



Activities of the Comet Interceptor Comet Environment Working Group

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Introduction: Comet Interceptor [1] is a joint space mission of the European Space Agency (ESA) and the Japan Aerospace Exploration Agency (JAXA). Its primary goals are to provide the first-ever in-situ characterisation of a Long Period Comet (LPC), which could be a dynamically-new comet or an interstellar object, and to perform the first simultaneous multi-point exploration of a cometary coma and nucleus.

Comet Interceptor is the first rapid response mission [2]. The mission will be launched in 2029 on Ariane 6 (together with the Atmospheric Remote-sensing Infrared Exoplanet Large-survey (ARIEL) mission) towards the Sun-Earth Lagrange point L2, where it will wait for its target comet passage.

Comet Interceptor consists of one main spacecraft (S/C A), and two deployable probes, named Probe B1 and Probe B2, which are provided by JAXA and ESA, respectively, allowing unique and simultaneous observations of the target from different geometries. The S/C A is devoted to the physical characterisation of the cometary nucleus and coma via remote sensing and in situ observations during the selected target fly-by.

Science Objectives: The mission will investigate the processes of planetesimal formation and disentangle primordial versus evolutionary processes by comparing the composition and physical properties of a pristine long period comet with those of SPC previously investigated by space mission, in particular by the Rosetta mission which scrutinized for more than 2 years comet 67P. Specifically, the objectives of Comet Interceptor are:

1) *Comet Nucleus Science:* What is the surface composition, shape, morphology, and structure of the target object?

2) *Comet Environment Science:* What is the composition of the coma, its connection to the nucleus (activity) and the nature of its interaction with the solar wind?

Science Activities: The search for the target comet is underway, and preparations are being made for the scientific exploitation of the data from the mission's three spacecraft.

The selection and scientific investigations of the target comet, as well as the development of the mission instruments and science operation areas, are supported by Working Groups (WGs). These are the Target Identification WG and Comet Environment WG. The latter comprises three sub-WGs, covering the Comet Nucleus, Near-Environment (inner dust and gas coma), and Far-Environment (outer dust and gas coma and tails). The specific tasks of the Comet Environment WG are to develop and provide results from scientific models addressing questions relevant to the implementation and operation of the mission and to achieve its scientific objectives.

Here, we provide a brief overview of the mission, and we present and describe the aims and activities of the working groups over the past year. One of the recent activities of all the Comet Environment sub-working groups is the preparation of a large repository of numerical models to favour the successful planning for scientific operations and data interpretation . Other activities include the analysis of available data on comets to better understand the environment expected during the encounter and establish base line parameters for target selection. A list of potential LPC targets has been established and these targets are under evaluation. Additional potential targets are expected to be detected in the near future thanks to ground-based survey, notably from the Vera C. Rubin Observatory Legacy Survey of Space and Time (LSST) [3].

References: [1] Jones, G.H. et al. (2024) *Space Sci. Rev.* 220, 9. [2] Snodgrass, C. & Jones, G.H. (2019) *Nat. Comm.* 10, 5418. [3] Inno, L., et al. (2025) *Icarus* 429, 116443.