SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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INVESTIGATIONS OF FUTURE EXPENDABLE LAUNCHER OPTIONS

Abstract

Two new launchers, Soyuz and Vega, are scheduled to enter operation in the coming months at the Kourou spaceport, increasing the range of missions able to be launched by Western Europe. Nevertheless, continuous improvement of the launch vehicles is necessary in the future which requires starting such investigations already today.

DLR's launcher analysis group SART is focusing its research on a few promising development lines. Some concepts have been studied jointly with industry; other investigations are carried-out independently by internal DLR funding. The paper provides an overview on the recent results of these activities.

A DLR space agency funded study called VENUS is looking on future upgrades of Vega. This analysis is now focusing on three and four stages configurations based on solid rocket motors for the lower stages and on different storable liquid propellant upper stages.

Another interesting, simpler concept is currently studied by SART, namely a two-stage to orbit launch vehicle (TSTO) making use of synergies by implementing stage or component hardware already existing or under development. This approach should reduce development cost, but even more importantly, to raise production numbers of components and thus decrease manufacturing cost and enhance quality. The studied TSTO configurations, which aim at exceeding Vega's performance, are all based on a solid rocket motor for the first stage and a cryogenic liquid propellant upper stage with VINCI engine currently under development for Ariane 5 ME. Preliminary results showed promising performance but also the need for improvement on the booster side [1]. The first stage should be based on a single segment grain propellant and a carbon-epoxy filament wound monolithic motor case, similar to the current Vega P80FW. The considered more powerful motors contain up to approximately 140 tons of solid propellant. Different combinations of solid strap-on boosters might be interesting for further performance enhancement.

Under the term "NGL" a still somehow nebulous future medium lift launcher configuration is investigated in Europe. A broad payload class range from 3 to 8 tons in GTO reference orbit should be served by a flexible arrangement of stages and strap-on boosters. The recent SART work focused on two and three-stage vehicles with cryogenic and solid propellants. Strap-on boosters are attached to allow adjustment to the payload range.

The paper presents the promises and constraints of all investigated future launcher configurations.

1. Sippel, M.; Lang, A.; Dumont, E: Advanced Technology Upper Stages for Future Launchers, IAC-10-D2.3.1, September 2010