

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry & Landing Systems (3)

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PER ASTRIS AD ASTRA – HOW ARIANE’S KICK STAGE PROPELS EUROPE INTO FUTURE
IN-ORBIT APPLICATIONS**Abstract**

The need to inject spacecraft directly into their operational orbit or nearby is becoming more and more pertinent as it drastically reduces the complexity and risks of the spacecraft’s Launch and Early Operation Phase. Such a service also results in a significant simplification of the spacecraft platform design and at the same time in an increase of the estimated life-time. Moreover, many other use cases and enhanced services relying on in-orbit transport vehicles are under discussion and prove to be at the heart of end-to-end space infrastructure. Concretely, orbital transport vehicles, such as kick-stages, which are capable to evolve into in-orbit logistics platforms and which are adaptable to serve a variety of missions, need to be developed for different kinds of payload classes.

In Europe, the ASTRIS kick stage is currently under development by ArianeGroup, targeting a variety of missions including the injection of a spacecraft weighing around 4t into a Lunar Transfer Orbit once released by an Ariane 6. With the strong support of Germany, ESA decided to start a fast-track development that is a stress case for the historical ESA development methodology. The main engine for its propulsion system, a storable bi-propellant engine of the 4kN thrust class, is being developed in parallel to the kick stage, after a four-year preparatory phase in the Future Launchers Preparatory Programme (FLPP). The first flight of the vehicle is foreseen end of 2024.

This paper describes how the development challenge for the ASTRIS vehicle is tackled, especially focusing on the propulsion system, and presents the possible evolution of the vehicle into an in-orbit logistics platform performing relocation, refuelling, data transmission relay and deorbiting services. These evolutions represent a major goal for Europe towards a more sustainable space infrastructure, and are prepared by the ESA Future Launchers Preparatory Programme through for example the Luna Nova project, a further enhancement of the vehicle into a versatile green propellant orbital platform or through space logistics proof of concept missions.

ASTRIS is a step stone into a key element for the European Earth-Moon logistics architecture as its

main engine can be used for in-orbit transfer as well as lander vehicles: an adaptation of the ASTRIS main engine to a deeply throttleable engine is also being investigated.