

Our test mission for the Ariane 6 launcher

Test references from Applus+ IMA

- ▶ Test period from 2018 to 2022
- ▶ In Dresden, Germany



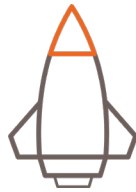
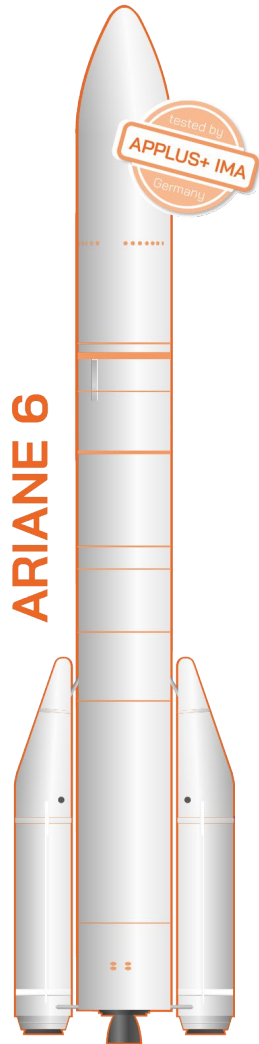


Structural tests on the Ariane 6

Within the framework of major European launch vehicle programs, Applus+ IMA engineers have been entirely responsible for developing test rigs for large structures and testing them to failure.

This presentation will give you an insight into the scope of testing and the testing programs.

From Material to Full-Scale



Level 4 Full-Scale

- Structure testing: Testing of the external force effect on strength and stiffness under realistic loads until failure. (Interstages, Thrust Frames, Interstage Structures)
- Testing with media: Tank tests - test bench with refueling and pressure generation procedures, test specimen loading until bursting.



Level 3 Bread Boards

- Interface between lower level tests (coupons/lap joints) and full-scale test specimens with a focus on sub-areas such as rivets, stringer runout or window cutouts.
- Damage analysis



Level 2 Joints

- Connection from one component to the next (weld, rivet, adhesive)
- Comparison of material use and design principles, verification of calculation methods



Level 1 Materials

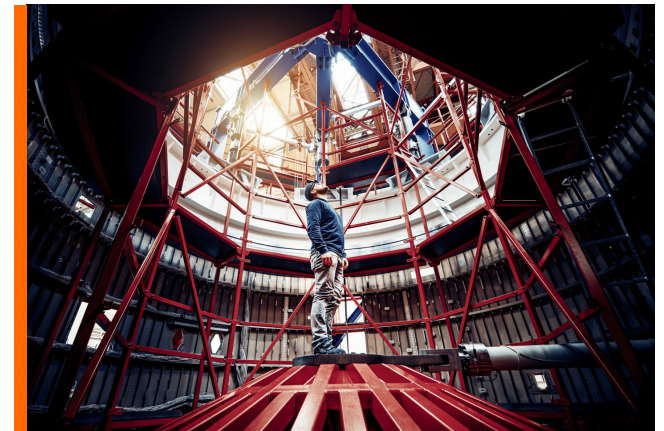
- Material characterisation testing on metallic, composites, silicones, bonded assemblies, coatings
- Samples manufacturing and cutting of specimens

Upper Intertank Structure (U-IST)

