23 - A distributed network for asteroid exploration

In recent years, the development of in-space technology has accelerated, unlocking the deep space frontier for an increasing number of scientific missions. As the costs to launch and operate payload drops, the race to miniaturise spacecrafts into smaller and smaller form factors enables for the emergence of a new generation of deep space missions.

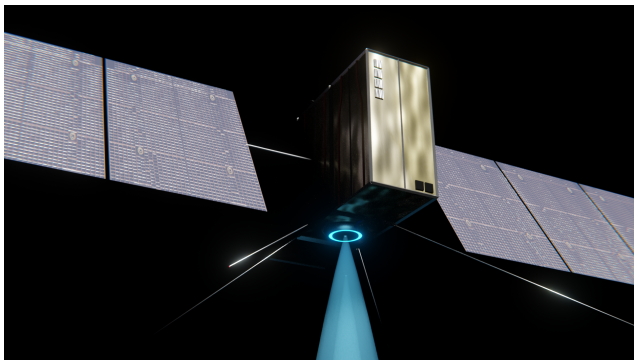
Mission Objective

The Distributed Asteroid Surveying Herd (DASH) is a versatile and scalable network of CubeSats that is designed to host a variety of different payloads. The demonstrator mission will be deployed around the Didymos asteroid system to characterise its composition, and to analyse the results of NASA's asteroid redirection test. With its novel mission architecture, DASH aims to lower the costs and long-term contamination of exploring deep space.

System Design

The DASH mission consists of several satellite groups, called TRIADs, each made up of three interconnected CubeSats. Each TRIAD acts as a single spacecraft until arrival at the target, where it separates into the three constituent spacecrafts to begin scientific operations. This allows for task specialisation of the individual CubeSats, which greatly increases the versatility and effectiveness of the system as a whole. Each TRIAD is composed of a SHEPHERD, providing the transfer propulsion and serving as a long range communication node, and two DOTs, focused on maximising the payload fraction available to the customer. As multiple TRIADs reach their destination, SHEPHERDs provide a deep-space capable communication network to the distributed sensor array the DOTs compose. The target asteroid can then be analysed with potentially superior temporal and/or spacial accuracy to characterise its composition, gravitational field, and density swiftly and cost-effectively.

Task specialisation is a key enabler of DASH competitiveness as a distributed mission. Dividing tasks, such as propulsion or communication, across different CubeSats allows preserving the very small form factor while not compromising on system performance. Furthermore, having TRIADs as self-sufficient and fully capable deep space transfer vehicles means much greater scalability of the overall architecture. One or several TRIADs can be deployed just as easily to effectively scale up or down the mission. This allows for tailor-made custom scientific sensor arrays to be delivered to a wide range of near Earth targets with the exact desired performance at no extra development cost. Making use of widely compatible custom containerised deployers, TRIADs can be integrated on virtually any commercially available launcher.



With the recently exponential growth in the space industry, the overall market cap is estimated to double within the next five to ten years. Although unproven, DASH has the potential to set a new standard for future deep space missions.