Solar Dynamics Laboratory's Smart Design Fosters Perfect Fit

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An artist's concept of SDO observing the sun. Credit: NASA/Goddard Space Flight Center Conceptual Image Lab

Imagine a wedding dress or a tailored suit that fit the first time you try it on. That's pretty similar to how engineers felt when the Solar Dynamics Observatory (SDO) spacecraft bus was lowered onto the propulsion module and it attached on the first try.

"It’s like lowering a telephone booth over a person," said Gary Davis, SDO propulsion subsystem manager at NASA Goddard Space Flight Center, Greenbelt, Md. "The mechanical people made the operation look easy. It's never easy. There are some mechanical things you can never model and predict."

SDO will help scientists zoom in on solar activity such as sunspots, solar flares and coronal mass ejections, to better understand the causes thus improving forecasts of solar storms. Bad "space weather" can pose a threat to astronauts in orbit, as well as to aircraft crews flying over the poles of Earth -- and that's just the tip of the iceberg. Electrical power to our homes, satellite communications and navigation systems can all be disrupted by magnetic storms triggered by solar activity. SDO will provide a close-up look at these events.

For the past year, all of the spacecraft avionics were integrated and tested on a spacecraft bus. The spacecraft bus includes Goddard-built electronics, instrument electronics as well as procured components. It has everything required to control the spacecraft and get the data from the instruments to the ground.

During the same time, another team at Goddard was building the propulsion module, which includes all the hardware needed to get the spacecraft from the point at which the rocket leaves the observatory, the transfer orbit, to its final orbit. "We built these modules up in parallel to allow us to get more done in a shorter amount of time," said Brent Robertson, SDO Observatory Manager at Goddard.

This was the first time Goddard engineers built a bipropellant propulsion system. A bipropellant system is a two tank system with fuel in one tank and oxidizer in another. When the chemicals mix, they burst into flame. The main engines use the same technology as the Lunar Landers for the Apollo missions.

The propellant tanks are titanium balloons with the thickness of just 9 sheets of notebook paper, but they can hold 27 times their weight. There are 8 smaller attitude control thrusters and one main engine thruster. Four of the attitude control thrusters are backups. If the main thruster goes out, the smaller thrusters will be able to carry out SDO's mission. SDO is a five year mission, but the spacecraft will carry enough fuel for at least 10 years.

"There was a lot of anxiety about mating these highly complex modules," said Robertson. "We wanted to avoid any interference that might damage items such as the harness or thermal blankets. We had a well thought out and documented procedure for this operation."

In a very short amount of time, 30 minutes, engineers and technicians lowered the spacecraft bus onto the propulsion module with surgical precision. "The whole design was smart from the beginning," Davis says.

Source: NASA, by Rani Gran

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