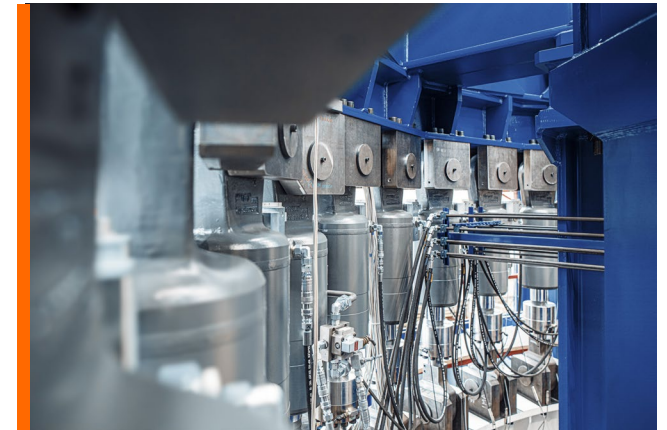
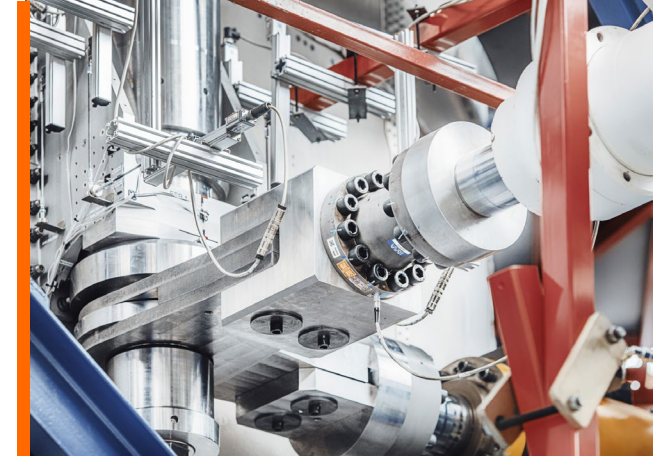
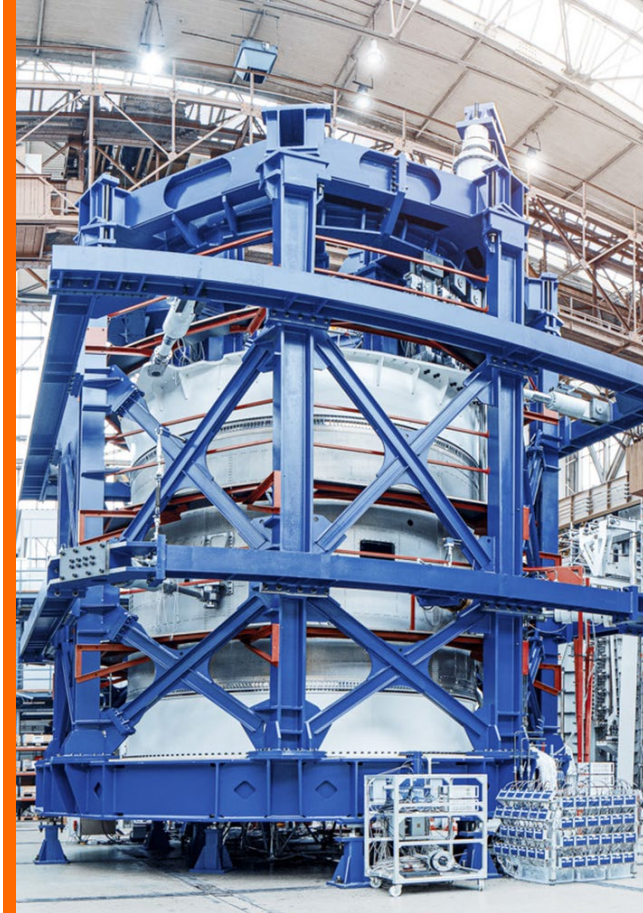
Tested to the extreme

We were able to draw on our wealth of experience in structure testing for an order from our project partner MT Aerospace: As part of a test programme for the Ariane 6 launcher, we tested the upper and lower intertank structures (ITS) of Ariane 6.

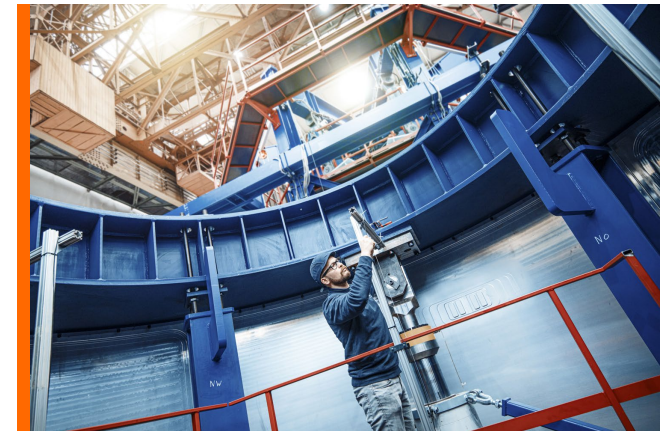
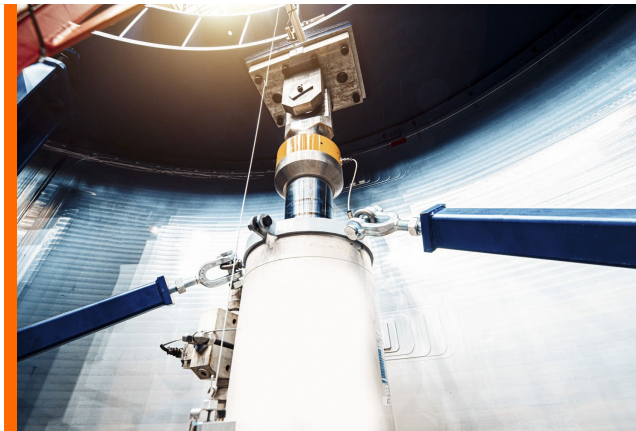
In the case of the Ariane 6 intertank structures, there was a particular focus on two things: the introduction of several independent, large forces in one point and the introduction of distributed loads along the flanges of the structures.



