Jury Summary

Design Synthesis Exercise Fall 2017

DSE GROUP 2 – RECOVERY OF ARIANE 6 FIRST STAGE KEY COMPONENTS

In the past few years, the global space market has been pushing towards lowering the costs of launching spacecraft by reusing parts of the launchers. Private companies have now proven that it is feasible to make a launch vehicle reusable. As a first step towards this market demand, on behalf of Airbus Defence and Space, it has been investigated whether it is cost-effective to recover, refurbish and reuse the key components of the first stage of the Ariane 6. The Ariane 6 is a future European space launcher which is expected to be operational by 2020.

More specific, the objective of the design synthesis exercise is to: "Design a feasible recovery system for the Vulcain aft bay of the first stage of the Ariane 6 launcher that shall be operational by 2022, conducted by 10 students in 10 weeks."

From launch to re-entry to landing and finally to the refurbishment of the Vuclain aft bay (VUAB), we have developed a system that will cover the full life-cycle of an Ariane 6 launcher. The recovery system will consist of a cutting-edge inflatable aero shell to survive the atmospheric re-entry environment, one of the largest parafoils in the world to descend and glide towards the landing zone and a helicopter mid-air catch to allow for a safe and reliable landing of the VUAB. After first stage separation, the aero shell will deploy and re-enter the atmosphere at a velocity of 6900 m/s at 100 km altitude. Next, at roughly 10 km altitude the heatshield will be discarded to make way for an 836 square meter parafoil. This will slow the VUAB further down to 5.5 m/s at 2 km altitude. Lastly a heavy lift cargo-class helicopter will catch the VUAB and carefully return the VUAB to a transport ship. The system will be optimized for weight, cost and reliability.

At the moment of writing this jury summary we have finished the flight models which will accurately simulate the entire flight trajectory, from first stage separation to touchdown. The models include all necessary maneuvers as well as accuracy predictions. The parameters that flow out of the flight model gave us accurate inputs for the design of the subsystems. Currently, the design optimization is converging towards the final design which will be frozen in the next few days. In the next two weeks we shall analyze the design for return on investment, manufacturability, risk and sustainability. The design trade-off included a SpaceX-like landing, a hard landing with parafoils as well as a winged concept. At this stage we have very positive prospects towards the feasibility and success of the design, more so even than during the concept trade-off!

We look forward to presenting to you the final design and convince you that with our design Airbus will be a highly competitive player on the reusable launcher market!

Kind regards,

Jean-Luc Overkamp
Team Manager of DSE group 2