EXO-C: A PROBE-SCALE SPACE MISSION FOR DIRECT IMAGING AND SPECTROSCOPY OF EXTRASOLAR PLANETARY SYSTEMS

K. R. Stapelfeldt[1], R. Belikov[2], G. C. Bryden[3], K. Cahoy[4], S. Chakrabarti[5], M. S. Marley[2], M. W. McElwain[1], V. S. Meadows[6], E. Serabyn[3], J. T. Trauger[3], and the Exo-C Engineering Design Team (F. G. Dekens, M. P. Brenner, R. T. Effinger, K. R. Warfield et al.)[3].

[1]NASA Goddard Space Flight Center, Exoplanets and Stellar Astrophysics Laboratory, Code 667, 8800 Greenbelt Road, Greenbelt MD 20771. Karl.R.Stapelfeldt@nasa.gov
[2]NASA Ames Research Center, Moffet Field CA 94035
[3]Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA 91109
[4]Massachusetts Institute of Technology, Cambridge MA 02139
[5]University of Massachusetts, Lowell MA 01854
[6]University of Washington, Seattle WA 98195

"Exo-C" is NASA's first community study of a modest aperture space telescope optimized for high contrast observations of exoplanetary systems. The mission will be capable of taking optical spectra of nearby exoplanets in reflected light, discovering previously undetected planets, and imaging structure in a large sample of circumstellar disks. It will obtain unique science results on planets down to super-Earth sizes and serve as a technology pathfinder toward an eventual flagship-class mission to find and characterize habitable Earth-like exoplanets. We present the mission/payload design and its science yield, highlighting steps to reduce mission cost/risk relative to previous mission concepts. Key elements are a 1.4 m unobscured telescope aperture, an internal coronagraph with deformable mirrors for precise wavefront control, and an orbit and observatory design chosen for high thermal stability. Exo-C has a similar telescope aperture, orbit, lifetime, and spacecraft bus requirements to the highly successful Kepler mission (which is our cost reference). The needed technology development is on-course to support a mission start in 2017, should NASA decide to proceed. This paper summarizes the study final report completed in February 2015. Key accomplishments include excellent modeled telescope stability, a telescope and instrument design that is optimal for dual polarization throughput, and fitting the mission into the prescibed cost cap. See http://exep.jpl.nasa.gov/stdt/exoc for the final study report. The figure to the right shows the observatory flight configuration.