ADVANCED POINTING IMAGING CAMERA (APIC) CONCEPT. Ryan S. Park[1], Bruce G. Bills[1], John Jorgensen[2], Insoo Jun[1], Justin N. Maki[1], Alfred S. McEwen[3], Ed Riedel[1], Marc Walch[1], Michael M. Watkins[1], [1]Jet Propulsion Laboratory, California Institute of Technology (Ryan.S.Park@jpl.nasa.gov), [2]Danmarks Tekniske Universitet, [3] The University of Arizona, Lunar and Planetary Laboratory.

Introduction: The Advanced Pointing Imaging Camera (APIC, see Fig. 1) concept is envisioned as an integrated system, with optical bench and flight-proven components, designed for deep-space planetary missions. The APIC concept's unique capabilities include:

- 2 degree-of-freedom (DOF) control capability, allowing rapid and flexible image acquisition, and image motion compensation
- Innovative periscope design capable of simultaneously acquiring images of target and star field for precise image pointing knowledge.

APIC is a part of NASA's New Frontier's Homesteader Program. By the end of CY2016, all of APIC's components will achieve TRL 5-6, making APIC, as a whole, to be TRL 5. More specifically, these tasks would retire:

- Almost all radiation-related issues (including the Jovian system enviroronment). **TRL-5**
- Field-test proven 2-DOF actuation. **TRL-6**.
- Thermally stable optical-bench structure (Carbon-fiber-composite) with arc-second stability in rad-hard environment. **TRL-6**.

Size, mass, and various parameters of interested can be found in Table 1.

Science and Engineering Enabled by APIC: APIC's 2-DOF actuation would allow effective and efficient science/mission operations by providing rapid and flexible imaging capability (e.g., substantial reduction in mission duration and much less constraints on spacecraft operational geometry). APIC's internal image-motion compensation (IMC) using the internal gimbal and attitude knowledge dramatically reduces the operational cost of IMC for any mission, and increase fast flyby mission imaging resolution.

APIC's unique periscope design with high-resolution narrow-angle-camera (NAC), and an optional wide-angle-camera (WAC), would provide important unique science return via the ability to simultaneously take the images of target body and star field, allowing high-resolution surface imaging with extremely precise pointing knowledge. Such imaging data with precise pointing information can accurately measure the tidal deformation and/or libration/precession of the target body, and thereby reveal target body's interior structure. Furthermore, APIC can provide stereo reconstruction of target topography and control network that would provide very accurate determination of the target-relative position of the spacecraft.

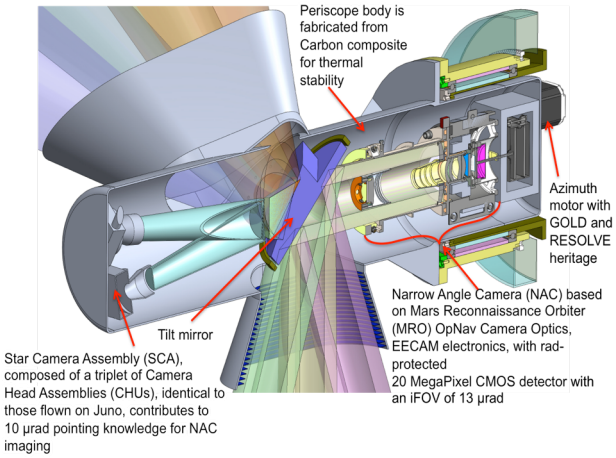

Figure 1: Cut-away view of the Advanced Pointing Imaging Camera (APIC) Instrument concept, which will far advance the planetary imaging state of the art.

Parameters	Values
Dimension	60x19x19cm
Mass	14 kg
Radiation Shielding	4 kg
Power	12 W
Image Resolution	13 µrad (~3 arcsec)
Pointing Knowledge	2 arc-second
Azimuth Range	±80°
Elevation Range	±30°
Azimuth max rate	30°/s
Elevation max rate	30°/s

Table 1: Capabilities and characteristics of the APIC concept.

APIC's combined functionalities would offer a powerful optical navigation capability, that would significantly enhance spacecraft orbit reconstruction and prediction accuracy, and thus, reducing operational cost. Also, APIC can serve as an ideal platform for autonomous navigation. Internal star-finding/tracking can provide backup attitude information for the host spacecraft.