Lower Intertank Structure (L-ITS)



Lower Liquid Hydrogen (LH2) - Tank



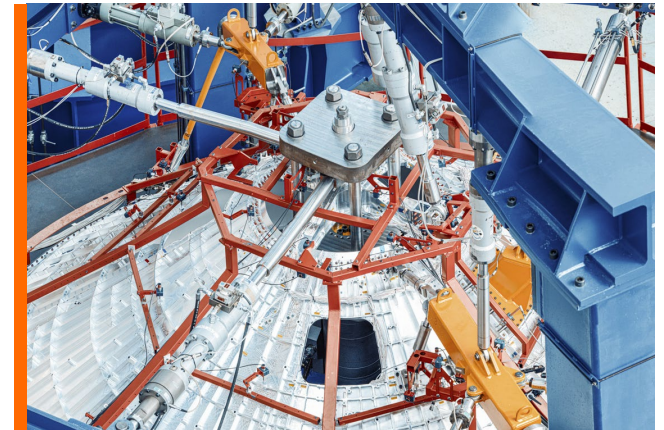
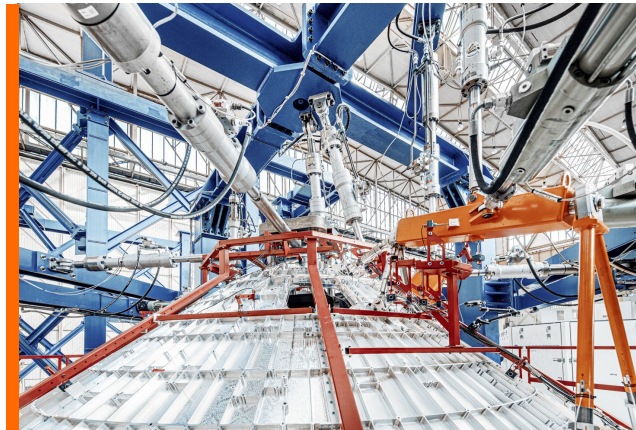
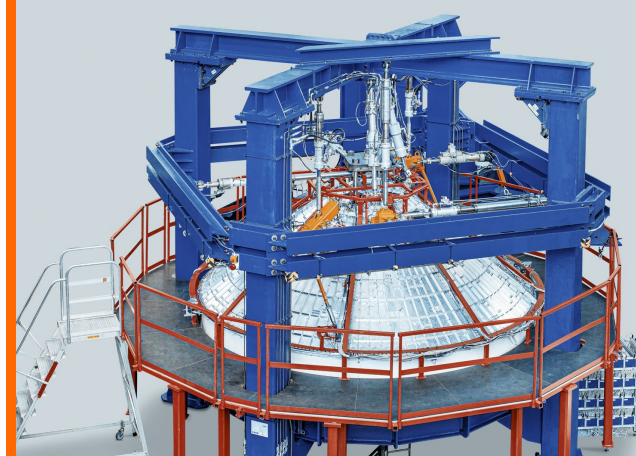


Thrust frame – Vinci intermediate thrust frame VITF

In endurance test

As part of a test programme for the Ariane 6 launcher, induced by the European Space Agency, we tested the Vinci Thrust Frame. Ariane Group acted as prime contractor and Airbus Defence and Space Netherlands was our direct project partner.

The Vinci Thrust Frame is the load-bearing structure of the VINCI rocket engine that propels the Ariane 6 upper stage and payload into the correct orbit. We developed our own test rig for the complex test component and tested the structure there.



