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TOLIMAN MISSION - IN SEARCH OF EXTRATERRESTRIAL LIFE

**Abstract**

Turning humans into interstellar species is a long journey, but it begins with one small step, which could be as small as a CubeSat. University of Sidney and EnduroSat, together with Breakthrough Initiatives, are developing a 16U CubeSat to search for exoplanets in the habitable zone around several solar-like stars, with main focus of observation Alpha Centauri A and B.

A custom-designed telescope will perform astrometry observations of the target stars. It will track very precisely their positions in the sky and search for tiny wobbles caused by gravitational irregularities. This will indicate the presence of a planet orbiting the star. The innovative telescope will be equipped with a diffractive pupil lens that spreads starlight into a flowerlike pattern. This allows detection of tiny irregularities in the movement of the stars, thus allowing planets to be discovered.

Discovering exoplanets, however, is a major technological challenge, even for large satellites. For a CubeSat, this becomes even more challenging since the satellite needs to fit the telescope within 8 units of volume, to maintain it in thermal equilibrium using cold-biased thermal system and to have pointing accuracy of less than 5 arcsec and stability of less than 0.5 arcsec/sec. This will be achieved by implementing three ADCS control loops for coarse and fine pointing. Two sets of reaction wheels of different sizes will be used and the payload feedback will also be included in the equation. This will fine-tune the spacecraft's pointing stability and allow it to observe the target stars continuously. Several sets of heaters will be mounted on the circumference of the telescope in order to control its temperature and to keep it almost at room temperature throughout the entire orbit. EnduroSat's flight-proven platform is capable of downloading payload data at a speed of 125 Mbps, which will ease the payload operations and allow for longer observation sessions.

This groundbreaking mission will become an inspiration not only to future astronomers around the world, but also to small satellite companies aiming towards exploration missions. It will prove that CubeSats are capable of performing complex missions and contributing to revolutionary discoveries and it might be humanity's first step in finding extraterrestrial life.