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THE RESURGENCE OF SMALL-APERTURE TELESCOPES FOR PLANETARY SCIENCE AND HELIOPHYSICS: AIRBORNE, SMALLSATS AND COMMERCIAL SUBORBITAL

Abstract

Throughout the later half of the 20th century, as astronomical instruments and platforms became more sophisticated, the primary aperture of airborne and and space telescopes required to conduct cutting-edge research in heliophysics, planetary science and astronomy grew larger and larger. No where is this most apparent than in airborne astronomy, where the natural progression of NASA's early airborne platforms, the Convair CV-990 and the Learjet (11" primaries), developed into the more capable and larger Kuiper Airborne Observatory (KAO, 36" primary). Currently, the NASA/DLR run Stratospheric Observatory For Infrared Astronomy (SOFIA) is the premier in airborne astronomy (2.5 m primary). However, the ever increasing demand for, and high operating costs of, SOFIA has reinvigorated a small and growing need for small aperture astronomy that can return high science impact at relatively low costs.

In 2017, a new platform for airborne astronomy was realized. A pair of NASA's WB-57 Canberra high-altitude research aircraft will fly at 50,000ft to observe the total solar eclipse above central America on August 21. Each aircraft fitted with a pair of HD visible and infrared cameras behind 9" telescopes, achieving 1 arc second pointing, they will conduct cutting edge research on the solar corona, Mercury and Vulcanoids. At the same time, these same platforms were studied for potential deployment to observe the stellar occultation of the Kuiper Belt Object MU69 in July 2017, the target of NASA's New Horizons spacecraft. Had they been deployed, they would be have formed an important part of the mission support infrastructure for this planetary science mission in the Kuiper Belt.

Concurrently, NASA is developing a stratospheric balloon observatory for planetary science (GHAPS). Although the observatory is in the meter class, it's ability to have sub-arc second pointing from fine-steering mirrors has important applications for small aperture telescopes. Combined with the new push for small-sat and cube-sats, the new growth of small aperture photometry, spectroscopy and astronomy for planetary science is apparent. Lastly, future NASA funded research on commercial suborbital vehicles that reach in excess of 300,000 ft has the potential to increase the science-to-cost ratio by orders of magnitude. This presentation will highlight what planetary science and heliophysics research can be accomplished now and in the future with small aperture telescopes.