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Characteristics of our Payload Fairings

Challenges
- Severe environmental conditions induced during flight
- Total protection of payload
- 100% reliability

Technologies
- Low-shock pyrotechnical separation
- Comprehensive simulation of separation dynamics
- Advanced materials and processes

Solutions
- Lowest shock levels
- Guaranteed-in-flight functional separation performance
- Customisation to mission-specific needs

Customer Values
- Low environmental conditions imparted to the payload
- Increase of payload mass
- All 185 missions 100% successful

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Oerlikon Space is well known in the international space business and your reliable partner for:
- Payload Fairings for Launch Vehicles
- Spacecraft Structures
- High-Precision Mechanisms
- Scientific Instruments
- Electro-Optical Systems

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Your Partner
for Reliable Payload Fairings
The payload fairings for the first three generations of the Ariane launcher family reflected classic aircraft technology. With the Ariane 5’s ‘Nabucco’, Clariant’s design was set on a new path by utilizing composite technology based on carbon-fibre tapes and honeycomb structures. This construction method allowed new attractive specifications by combining two main properties with high stiffness. For the European Ariane 5 and Vega launchers as well as for the US-American Atlas V-500 launch vehicle, Clariant Space made a further step forward by introducing the ogive shape for the fairings thereby reducing significantly the aerodynamic drag and increasing the launch vehicle’s payload capacity.

The payload fairings are made up of two halves, which are connected by means of a robotic system at the test facility. The horizontal separation system fixes the fairings to the launcher. Triggered by the onboard computer at the proper flight altitude, the pyrotechnical elements of the separation system are ignited and the fairing halves are jettisoned.

The shell elements, which are produced on specially designed bonding moulds, consist of five layers. The inner face sheet, the core and the outer face sheet, including possibly a thermal protection, are laid up onto the bonding mould, where the resin of the face sheets is cured and a secure bond is achieved.

The all-new 5m-diameter Vega payload fairing configured by Clariant Space. A very comprehensive integration process is applied, where horizontally non-tiltable, but perfectly matching fairing halves are assembled. Machining operations are automated to a large extent to yield an ergonomic and cost-efficient process.

The larger shell elements for the 5.4-m fairings are transported to Fukuoka Aerospace all Emmei (Sakaijima), where they are integrated to combined fairing halves on behalf of and under supervision by Clariant Space AG. The fairing halves are then equipped with a special coating to prevent electronic charging and provide the necessary protection against solar heating until launch. On most of the fairings, a specifically tuned acoustic protection is installed internally, to protect the spacecraft from the harsh external acoustic field during lift-off and in the transonic phase. An electromagnetic shield is mounted on a wide variety of sensors for on-ground and in-flight monitoring of the spacecraft. Special sensors and equipment for acoustic protection are also mounted. Finally, shortly before acceptance and delivery, a set of mission-specific installation tools are delivered by the launcher’s customer.

Testing

Extensive testing programmes on system level complete the design and development phases of a new generation of payload fairings. The test data are checked against the numerical simulation results. Test and flight programme ranges from static load tests through static load tests with dummy payloads to static load tests under vacuum. To this end, the payload fairing test article is assembled in the world’s largest vacuum chamber of NASA in Ohio (USA) and subjected to a separation test. The separation sequence is recorded manually by means of a set of high-speed cameras and the resulting data is again checked against the forecast of the numerical simulation.

Launch Support

Oerlikon Space not only designs and manufactures payload fairings but provides the customer also with the required support on the launch site. Together with the satellite provider’s specialists, representatives of Oerlikon Space install the spacecraft together with the fairing halves on top of the composite of the launcher. The upper composite is then mounted on top of the launcher. Finally, the pyrotechnical elements are added into the fairing’s separation systems and the last remaining checks are executed, which leaves the upper composite ready for launch. Based on decades of experience on launch support, Clariant Space is an invaluable partner when it comes to development, verification and qualification of lean and reliable and fast final integration processes. This minimizes ground time of the spacecraft and the launcher. The necessary ground support, handling and transport equipment is designed, manufactured and tested by Oerlikon Space.

