

DEVELOPMENT, SIMULATION AND TESTING OF TEMPERATURE SENSORS FOR THE ATTITUDE DETERMINATION OF THE MASCOT ASTEROID LANDER

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This paper discusses one of the sensor concepts that have been considered for the attitude determination system of the Mobile Asteroid Surface Scout (Mascot), currently on its way to the near-Earth asteroid 1999 JU3 on the Hayabusa2 spacecraft. A newly developed Orientation Temperature Sensor (OTS) is used to acquire temperature readings from multiple sides of Mascot, and determine the landers orientation relative to the asteroid surface based on these readings.

We describe the modelling and hardware testing of these OTS using different optical surfaces with high and low values of absorption α and emissivity ϵ . OTS performance is then evaluated under actual mission conditions to determine which sensor type, or combination of sensor types can be used for attitude determination. The obtained results show that both single and multiple sensor type concepts can be used to determine attitude relative to the asteroid surface. A single type low α , high ϵ sensor provides information on which side of the lander is facing the surface, while a combination of two sensors with identical ϵ and distinct α allows determining the location of the Sun within an error of 7 deg.

While not used as part of Mascots attitude determination system due to a delayed response time of 5–10 min, compared to other available, instantaneous sensor types (optical & photovoltaic), the OTS have been added to the Mascot baseline design as a proof of concept, and to collect additional science data during Mascots mission on the surface of 1999 JU3. This provides the opportunity to validate the OTS hardware and concepts as a lightweight, low cost alternative for future missions, and directly compare their performance to Mascots other sensor types.