SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 2) (4B)

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DEVELOPMENT AND TESTING OF A PYRO-DRIVEN LAUNCHER FOR HARPOON-BASED COMET SAMPLE ACQUISITION

Abstract

The CORSAIR (COmet Rendezvous, Sample Acquisition, Investigation, and Return) mission is a

study for the fourth NASA New Frontiers program. It belongs to the Comet Surface Sample Return mission theme which focuses on acquiring and returning to Earth a macroscopic sample from the surface of a comet nucleus. CORSAIR uses a harpoon-based Sample Acquisition System (SAS) with the spacecraft hovering several meters above the comet surface. This stand-off strategy overcomes disadvantages of systems using drills or shovels. Since comets are low gravity objects, these techniques would require anchoring before sampling which is not necessary here. Moreover, the harpoon-based system allows for acquiring several samples from different locations on the comet maximizing scientific output of the mission.

Each SAS assembly consists of a pyro-driven Launcher, a Sample Acquisition and Retrieval Projectile (SARP) and a retraction system using a deployable composite boom structure. In order to collect enough cometary material, the Launcher has to provide the required kinetic energy to the SARP. Due to high energy densities, pyrotechnically actuated devices ultimately reduce the overall system mass and dimensions. Here, an overview of the development, design and testing of the Launcher is given. Furthermore, the Launcher theory is introduced explaining the entire reaction chain: initiation $\rightarrow$ gas dynamics $\rightarrow$ SARP motion.