THE ORIGINS SPACE TELESCOPE AND THE QUEST TO UNDERSTAND HABITABILITY.
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Abstract:

The *Origins Space Telescope* 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? How do habitable conditions arise during the process of planet formation? How common are life-bearing planets? To enable the community to answer these and other important questions, *Origins* will operate at mid and far-infrared wavelengths and offer sensitivity and spectroscopic capabilities vastly exceeding those found in any previous far-IR observatory.

During the past two years, the *Origins* mission concept study team prioritized scientific objectives, explored many facets of the mission concept solution space, evaluated two alternative mission architectures, 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. The *Origins* study culminated in the recommendation of a scientifically compelling, low-risk, and executable mission concept to the National Academies' 2020 Decadal Survey in Astrophysics. Figure 1 is an artist's concept of the *Origins Space Telescope*. Table 1 and Figure 2 summarize key features of the design.

The science case for *Origins* is strongly aligned with the focus of the *Habitability* conference on the development of conditions conducive to life. This presentation will summarize the mission concept and describe the habitability-related science program envisaged for *Origins*.

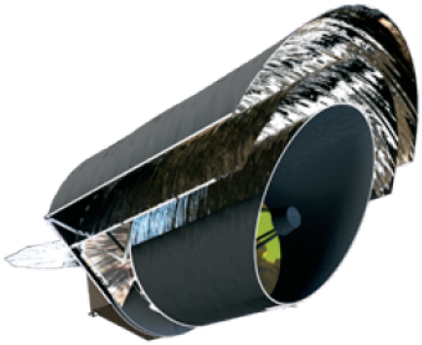

Figure 1. Artist's concept of the *Origins Space Telescope.*

Table 1. Features of the *Origins* 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*

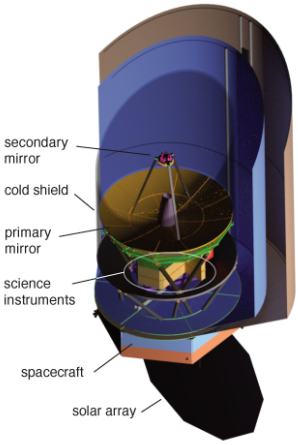

Figure 2. The *Origins Space Telescope* has the light-collecting area of JWST and an architecture similar to that of the *Spitzer Space Telescope*. The community will use *Origins* to learn how the conditions for habitability can arise during the process of planet formation, and to characterize exoplanets and search for biosignatures in their atmospheres.