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Title

Development of low-shock separation systems for payload fairings

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Abstract

Payload fairings (PLF) protect the payloads from aerodynamic and acoustic pressure, heat, and environmental influences during ground operations as well as during the initial stages of flight. Once the launch vehicle crosses the dense atmosphere and the aerodynamic loads become negligible, the payload fairing is jettisoned from the rest of the launch vehicle to optimize the propellant consumption. For the past decades, payload fairing and stage separation systems have typically relied on pyrotechnical solutions. These systems have an extensive heritage in the space industry and have the main advantage of being very reliable, compact, and efficient. However, they also have drawbacks such as increased cost compared to other solutions and relatively high shock transferred to the adjacent structures, which limits the potential payload comfort.

For the last years, Beyond Gravity has been developing a modular low-shock separation and jettison system for PLFs. The new system is based on discrete mechanical latching points, pneumatic actuators, and a gentle, rotational jettisoning trajectory safely guided by hinges. This solution offers a very low-shock environment during fairing separation and has the advantage of modularity, making it suitable for small size adaptations and scaling with a significantly lower development effort.

This study presents the most recent achievements of the development activities, funded by the European Space Agency's Future Launchers Preparatory Programme (FLPP). The separation system employs mechanical latches for all connections of the vertical separation system (VSS) as well as the horizontal separation system (HSS), relying on the same technology for all separation locations. The main benefit of having the same type of separation system is that it allows for a reduction of the development effort and complexity. First prototypes of such latches have been built and successfully qualified, showing reliable results and very low output shock during actuation, which would enable to increase the payload comfort of future payloads.

This paper shows the main design and functionalities, together with the key advantages of this type of separation and jettison system compared to the existing state of the art systems. Furthermore, this proceeding gives an overview of the development activities ongoing and planned for the next years to contribute to the development of future payload fairings.

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