

# 26 - Ouranos

The "Ice Giant Region" is the portion of our Solar System encompassing the planets Uranus and Neptune. Due to their distant location, they were never visited by their own dedicated space mission which is why scientific knowledge of them is limited. A favourable alignment of the planets in the 2030s will allow mankind to explore the Ice Giants up close. The scientific community is particularly interested in an atmospheric study of the planets since that would help them better understand the planet's formation and the Solar System as a whole.

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## Mission Objective

The Ouranos mission designed by our company, CAELUS (Comprehensive Atmospheric and Environmental Learning of Uranus's System), will focus on Uranus and provide scientists with data to unravel the formation of the planet through an in-situ scientific study of its atmosphere, and a scientific investigation from orbit.

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## System Design

The mission consists of three main parts: the interplanetary transfer from Earth to Uranus, the scientific investigation of Uranus from space, and the in-situ atmospheric analysis. For each of these phases, various possibilities were considered: for the interplanetary transfer phase, either a direct transfer or a gravity-assisted transfer was considered. Regarding the analysis-from-space phase, a choice was made between using a single space platform, multiple space platforms, CubeSats, or a combination of these. Finally, for the atmospheric flight phase, the possible candidates for atmospheric vehicles were a rotorcraft, a winged body or a blunt capsule. Multiple trade-offs and fine-tuning processes were performed to come up with the best combination of space trajectory, space vehicle and atmospheric vehicle: the selected final choice consists of an interplanetary transfer that exploits the gravity of other planets (Jupiter among them), a single orbiter and an unpowered winged body, hence a glider. An aeroshell will be used to protect the glider as it enters Uranus' atmosphere at a velocity of over 25 kilometres per second.

The transfer phase from Earth to Uranus lasts between 20 to 25 years which, besides allowing for significant savings in propellant mass, will enable scientific measurements to be taken

of the planets passed during the gravity assists, further increasing the scientific yield of the mission. Once the spacecraft closes in on Uranus the orbiter will detach from the aeroshell, effectively separating the fate of the two vehicles. The orbiter will insert into orbit around Uranus, during which it will not only relay the scientific data transmitted by the glider but also as measure the magnetic field and the photometric light curve of the planet. The aeroshell, on the other hand, will plunge into Uranus' atmosphere, resisting the heat loads and decelerating enough for the glider to be safely deployed. Once the glider is released, it will exploit its altitude to gracefully descend through the atmosphere, during which it gathers valuable scientific measurements, such as data on the abundance of noble gases, and the thermal and dynamical properties of the winds.

