Extreme precision needed to attach two main parts of Euclid spacecraft together

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On 24 March 2022, ESA came one step closer to unveiling the mysteries of the dark Universe, following the coming together of two key parts of the Euclid spacecraft—the instrument-carrying payload module and the supporting service module. This image shows the 800-kilogram payload module being lifted by a crane, just before it was lowered onto the service module. Credit: ESA—S. Corvaja

On 24 March, over a dozen engineers gathered at Euclid industrial prime contractor, Thales Alenia Space in Turin, to carefully attach the two main parts of the Euclid spacecraft together. This task required such extreme precision that it took a whole day, followed by two days of connecting electronic equipment and testing that Euclid's instruments still work.

"It was really exciting to see the spacecraft coming together and get one step closer to seeing the mission become a reality. I almost feel like we have united two family members," says Euclid Assembly, Integration and Testing engineer Hans Rozemeijer.

Provided by Airbus Defence and Space, Euclid's payload module houses a reflecting telescope to capture and focus light from distant stars, as well as two instruments to record this light—the VISible imager (VIS) and the Near Infrared Spectrometer and Photometer (NISP).

Together, the telescope and instruments will image billions of galaxies with unrivaled accuracy to help astronomers better understand how they have evolved and clustered into cosmic structures over the last 10 billion years. This will give us clues on the nature of the enigmatic dark matter and dark energy, the two main drivers of the expansion of the Universe.

Euclid's instruments were integrated onto the payload module at the end of 2020. During 2021, the complete module successfully passed intensive testing under simulated space conditions to check that the telescope and instruments work as expected.

The service module is equally as important. It contains computers to control the instruments as well as all the essential parts that Euclid needs to function, including subsystems to control the orientation of the spacecraft, propel it through space, distribute power, communicate with Earth, and handle data transfer.

To connect the two modules together, engineers used a crane to lower the 800-kilogram payload module onto the service module via six attachment points. The team took great care to make sure that these points matched up very well, as a poor contact could induce stresses that damage the structure or deform Euclid's 1.2-meter telescope mirror.

"We had to make sure that the flatness of the service module closely matched the flatness of the payload module at the connection points to reduce the loads on the telescope as much as possible," explains Hans. "We were targeting a difference of less than 50 microns at every point. It's not like a piece of Ikea furniture that you can hammer into place—this task required extreme precision!"

To put this into perspective, 50 microns—or 0.05 mm—is the diameter of a thin human hair. Before attaching the two modules together, the assembly team checked the smoothness of the connection points with a laser and used very thin spacers called shims to even out the surfaces where needed.

Hans continues: "After the modules were joined mechanically, we added connector brackets and plugged in the electrical connectors. Then we checked that everything was working properly. Finally, we covered the connector brackets and any tiny remaining gaps between the two modules with thermal insulation to really seal up the spacecraft."

"The Euclid spacecraft is truly complex and during the past months all the people involved in its integration were asked to be highly performant in meeting challenging schedule and operations. Let me thank the team of Thales Alenia Space and our industrial partners for the remarkable job done in full synergy with ESA representatives to reach this important milestone," says Paolo Musi, Director of Science Programs at TAS.

In April engineers will attach Euclid to its combined sunshield and solar

panels. The sunshield will shade the payload module from the Sun's intense radiation, helping the mission perform to the very best of its abilities.

Once the sunshield is connected, the high gain antenna will be added and then Euclid will be complete. The finished spacecraft will measure about 4.7 m tall and 3.7 m wide. After that Euclid will be tested as a complete system and prepared for launch from Europe's Spaceport in French Guiana.

Provided by European Space Agency