

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Small Bodies Missions and Technologies (Part 1) (4A)

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## ESA'S COMET INTERCEPTOR MISSION DESIGN

**Abstract**

Comet Interceptor is the first fast (F-class) mission in the ESA Science Programme, planned to be launched in 2029 together with ESA's Atmospheric Remote-sensing Infrared Exoplanet Large-survey (ARIEL) mission. Comet Interceptor was selected in May 2019 and is currently completing its definition phase, with the Preliminary Design Review (PDR) planned for June 2022 in preparation for the implementation phase. The objective of the Comet Interceptor mission is to characterize a pristine comet by performing multi-point observations during a dedicated close-range fly-by. To date, all comet missions have visited short-period comets, which have approached the Sun multiple times along their orbits in relatively recent times and as a consequence have undergone significant changes. Instead, Comet Interceptor will encounter for the first time a long-period comet, possibly dynamically new; that is, a primordial comet from the Oort Cloud entering the inner Solar System for the first time. If a suitable opportunity arises, Comet Interceptor could alternatively visit a rare interstellar object. The mission concept is based on a launch towards the Sun-Earth libration point L2 (SEL2). Comet Interceptor will wait in an orbit around SEL2 until a suitable target has been identified and the optimum time arrives to initiate the transfer to intercept the comet. The mission architecture involves a main spacecraft that will carry two small probes that will be released shortly before the comet encounter. One of the probes will be provided by the Japanese Space Agency (JAXA), whereas the other, provided by ESA (like the main spacecraft), will be spin-stabilized to allow it to venture closer to the nucleus. The three spacecraft will embark a complete suite of both remote sensing and in-situ instruments, and the data from the small probes will be relayed back to Earth via the main spacecraft, thus providing a unique 3D perspective of the target and its jets/coma. This paper provides an update on the mission development and discusses the main design challenges posed by a target yet to be identified, the high relative flyby velocity, and the dust environment around an active comet. The trade-offs performed during the definition phase and the preliminary design of the different mission elements (mission profile, main spacecraft, small probes, instruments, operations) are presented and discussed.