

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

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A VIABLE AND SUSTAINABLE EUROPEAN PATH INTO SPACE – FOR CARGO AND  
ASTRONAUTS**Abstract**

The recent rapid development of advanced technologies in the field of international space transportation systems requires an updated and refined European strategy based on two pillars, taking into account shortterm as well as a longterm aspects:

1. The reliable and powerful Ariane launcher system is to be systematically further improved with perspective of reducing costs while improving versatility. Within the next few years, an expansion of the mission spectrum including astronautic transport and the possibility of bundling missions should be planned.

2. A new generation of modern, high-performance launchers is to be prepared that is capable of serving all major missions relevant to Europe - in a highly cost-efficient, sustainable, flexible and performance-oriented manner.

A joined think tank of DLR Research and ArianeGroup reflected on the market perspectives, broadening the mission capabilities for European access to space including human mission towards LEO, supporting potential future commercial markets. Accordingly, astronaut transportation based on the new European Ariane 6 had been preliminarily analyzed. An overview will be given on its mission requirements, technical concepts and cost estimates.

The second, ambitious goal of new generation, high-performance launcher is unlikely to be achieved by minor modifications to existing systems alone, but is requiring more wide-ranging steps. Partial reusability is probably the most promising approach for such a new launcher system that, nevertheless, could exploit synergy potential with Ariane, already containing important technological building blocks.

The paper summarizes major results of preliminary technical design studies performed in Germany, both for a future Ariane 6 evolution including astronaut transport to and from LEO and for the next generation of partially reusable concepts. Return of the RLV is pondering options of powered descent and vertical landing and smart winged return technologies with horizontal landing close to the launch site.

The main propulsion system is considering LOX-LH2 in different cycle architectures as well as LOX-LCH4 of the ongoing PROMETHEUS development program.

For the studied concepts, the overall shape and aerodynamic configuration, the propulsion and feed system, the architecture and structural lay-out of the stages will be described and different technical solutions will be compared. An evaluation process shows significant differences in size and mass of the launcher options all sized for similar missions in the class of Ariane 6 and its Evolution.