The data collected during the payload fairings’ ground, flight and separation phases are routinely measured. The detailed data are down-loaded in real time to the ground control station and later analyzed by Oerlikon Space specialists. These data, especially the data from the dynamic separation trajectory, are integrated into the numerical simulation models to enhance the database contributing thereby to the high quality of future payload fairings.

Conclusions

Since their introduction in 1979, the payload fairings from Oerlikon Space have become a world benchmark in the space industry market thanks to their unrivalled 100% reliability. Many different types of launchers have been equipped with Oerlikon Space payload fairings. Permanent product and process improvement efforts as well as co-operating partnerships with international customers constitute the basis for this outstanding success.
Design

Drinkleron Space has on its premises the complete infrastructure available to design, develop, produce and test payload fairings for launchers. The fairing halves are made up of a number of shell elements, which are produced on specially designed bonding machines. The different layers of the shell elements, i.e. the inner face sheet, the core, the outer face sheet including possibly a thermal protection, are laid onto the structure in such a way that the resin of the face sheets is cured and a secure bond of the face sheets to the core is achieved.

The mechanical and thermal loads during ascent and separation and as well as for the 5400 in four different length versions, which allow to guarantee the required safety margins. Testing on component, subsystem and system level is executed in order to provide the necessary protection against solar heating and to react directly to the market’s needs.

The all-new 3m-class Vega payload fairing is manufactured by Drinkleron Space. A new combined integration process is applied, where horizontally two individual, but perfectly matching fairing halves are assembled. Machining operations are automated to a large extent to yield an ergonomic and cost-efficient process.

The larger shell elements for the 5.4 m fairings are transported to FLUG Aerospaces at Emmen (Staatslund), where they are integrated to combined fairing halves on behalf of and under supervision of Drinkleron Space AG. The fairing halves are then equipped with a special coating to prevent electromagnetic charging and to provide the necessary protection against solar heating until launch. On most of the fairings, a specifically tuned acoustic protection is installed internally to protect the spacecraft from the harsh external acoustic field during lift-off and in the transonic phase. An electrically neutral conductive layer is deposited which can also be used for ground and in-flight monitoring of the spacecraft electronics and structure, which is also mounted. Finally, shortly before acceptance and delivery, a set of mission-specific installations derived by the launcher’s customer are added onto the fairing’s separation systems and the last payload cooling are also provided.

Fairing separation test under vacuum performed in Oerlikon Space’s test chamber by the customer and packed in containers or loaded in a truck on top of the launcher. Finally the pyrotechnical elements are added into the fairing’s separation systems and the last pyrotechnical checks are executed, which seals the upper composite for launch. Based on decades of experience on launch support, Drinkleron Space is an invitee quality partner when it comes to development, verification and qualification of lean and low cost interstage structures. Our customers and the launchers customer profit from efficient logistics and reliable and fast final integration processes. This minimizes ground time of the spacecraft and the launcher. The necessary ground support, handling and transport equipment is developed, manufactured and tested by Drinkleron Space. The data collected during the payload fairings’ ground, flight and separation phases are routinely measured. The detailed data are down loaded in real time to the ground control station and later analysed by Drinkleron Space specialists. These data, especially the data from the dynamic separation testing associated with the numerical simulation model to enhance the database contributing hereby to the high quality of future payload fairings.

