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Satellites: Beyond Gravity checks sandwich panel inserts with proofload testing machine from Kistler

The mobile proofload testing machine from Kistler for satellite tests at Beyond Gravity consists of the test head with integrated sensor technology, and the electronics case with the process monitoring system.

The challenge: a mobile and efficient method of testing threaded inserts in sandwich panels for satellites. The solution: Kistler collaborated with Beyond Gravity to develop a special proofload testing machine. Thanks to this innovation, the Swiss supplier to the space industry ensures the quality of its products and can also provide on-site support for its customers when required. The Kistler CPL (Custom Product Lane) has already supplied Beyond Gravity with a second proofload testing machine.

Space doesn't forgive mistakes. Malfunctions and quality defects in components and systems can only be rectified at great expense and effort – if at all – and they may lead to serious consequences. That's why in-depth testing of all components in rockets, satellites and spacecraft is so critically important. Testing technology and test procedures play a major role in spaceflight, and recent decades have seen groundbreaking developments in these fields. But time and again, cases arise where no suitable solution for a specific testing requirement is available as yet.

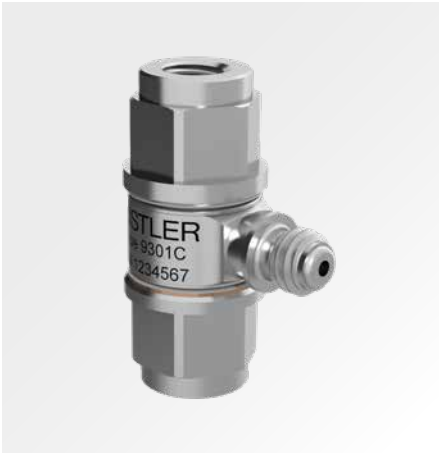
Beyond Gravity is one of Europe's leading suppliers to the space industry, with 12 locations in six countries (Switzerland, Sweden, Austria, the USA, Finland, and Portugal) and over 1,800 employees. Beyond Gravity with its headquarters in Zurich is a leading provider of structures for rockets and different products for satellites. Both ESA and NASA as well as many commercial and international players number among the company's customers. At its Space Test Center in Zurich, various vibration and shaker tests, environmental and climatic tests as well as other load tests (shock, pyroshock, thermal shock, drop tests and more) can be performed on medium-sized and large structural elements.

Mobile proofload testing machine for satellite structures

Products manufactured and tested by the Satellite Structures business unit at Beyond Gravity include lightweight sandwich panels for satellites – both prototypes and series of up to 100 units, or even more. Markus Wyss has been with Beyond Gravity for 15 years. He specializes in fiber-reinforced composites, and his role as a quality engineer places him on the interface between production and testing. He reports: "We approached Kistler because we needed a new proofload testing machine for non-destructive load testing of the inserts in the sandwich panels. The old machine was originally the result of a university project. It's getting on in years, and is increasingly prone to faults." The panels for satellites measure as much as 4x3 meters, and each of them has several threaded inserts for attaching assemblies. "Depending on the specification, each insert is tested with up to 4 kN for a maximum of 99 seconds. What was most important for us was to record the force curve for the documentation we

The maXYmos TL process monitoring system from Kistler monitors and controls the load tests on the inserts for sandwich panels – including documentation of all measurement results.

From left to right: Alex Schaad and Markus Wyss (Beyond Gravity) together with Marvin Tüscher (Kistler) in front of the proofload testing machine; on the right, one of the sandwich panels for satellites that is to be tested.



Three 9301C piezoelectric force sensors from Kistler series are installed in the proofload testing machine to measure forces of up to 4 kN over a maximum duration of 99 seconds.

supply to the customer. And, of course, another key feature was the mobility of the proofload testing machine – that allows us to move freely through the halls and offer on-site support to customers if required," Wyss adds.

The solution – dubbed the 'Proofload Machine' – was implemented by the engineers at the Kistler Custom Product Lane (CPL). The original concept, with the NCFH electromechanical joining module and maXYmos NC, proved not to be sufficiently mobile. So the engineers went on to develop a special test head with a gripper, a pneumatic cylinder with an integrated displacement measuring system, three piezoelectric force sensors, and a maXYmos TL process monitoring system from Kistler.

> "What was most important for us was to record the force curve for the documentation we supply to the customer. And another key feature was the mobility of the proofload testing machine"
>
> **Markus Wyss, Quality Engineer at Beyond Gravity**

"Our solution is force-controlled, so control and regulation of the load test – including the deformation displacement measurement – can be implemented precisely according to the customer's particular specifications," says Marvin Tüscher, CPL Development Engineer at Kistler. "With this approach, we achieve an accuracy of less than 3 percent of the target value over the entire measuring range from 100 N to 4 kN. What's more, the displacement measuring system means that this solution can also monitor the axial movement of the inserts with accuracy of ±0.07 mm. If an unacceptably large deformation occurs, the system interrupts the test process to prevent damage to the panel. An error message is also generated if the force exceeds or falls below the required value." The entire electronics, including the process monitoring system, are housed in a portable case – so the proofload testing machine is completely mobile. It was possible to calibrate the system on site at Beyond Gravity.

Second machine for load testing on inserts already delivered

The proofload testing machine is now in use at Beyond Gravity almost every day; on average, one to two sandwich panels for satellites are tested per day. "Collaboration with the developers was excellent, thanks in part to close geographical proximity," Wyss notes. "Support is provided very quickly, and the service is simply perfect." Reports on the force curves during the load test on each individual insert are generated automatically in PDF format, so they can easily be shared with customers.

Beyond Gravity has therefore ordered a second proofload testing machine to serve as a backup in case the first machine is being serviced or is in use at a customer's premises. In the spirit of continuous improvement, additional damping elements were installed to protect the machine against damage in case of overloading. Markus Wyss sums up: "Thanks to its Custom Product Lane, Kistler has proven to be highly professional and has become a valued partner for us. Looking ahead, there could be interest in a collaboration in the USA, where sandwich panels for satellites are also built and tested – and above and beyond that, of course, there are prospects for cooperation on other Beyond Gravity projects."

Straight to the desired solution: the Kistler CPL

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