

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Technologies for Future Space Transportation Systems (5)

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## TOWARDS A NEW CLASS OF ENGINE FOR FUTURE HEAVY LIFT LAUNCH VEHICLES

**Abstract**

The speech of the President of the French Republic at the Space Summit Meeting in February 2022 recalled the European interest for exploration and manned spaceflight. A double observation can be made on this basis: - Ariane 6 is on its way to launch operations, the present studies of future heavy space transportation systems rely on the 120 tons class Prometheus reusable engine, and first stage recovery demonstrations (Callisto and Themis demonstration stages). These launchers (A6 and next step prospects) belong to the class of heavy launchers (max 20T LEO). - The context is moreover evolving, with in the one hand the intensification of the participation in the exploration programs, as well in Earth orbit as in Lunar orbit (and beyond), and in the other hand the fierce competition for commercial access to space. This might lead for Europe to the need of a significant increase in payload capacity, therefore in launch system class as well as propulsion class. Two questions then arise: What type of transportation system (architectures and launch strategies), and what technological steps to prepare this scenario, in particular in the field of Liquid Propulsion, which is a long-term matter? This forward-looking approach resulted in a set of internal studies as well as the performance of a workshop dedicated to European super-heavy launchers prospects and associated technologies, during which the evolutions of the Propulsion Systems were addressed in particular. Several system and engine concept studies have already been started in this way, with the aim of reviewing knowledge and past achievements, then leading to the initiative toward a very-high-thrust engine, possibly with a staged combustion cycle. The objective of this initiative is to prepare the dedicated skills in the French industrial ecosystem and the technologies associated to very high thrust / staged combustion engines, including the benefit of synergies with the existing Prometheus development: engine hardware that can serve as demonstration platform, available test benches for Prometheus and Themis, team competences at ArianeGroup in Vernon. The first phases of the study are already running to identify engine configurations and technological challenges to overcome, and the demonstration elements of a staged combustion cycle engine will be the next objective of this approach to be implemented.