



COBALT

CoOperative Blending of Autonomous Landing Technology

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HAT: 4.1a Precision Landing & Hazard Avoidance (PL&HA) TA: 9 EDL Systems – PL&HA TRL: start 2 / current 4

OVERVIEW

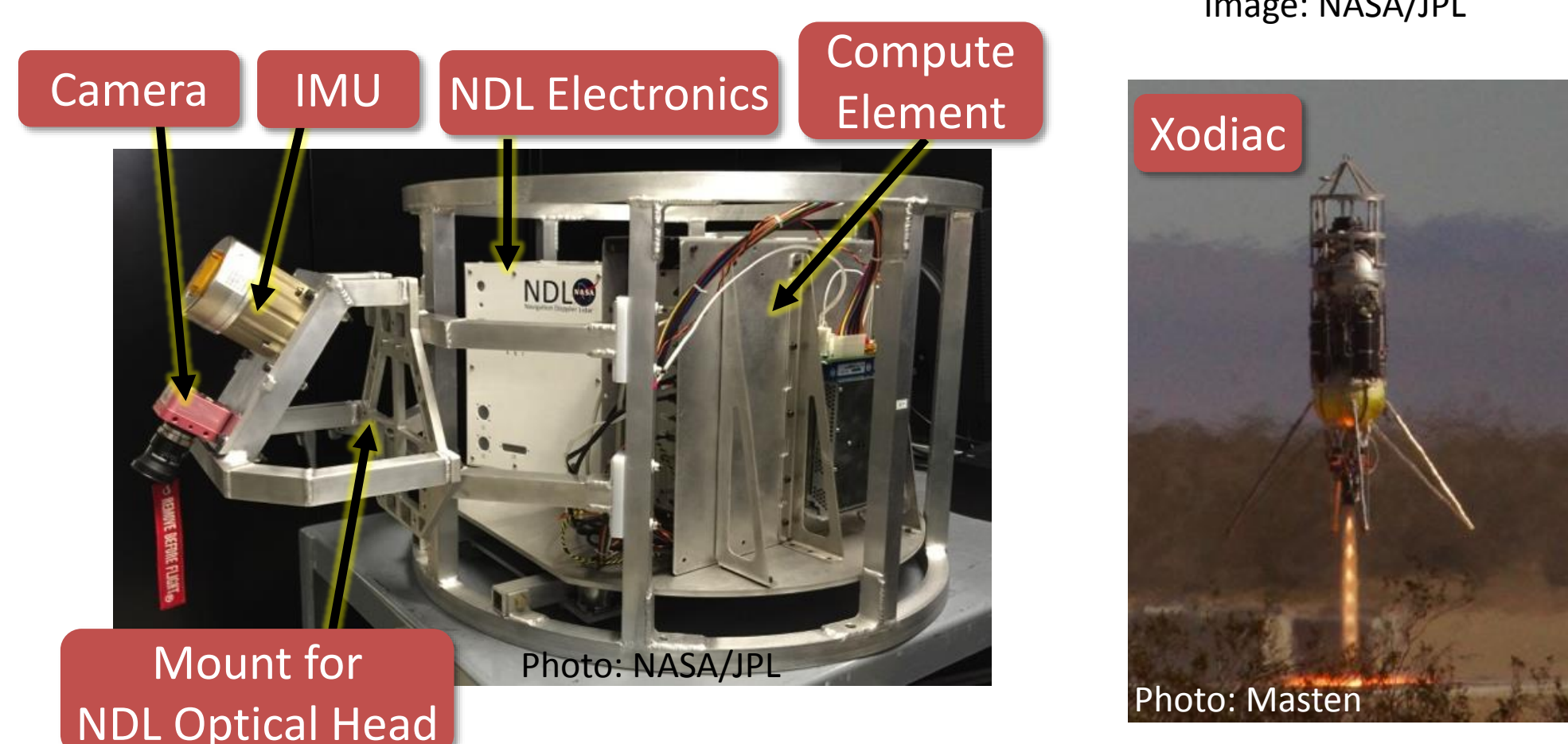
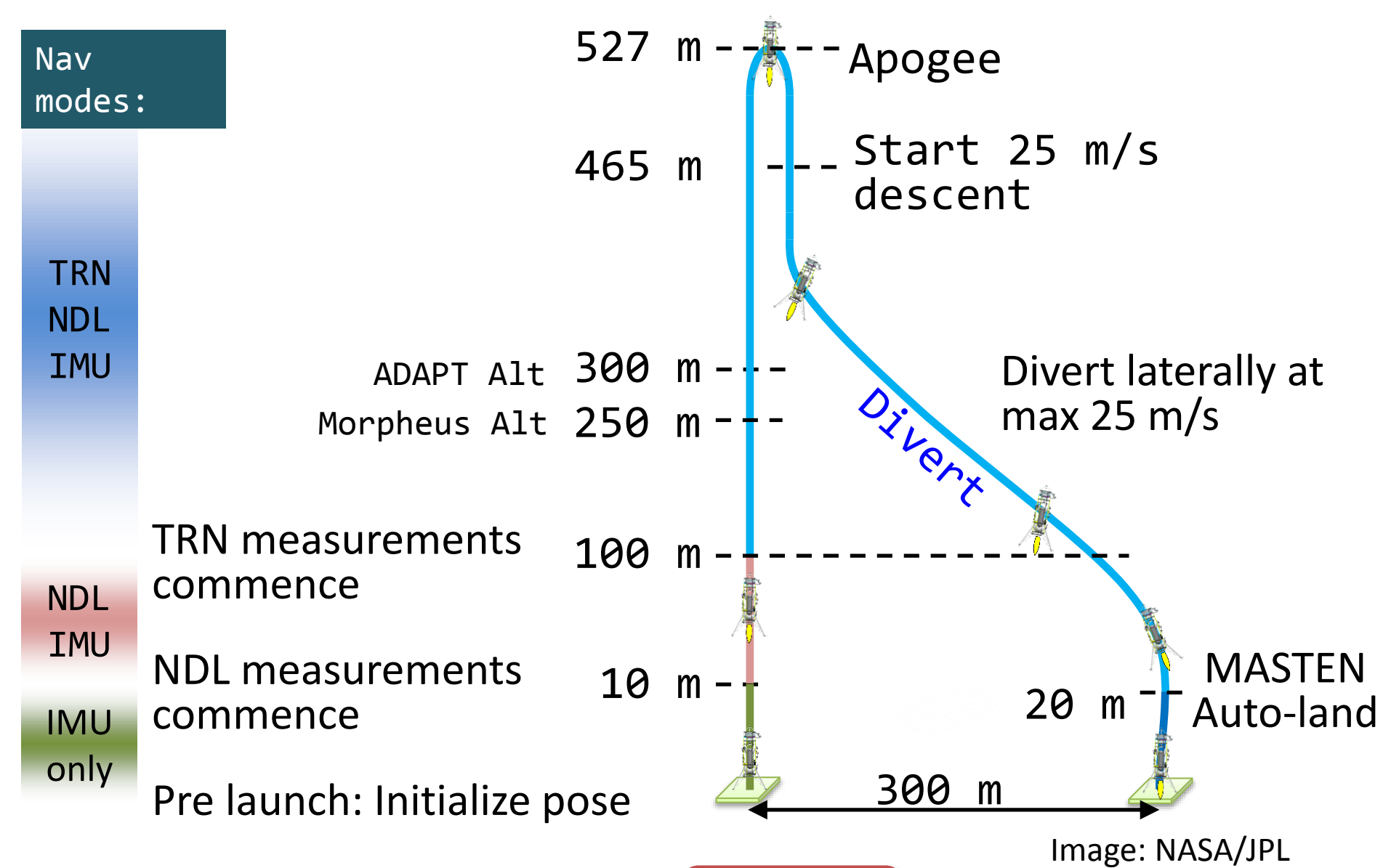
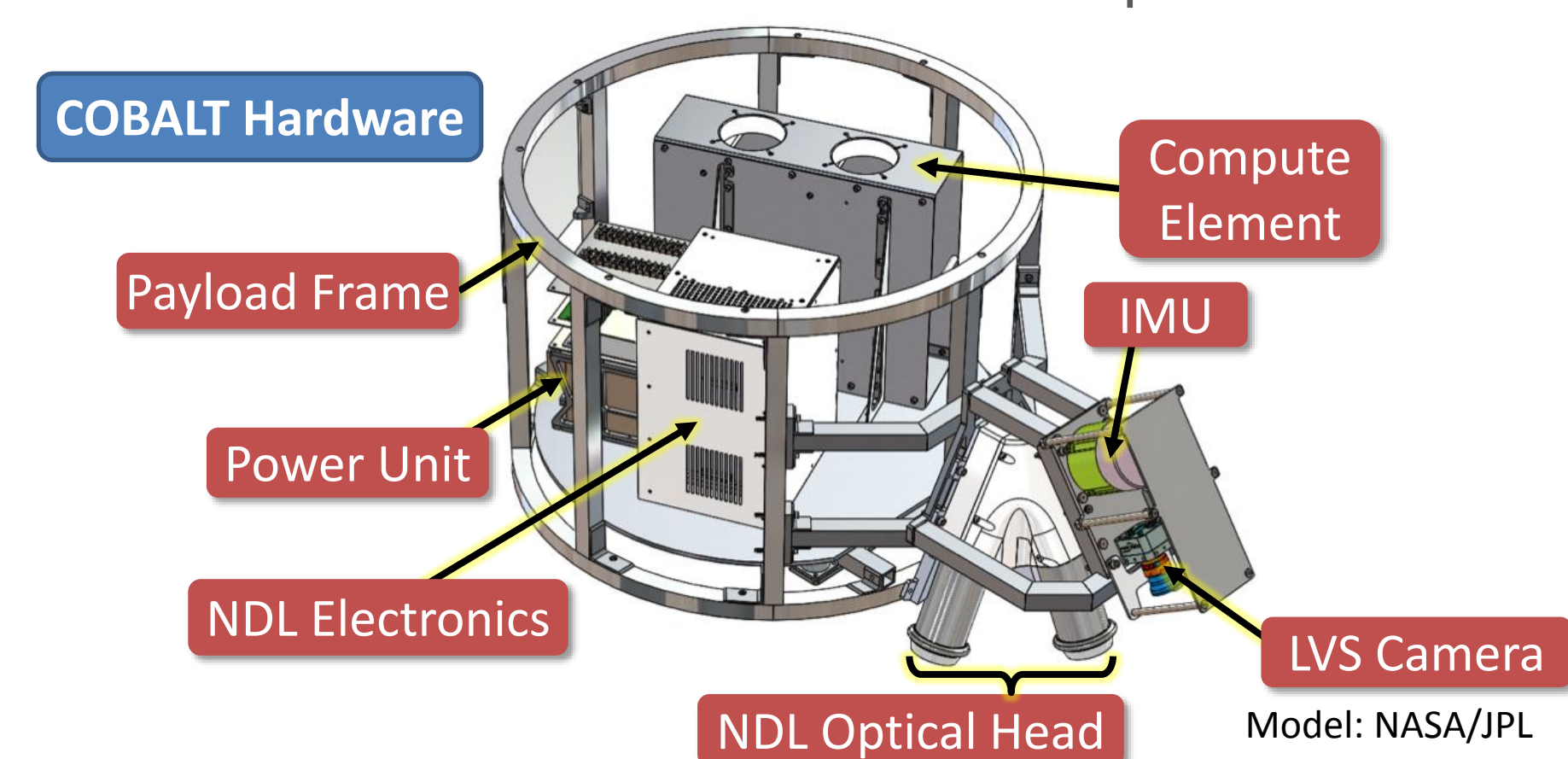
COBALT is a terrestrial test platform for development and maturation of GN&C (Guidance, Navigation and Control) technologies for PL&HA (Precision Landing and Hazard Avoidance). The project is developing a third-generation, Langley Navigation Doppler Lidar (NDL) for ultra-precise velocity and range measurements, which will be integrated and tested with the JPL Lander Vision System (LVS) for Terrain Relative Navigation (TRN) position estimates. These technologies together provide navigation that enables controlled precision landing. The COBALT hardware will be integrated in 2017 into the GN&C subsystem of the Xodiac rocket-propulsive Vertical Test Bed (VTB) developed by Masten Space Systems (MSS), and two terrestrial flight campaigns will be conducted: one open-loop (i.e., passive) and one closed-loop (i.e., active).

