Space maneuvers

Launching a satellite is just the beginning

By Dave Garlick

For the men and women who design, build and test satellites, all hopes ride on those first few fiery moments when the satellite is launched. However, launch is just the beginning. Then comes the work of satellite operations; that is, communicating with the satellite from the moment it's jettisoned from the launch vehicle until it is fully deployed, tested and in the correct orbit. Only then is the satellite ready to be handed over to Boeing's customer.

GRAPHIC: The WGS-2 satellite completed on-orbit testing and was handed over to the U.S. Air Force on June 15.
JIM SANTONI/BOEING

To understand exactly what takes place, consider the recently launched Wideband Global SATCOM (WGS)-2 satellite for the U.S. Air Force. Following the satellite's 44-minute trip to space on April 4 aboard a United Launch Alliance Atlas V rocket, separation of the satellite from the rocket and acquisition of its electronic heartbeat, engineers at Boeing's new Mission Control Center, or MCC, in El Segundo, Calif., took over.

Immediately after separation, WGS-2 is 250 miles (402 kilometers) above the Earth's surface and speeding faster than a bullet at 6.44 miles per second (10.4 kilometers per second). Using precise calculations and split-second timing, engineers at Mission Control gradually raise the orbit using the main thruster mounted on the aft end of the satellite. Fuel is burned in bursts up to 100 minutes long during the 10–14 days it takes to complete this first phase of the trip out to the satellite's geosynchronous orbital work zone.

For the flight, the satellite is deployed, or unfolded, from its compact launch configuration. In a three-day ballet in space that the MCC team performs 100 percent accurately, all of the solar arrays, antennas, sensors and radiator heat panels are deployed in prearranged order. Relatively low-tech, spring-loaded mechanisms and centrifugal force do most of the job. The goal—in the case of the WGS satellite—is for the satellite to unfold smoothly and orient itself so its antennas are pointing toward Earth and its solar arrays are tracking the sun.

Next, another type of thruster takes over for the long haul out to geosynchronous orbit, 22,300 miles (35,900 kilometers) above Earth. The Xenon Ion Propulsion System

PHOTO: (LEFT) In April, the United Launch Alliance Atlas V rocket carried the WGS-2 satellite to space. Following the satellite's separation from the rocket, engineers at Boeing's new Mission Control Center took command. PATRICK CORKERY/UNITED LAUNCH ALLIANCE

PHOTO: Eric Barnett, Wideband Global SATCOM mission director, sits at the controls at the new Boeing Mission Control Center in El Segundo, Calif.
DANA K. REIMER/BOEING

engines use electricity supplied by the solar panels to fire high-speed particles (called ions) of xenon gas out of a thruster, like a micro-sized jet. The engines produce very low levels of thrust, but they are highly fuel-efficient. So efficient, that WGS can carry enough fuel to burn 24 hours a day for 30 days and still have enough for stationkeeping during its 12-year contractual life.

The final stage of the satellite launch process involves in-orbit payload tests to make sure the satellite works as designed. Antennas, the communications payload and electronics are tested to be sure the patterns they project on the Earth's surface are what the designers intended, and that everything is in working order.

In the case of the WGS satellite, the whole process took less than three months from the time the satellite separated from the rocket on April 3 to its handoff to the U.S. Air Force on June 15, ready for many years of service.

But Boeing employees at the MCC didn't have time to pop open bottles of champagne. WGS-3 is waiting to be launched. It is the third of six WGS satellites Boeing is building for the Air Force over the next three years. The $1.8 billion constellation is scheduled to be completed in 2012. ■

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New satellite nerve center

For many U.S. Department of Defense and commercial programs, precision satellite control work is carried out from Boeing's newly built Mission Control Center in El Segundo, Calif.

Chris Cutroneo, flight and controls manager in charge of the MCC, and his team led the redesign of the building. Cutroneo said this new satellite control hub will help ensure there are no failures on the ground that could affect the satellite in orbit. "We planned this building very carefully, from the air conditioning to the cable connectors between our computers and ground stations around the globe," Cutroneo said.

There are multiple customer support rooms where engineers provide dedicated, around-the-clock assistance to individual customers' satellite programs. Rooms can be custom-fit for a particular customer in just a few days. In the past this exchange took weeks.

The center also is extremely flexible for meeting customer needs. Wiring is run through specially designed hatches between the satellite operations rooms and two separate computer server rooms—one for government programs and one for commercial or civil programs. "When we have a government customer mission, we open the hatch, connect up the cables and we're ready to go with our U.S. Department of Defense operations," Cutroneo said. "When it's over, we pull those cables back in, shut the hatch and, with a few minor changes, we're ready for commercial operations."

– Dave Garlick

PHOTOS: (TOP) The new Boeing Mission Control Center in El Segundo, Calif. **DANA K. REIMER/BOEING**

(LEFT) Chris Cutroneo, flight and controls manager in charge of Space and Intelligence Systems' MCC, at the new facility.
SALLY ARISTI/BOEING