Stage Separation

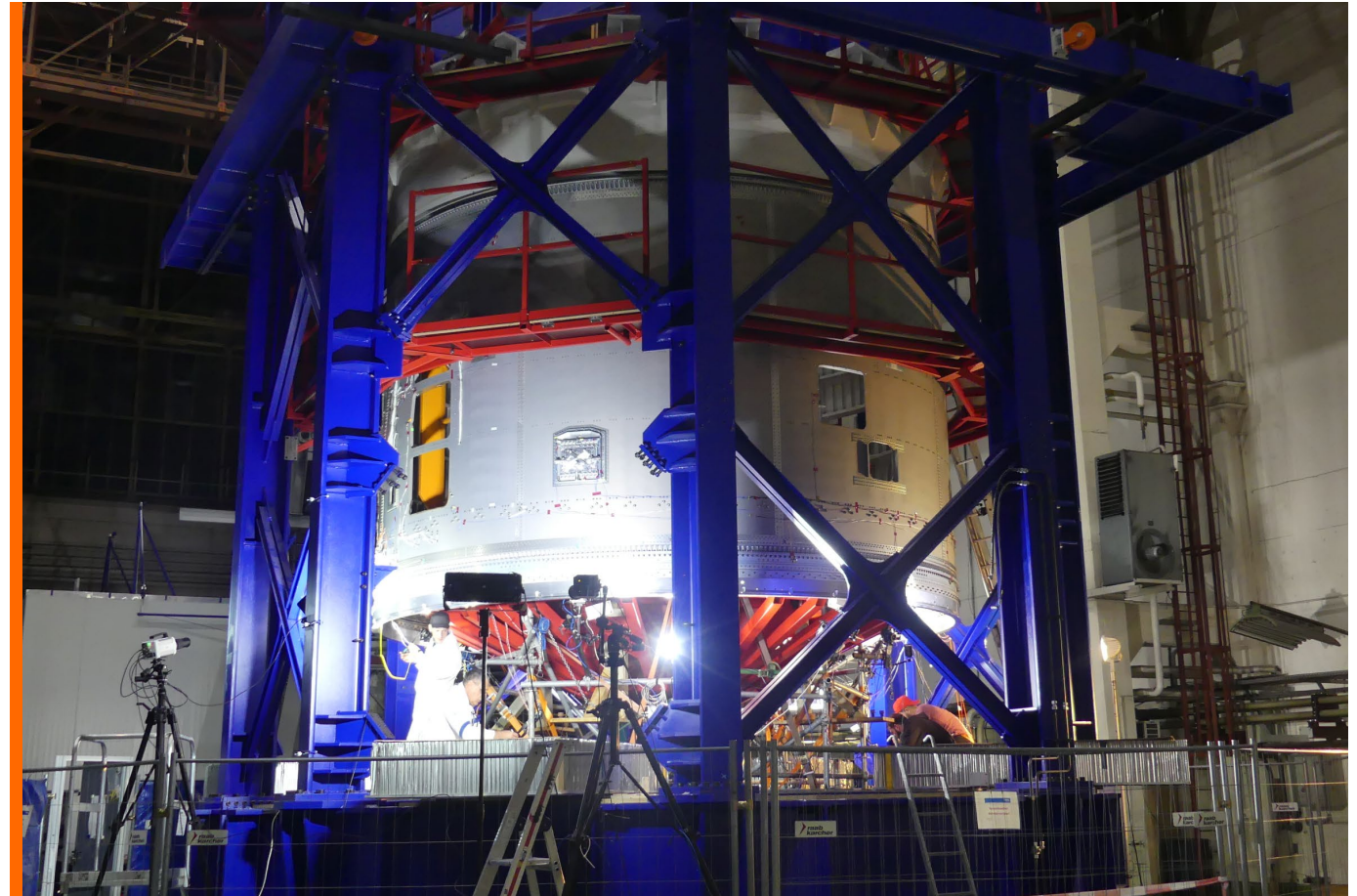
3 – 2 – 1 - Fire

A test, that only took a few milliseconds, but needed nearly half a year of very carefully preparations.

Here it all counts and there is no room for failure. There is only one test and this has to work – personal or system failures are not allowed!

This was the stage separation test, where a separation ring, which connected first and second stage, was separated by means of laser triggered pyro explosion.

The test was conducted successfully hand in hand by specialists of the contractor Ariane Group and Arplus+ IMA.