INNOVATION

- Matures critical precision-landing technologies for future robotic science and human Mars exploration
- Develops a reusable PL&HA terrestrial-test platform
- Integrates technologies directly into the VTB GN&C subsystem for relevant, dynamic flight testing

INFUSION SPACE / EARTH

- LVS will be infused on the Mars 2020 mission for TRN and targeting of favorable *a priori* landing sites
- NDL will achieve TRL 6 in FY2019, and infusion plans are in work for a 2020's robotic lander mission
- COBALT will be reused in future NASA projects and potential public/private partnerships for technology maturation aimed at Mars and lunar precision landing



PARTNERSHIPS / COLLABORATIONS

COBALT is a collaboration between multiple NASA centers: JSC, JPL and Langley. The project derives funding from multiple NASA directorates: HEOMD-AES, STMD-GCD and STMD-FO. The LVS technology was developed with funding from SMD and STMD.

PAPERS / PRESENTATIONS

J.M. Carson, *et al.*, "COBALT: a Payload for Closed-Loop Flight Testing of Lander GN&C Technologies on Terrestrial Rockets", 2016 AIAA Space Conference.

FUTURE WORK

The COBALT payload and NDL hardware have been assembled, and integrated ground testing is underway. Integration and flight testing with the Xodiac VTB will start in early 2017 with open-loop flight tests in winter 2017 and closed-loop flight tests in summer 2017.