THE ORIGINS SPACE TELESCOPE: DEVELOPMENT OF A SCIENTIFICALLY COMPELLING, LOW-RISK, EXECUTABLE MISSION CONCEPT. D. Leisawitz[1] and the *Origins Space Telescope* Mission Concept Study Team, [1]Sciences and Exploration Directorate, NASA Goddard Space Flight Center, Code 605, 8800 Greenbelt Rd., Greenbelt, MD 20771, david.t.leisawitz@nasa.gov.

Abstract:

The *Origins Space Telescope* (OST) will trace the history of our origins from the time dust and heavy elements permanently altered the cosmic landscape to present-day life. How did the universe evolve in response to its changing ingredients? Why is the Earth wet? How common are life-bearing planets? To enable the community to answer these and other important questions, OST will operate at mid and far-infrared wavelengths and offer sensitivity and spectroscopic capabilities vastly exceeding those found in any preceding far-IR observatory.

During the past two years, the OST study team prioritized scientific objectives, explored many facets of the mission concept solution space, evaluated two alternative mission architectures – one inspired by JWST and another by *Spitzer* – developed designs for and assessed the performance of four science instruments, and took steps to reduce cost and risk while retaining the measurement capabilities needed to answer definitively the driving science questions. We report on the overall study approach, the studied architectures, and the key decisions that led to a scientifically compelling, low-risk, executable mission concept. This "Baseline Mission Concept" will be recommended to the National Academies' 2020 Decadal Survey in Astrophysics.

Figure 1 is an artist's concept of OST. Table 1 and Figure 2 summarize key features of the Baseline Mission Concept.

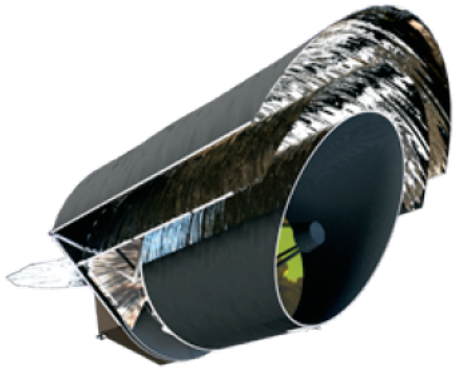

Figure 1. Artist's concept of the *Origins Space Telescope.*

Table 1. Key features of the OST Mission Concept

- *Spitzer-like architecture with minimal dependence on deployments*
- *JWST sized telescope (~25 m^2, 5.9 m diameter), diffraction limited at 30 µm*
- *Wavelength coverage from 3 to 600 µm*
- *Cold (4.5 K) telescope and three cold (≤4.5 K) instruments, cooled with long-life cryocoolers*
- *Efficient mapping: up to 60" per second*
- *Modular instrument bay facilitates integration, test, and serviceability*
- *Follows NASA "test-as-you-fly" golden rule*
- *Launch in 2035 on large vehicle (SLS or BF3)*
- *Detector technology development on track to reach TRL 5 by 2025*
- *Mission operations at Sun-Earth L2 orbit*
- *5-year lifetime, with consumables for 10 years*
- *Community-selected science programs*

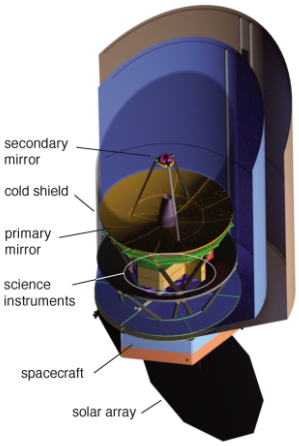

Figure 2. The *Origins Space Telescope* has the light-collecting area of JWST and an architecture similar to that of the *Spitzer Space Telescope*.