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Author: Dr. Stefan Völk
DLR (German Aerospace Center), Germany, stefan.voelk@dlr.de

Dr. Stephan Ulamec
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, stephan.ulamec@dlr.de
Dr. Jens Biele
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, jens.biele@dlr.de
Mr. Walter F. Smith
National Aeronautics and Space Administration Goddard Space Flight Center, United States, walter.f.smith@nasa.gov

THE CORSAIR COMET HARPOON IN THE CONTEXT OF PAST PLANETARY PENETRATOR CONCEPTS

Abstract

CORSAIR (COmet Rendezvous, Sample Acquisition, Investigation, and Return) was a mission concept that was submitted in response to NASA's New Frontiers 4 call. Although CORSAIR was not selected to be flown, the proposed sampling strategy offers a number of key advantages which are difficult to obtain by other means. The sampling strategy is based on a "harpooning" approach and differs substantially from other submitted concepts, as it allows the spacecraft to stay at some distance ($\approx 10\,\mathrm{m}$) to the surface of the comet. To some extent, there are parallels between the CORSAIR sample acquisition system and planetary penetrators. In both cases, a projectile needs to enter the surface material. Except for being tethered with the main spacecraft, the projectile portion of the CORSAIR harpoon resembles a penetrator with sampling capability. In the harpooning concept, similar dynamic behavior and technological challenges have to be considered. These aspects are investigated by comparing the proposed sample acquisition method with past planetary penetrator concepts of which only a few reached a level of maturity for the implementation into a space mission. Finally, possible reasons are examined why these concepts have been mostly rejected or descoped in the past and why they still might be of great relevance for future space missions.