IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems (4)

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AT CROSSROADS OF AERONAUTICS & SPACE: WHAT MATTERS FOR AEROSPACE VEHICLES FEATURING ULTRA-HIGH PERFORMANCE

Abstract

Making the best of both Earth very deep gravity well and thick atmosphere, the World's aerospace sector, be it civil-commercial or military, has managed to produce, especially since the World War II, a wide range of diverse ultra-high-performance flying systems. It is presently a very rich and still dynamic sector as it continues to develop and evolve very rapidly. It now covers a wide range of domains, categories, programmes and concepts, including new emerging vehicles able to fly through the airspace and the atmosphere and/or in the outer space, back and forth. These projects range from aviation (subsonic, transonic, supersonic or even hypersonic planes) to suborbital and orbital systems. They include ultra-high performance aerospace vehicles, sounding rockets, and other emerging or innovative systems like high-altitude platforms (HAPS, airships, balloons, drones), suborbital aircraft systems (either for local A-to-A flights or for A-to-B 'near-orbital' ultra-fast Earth-to-Earth transport) up to multi-stage space launching systems. They use a wide set of propulsion technologies, ranging from solar-electric engines, air-breathing high-bypass turbofan engines or ramjets, to anaerobic rocket-engines, cold gas Nitrogen-thrusters or even ion-thrusters suited for the vacuum of space. In order to better grasp how all these various systems and operations' types compare, complement and may interact with one another, main aerospace categories will be represented with respect to their altitudes, speeds as well as their embedded energies, in a pedagogical way. As such, the big picture will be provided together with a sense of scales. It also helps to trace potential articulation or gateways between aviation and space. Despite the absence, in conventional or customary international laws, of an explicit altitude delimitation between national sovereign airspaces and outer space, this paper will show that the anchoring physical limit for ranking these advanced systems is rather more a matter of embedded energy than altitude alone. Today's available cutting-edge technologies in propulsion, avionics, digitalization, energy, materials or systems' synergy allow new architectures and future types of reusable high-speed systems, which could be developed to operate at crossroads of aviation and space.