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THE ROAD TO HYPERDART, FAST AEROSPACE'S PARTIALLY REUSABLE PROPRIETARY HYPERSONIC STRATOLAUNCHER FOR SMALLSAT LEO DELIVERY

Abstract

FAST Aerospace, a new innovative Italian startup, has the goal of entering the Italian and European launcher market with the mission of offering satellite manufacturers a new bridge to space, with unique and highly innovative features, crushing the bottleneck currently afflicting the space access sector, particularly relevant for satellites of small to medium size. The company is currently designing a new proprietary launcher, that will allow non-equatorial and densely populated countries, including Italy and many European states, to have independent and dedicated access to space.

This launcher, called HyperDart, is a vehicle composed of two main parts: a remotely controlled drone, with a maximum atmospheric speed of Mach 5, which carries on its back and boosts a methalox-powered rocket, that covers the "last mile" between the high flight altitude of the drone and the target orbit of the payload. The system, the size of a business jet, is designed to be able to take off from existing airport runways and has a close-to-full reusability architecture, with up to 95% of the dry mass reused for each flight.

This paper explains how FAST Aerospace intends to pursue the HyperDart development program. The company has planned to design, build and fly a series of intermediate-sized demonstrators, all belonging to the so-called Dart family. This family is composed of the following vehicles, ordered from the lightest and easiest to the heaviest and most complex: MiniDart, weighting 3kg thrusted by electric propulsion and built with additive manufacturing; Dart, with a mass of 25kg, powered by a turbojet with a close-to-sonic top speed; SuperDart, weighting 5tons and with supersonic speeds, and eventually the prototype of HyperDart, with a maximum takeoff weight of 16tons, rocket included, with identical characteristics to the final carrier. This prototype will demonstrate the staging of the rocket in hypersonic flight regime, one of the core technologies of the launch system. Commercial-grade HyperDart's first flight is scheduled for the early Thirties.

All vehicles belonging to the Dart family are crucial and fundamental steps for the company, necessary for the development of all the technologies needed for the final launcher. In this paper, particular emphasis is

put on the design and build of the first demonstrator, MiniDart, and on the design and early prototyping of Dart, which first flight is planned for Q1 of 2025.