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Balloon Observation Platform for Planetary Science (BOPPS)

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In 2014 three Oort Cloud comets – C/2013 A1 (Siding Spring), C/2014 E2 (Jacques), and C/2012 K1 (PanSTARRS) – were each making their first apparition in the inner solar system. This unusual event provided an exciting opportunity to determine the composition and nature of these pristine cometary nuclei and thus gain an understanding of the condensation and evolution of primitive materials in the early solar system. The Balloon Observation Platform for Planetary Science (BOPPS) was developed in less than eight months under the leadership of NASA Glenn Research Center (GRC) and executed by the Johns Hopkins University Applied Physics Laboratory (APL) and the Southwest Research Institute (SwRI). During this flight BOPPS obtained the first ever images of Oort Cloud comets from a stratospheric balloon observatory using a 0.8 meter aperture telescope, a pointing system that achieved one arcsecond pointing stability, and an imaging instrument suite covering the near ultraviolet to mid infra-red.

The BOPPS instrument suite consisted of the BOPPS IR Camera (BIRC), developed by APL, that operated over nine narrow bands from 0.6 to 5.0 μm and the Ultraviolet/Visible (UVVis) optical imaging system, developed by SwRI, that operated from 0.3 to 0.85 μm, and included a fine-steering mirror. The BIRC measured the ratio of CO2 to H2O emissions from the coma as a vital diagnostic of the comet's origins while the UVVis observed at the wavelength of the OH emission.

BOPPS was the fifth flight of the High Altitude Research Platform (HARP) that is a multi-purpose stratospheric balloonborne gondola providing electrical power, mechanical support, attitude control, thermal control, and data transmission for multiple forms of high-altitude scientific research equipment. The platform has been used for astronomy, heliophysics, and astrophysics experiments but can also be applied to atmospheric studies, space weather and other forms of high altitude research. HARP first flew as Flare Genesis in 2000 and its sixth mission is known as Stratospheric Terahertz Observatory 2 (STO2) originating from Antarctica in December 2015.

The HARP structure, composed of an aluminum framework, is designed to provide ready access to the payload and supporting avionics. A light-weighted structure, capable of supporting Ultra-Long Duration Balloon (ULDB) flights that can last more than 100 days is available. Scientific research payloads as heavy as 600 kg (1322 pounds) and requiring 500 Watts electrical power can be supported. The platform comprises all subsystems required to support and operate the science payload. Electrical power is produced by solar panels for multi-day missions and batteries for single-day missions. The avionics design is primarily single-string; however, use of ruggedized industrial components provides high reliability. The pointing control system (PCS) provides three-axis attitude stability to 1 arcsec and can be used to aim at a fixed point for science observations, to perform science scans, and to track an object ephemeris.

This poster provides an overview of the BOPPS mission, announces its scientific findings, describes HARP's use on upcoming missions, and outlines the characteristics that can be customized to meet the needs of the high altitude research community to support additional future missions.