

Daedalus: A Low-Flying Spacecraft for the Exploration of the Lower Thermosphere - Ionosphere

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The Daedalus mission has been proposed to the European Space Agency (ESA) in response to the call for ideas for the Earth Observation programme's 10th Earth Explorer. It was selected in 2018 as one of three candidates for a Phase-0 feasibility study. Also selected were Stereoid and G-Class, both carrying synthetic aperture radars in novel ways aiming to provide views of processes at the Earth's surface.

The goal of the Daedalus mission is to quantify the key electrodynamic processes that determine the structure and composition of the upper atmosphere, the gateway between the Earth's atmosphere and space. An innovative preliminary mission design allows Daedalus to access electrodynamic processes down to altitudes of 150 km and below. Daedalus will perform in-situ measurements of plasma density and temperature, ion drift, neutral density and wind, ion and neutral composition, electric and magnetic fields and precipitating particles. These measurements will unambiguously quantify the amount of energy deposited in the upper atmosphere during active and quiet geomagnetic times via Joule heating and energetic particle precipitation, estimates of which currently vary by orders of magnitude between models. An innovation of the Daedalus preliminary mission concept is that it includes the release of sub-satellites at low altitudes: combined with the main spacecraft, these sub-satellites will provide multi-point measurements throughout the Lower Thermosphere-Ionosphere.

The synergy with ground-based volumetric imaging of the ionosphere-thermosphere by E3D was an important argument of the Daedalus proposal. We specifically discuss how Daedalus and E3D measurements would complement each other.