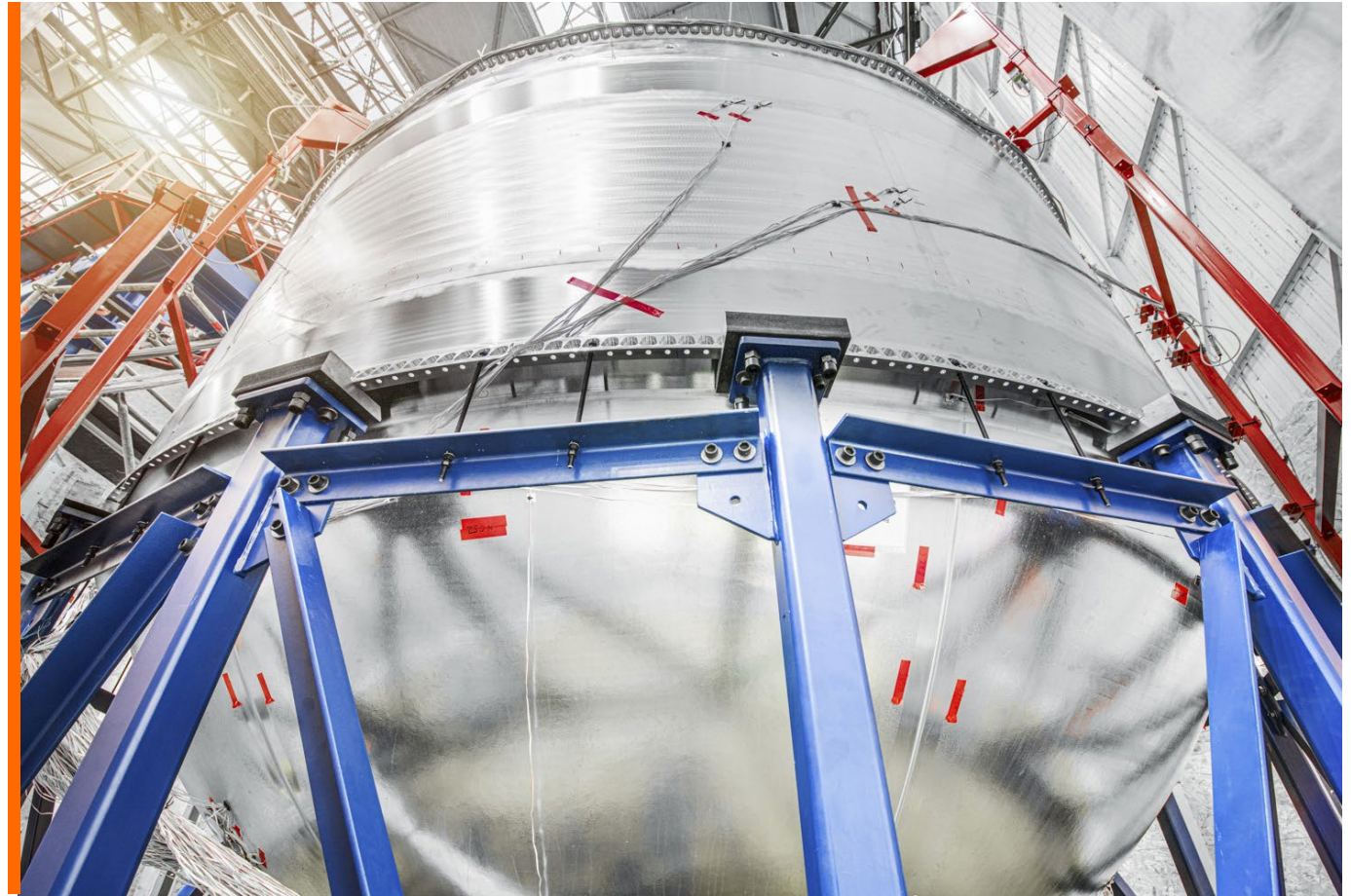


Upper Liquid Hydrogen (LH2) - Tank

Until they burst

The tanks of a rocket have to withstand a lot – we have tested those of the Ariane 6 to failure. One challenge was the complex sealing of the applied strain gauges inside the tank as well as the sealing of hundreds of wires, while leading them through the tank walls.

Once all the gauges and cables were in place, we filled the tank completely with water and pressurised them several times over a few weeks until they finally burst.



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Notes: The test mission was carried out and financed as part of an ESA programme, with the Ariane Group acting as the main contractor. The static tests were awarded to Applus+ IMA by MT-Aerospace.

Thanks



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