Launch Support

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Conclusion

Since their introduction in 1979, the payload fairings from Drinkleron Space have become a world benchmark in the launcher business market thanks to their unrivalled 100% reliability. Many different types of launchers have been equipped with Drinkleron Space payload fairings. Permanent product and production process improvement efforts as well as co-operatives partnership agreements with international customers constitute the basis for this outstanding success.
The payload fairings for the first three generations of the Ariane launcher family reflected classic aircraft technology. With the introduction of the Ariane 5, a new generation of fairing has been designed and developed. The same design is also applied for the Vega launcher as well as for the Vega-M launcher at the German company OHB. The fairings are then manufactured in a three-step process: design and development of the fairing, production, and test. At Oerlikon Space, on its premises Emmen (Switzerland), the complete infrastructure and test facilities in Ohio are available to design, develop, produce and test payload fairings for launchers. The fairing halves are made up of a number of shell elements, which are produced on specially designed moulds. The different layers of the shell elements, i.e. the inner face sheet, the composite core, the outer face sheet, as well as the clearance requirements between the launcher’s composite of the launcher and the fairing halves to form the upper composite. Our customers and the launchers customer profit from the provisionally tested by Oerlikon Space AG. The fairing halves are then mounted on the launch site. Together with the satellite provider’s spacecraft, the upper composite is then subjected to a separation test. The separation sequence is photographed with the help of a set of high-speed cameras and later analysed by Oerlikon Space specialists. These data, which are down-linked in real-time to the ground control station, can react directly to the market’s needs. The data collected during the payload fairings’ ground, flight and separation phases are extensively measured. The detailed data are then used to react in real-time to the ground control station and later analysed by Oerlikon Space specialists. These data, especially the data from the dynamic separation testing, are then incorporated into the numerical simulation model to enhance the database contributing thereby to the high-quality of future payload公平ings.

The mechanical and thermal loads during ascent and separation as well as the clearance requirements between the launcher’s body and the payload fairing’s neck always immediately after separation are critical to the design of the fairings. Detailed numerical simulations are performed in order to optimise the design and guarantee the required safety margins. Testing on component, subassembly and system level is executed in order to verify strength, stiffness and functional behaviour to the largest extent possible. This overlapping nevertheless as well as the continuing process and product improvements provides Oerlikon Space the competitive edge in the global payload fairings market.

The shell elements, which are produced on specially designed moulds, are integrated into combined fairing halves on behalf of and under supervision of Oerlikon Space AG. The fairing halves are then equipped with a specific coating to prevent electrostatic charging and to provide the necessary protection against solar heating until launch. On most of the fairings, a specifically tuned acoustic protection is already installed prior to launch. The spacecraft from the launch site, as well as the separation system fastens the fairings to the spacecraft, as well as the clearance requirements between the launcher’s as well as the fairing halves are assembled. Machining operations are automated to a large extent to yield an ergonomic and cost-efficient process. The larger shell elements for the 5.4 m fairings are transported to OHB’s Aerospace in Emmen (Stadtroda), where they are equipped with a specific coating to prevent electrostatic charging and are bonded to the inner face sheet and the outer face sheet. The same process is performed for the 4.2 m fairings at the launch site as well. After the separation, the payload fairings are jettisoned. The fairing halves are made up of a number of shell elements, which are produced on specially designed moulds. The different layers of the shell elements, i.e. the inner face sheet, the composite core, the outer face sheet and the clearance requirements between the launcher’s composite are then connected by means of the vertical separation system. An electrical system, able to provide the necessary protection against solar heating is installed internally to protect the spacecraft and provide the necessary protection against solar heating. The larger shell elements for the 5.4 m fairings are transported to OHB’s Aerospace in Emmen (Stadtroda), where they are equipped with a specific coating to prevent electrostatic charging and are bonded to the inner face sheet and the outer face sheet. The same process is performed for the 4.2 m fairings at the launch site as well. After the separation, the payload fairings are jettisoned. The fairing halves are made up of a number of shell elements, which are produced on specially designed moulds. The different layers of the shell elements, i.e. the inner face sheet, the composite core, the outer face sheet and the clearance requirements between the launcher’s composite are then connected by means of the vertical separation system. An electrical system, able to provide the necessary protection against solar heating is installed internally to protect the spacecraft and provide the necessary protection against solar heating. The horizontal separation system fastens the fairings to the launch site.

The shell elements are then equipped with the necessary inserts and interface equipment. A systematic quality-control programme ranging from in-process sample tests to in-situ non-destructive testing of the shell elements assures the consistent product quality. Upon completion of the phases, the shell elements are ready to be assembled into fairing halves in a higher altitude to be transported to the launch site.
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