed but each with their own specific capability and schedule risk:**
   a. DARPA's RSGS (Robotic Servicing & Geosynchronous Satellites) at GEO (contract with SSL already in place)
   b. NASA's Lunar-Orbital Platform - Gateway at cis-Lunar
   c. Orbital-ATK's Mission Extension Vehicle (MEV) at GEO (contracts in place)
   d. NASA's Restore-L at LEO