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TITLE: The StarLight Interferometer Architecture and Operational Concepts

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BIOGRAPHY: Riley Duren is the Interferometer System Engineer for the StarLight Project. His past work at JPL and other NASA centers covered system engineering, integration and test, mission operations, and/or data reduction on 7 space science instruments, including most recently the Space Interferometry Mission (SIM) and the Shuttle Radar Topography Mission (SRTM). He received a BS in Electrical Engineering from Auburn University in 1991 and pursued graduate studies in Physics and Astronomy at UCLA and the Florida Institute of Technology.

ABSTRACT: The StarLight mission is scheduled for a 2006 launch into an earth-trailing orbit. StarLight will validate the technologies of spaceborne long-baseline optical interferometry and precision formation flying for potential use on the Terrestrial Planet Finder (TPF) and other future astrophysics missions. The interferometer performance will be characterized by obtaining several hundred fringe visibility amplitude measurements for stars in the band 600-1000 nm for a variety of stellar visibilities (0.2-1.0), stellar magnitudes (Mv = 2-5), and baselines (B = 30-125 meters). Interferometry will be performed both in a 1 meter fixed-baseline combiner-only mode and in a formation mode. In formation mode, the combiner spacecraft will remain at the focus of a virtual parabola, while the collector spacecraft assumes various positions along the parabola such that the two arms of the interferometer remain equal over a variety of separations and bearing angles. Projected baselines of 30-125 meters can thus be achieved by spacecraft separations of 40-600 meters.

The project objectives result in a number of challenging interferometer requirements, including: stellar and interspacecraft laser metrology pointing control accuracies of 0.25 arcsec and 25 mas, respectively, 1 sigma with 50 Hz closed-loop bandwidths as well as optical pathlength control accuracy of 35 nm RMS, 500 Hz closed-loop bandwidth. Additional challenges to be encountered in flight include precision alignment and shear correction, delay and delay-rate estimation (20 um/sec), visibility calibration, and robust fringe tracking in the presence of local and inter-spacecraft dynamics. This paper describes the Interferometer System architecture and operational design envisioned to meet these challenges.

KEY WORDS: stellar interferometry; formation-flying