Thermal behaviour of ram-facing instruments during deep dives into a planetary atmosphere: The case of Daedalus/CWS

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Spacecraft that aim to study the atmosphere of a planetary object through in situ sampling face the problem of strong atmospheric drag. In order not to compromise mission lifetime, the orbit can be designed so that repeated deep dives into the upper atmosphere are performed to sample atmospheric density, pressure, and composition down to relatively low altitudes. During such deep dives, ram-facing instruments, such as ion and neutral wind instruments, in particular are exposed to a severe heating flux.

The present contribution focuses on the particular case of the neutral Cross-Wind Sensor (CWS) under study for the Daedalus Earth Explorer 10 mission led by ESA, which will sample the Earth’s upper atmosphere during its perigee passes at an altitude currently planned to be in the 110 to 140 km range. Thermal simulations are presented that show the transient heat loads on the CWS instrument. It is shown that, with an appropriate materials choice, these heat loads can be dealt with in a satisfactory manner.