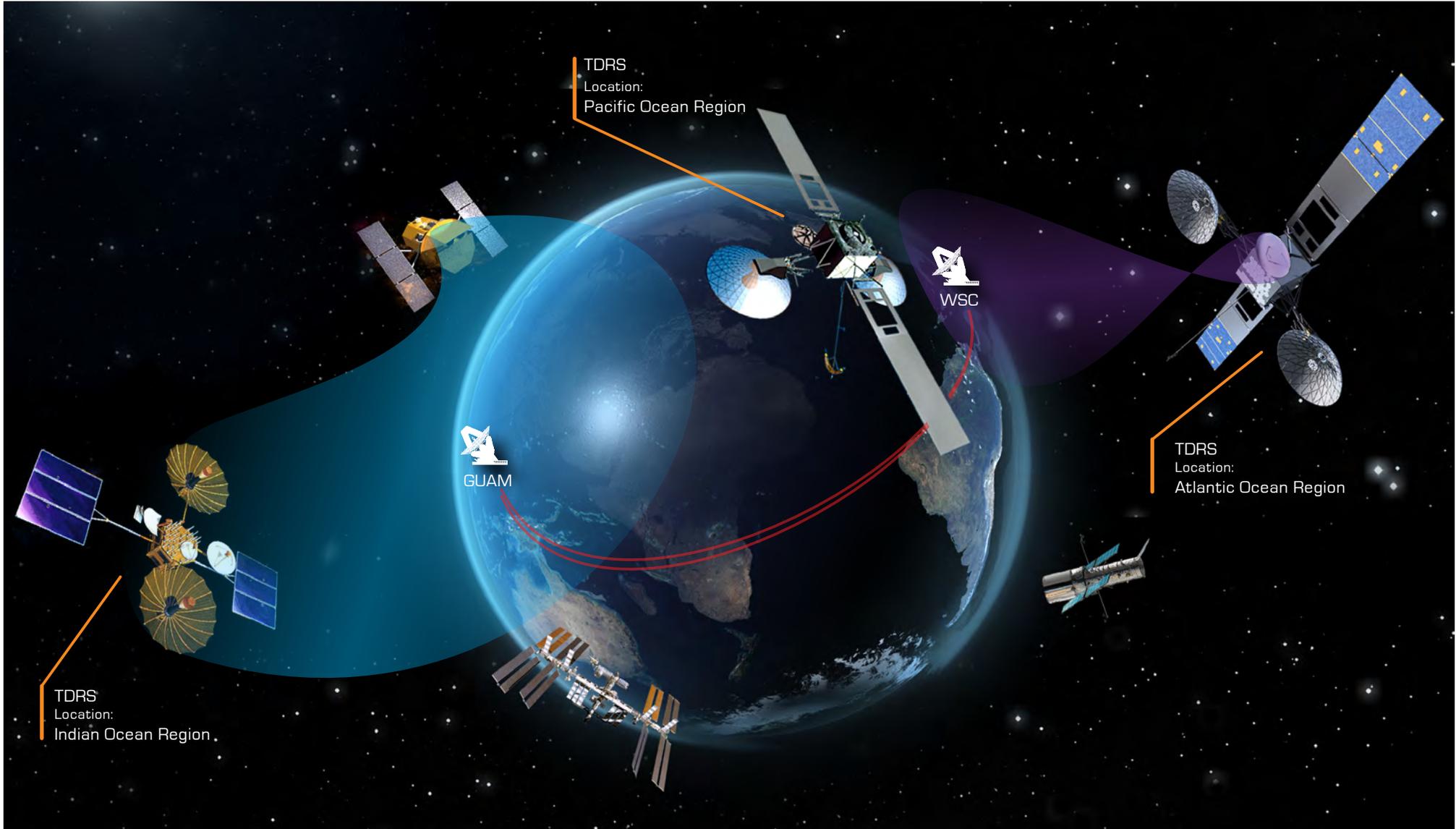




Tracking and Data Relay Satellite K, L, & M: Continuing the Critical Lifeline



Continuing the Communications Lifeline:

Since the first Tracking and Data Relay Satellite (TDRS) was launched in April 1983, NASA's TDRS spacecraft have been providing astronauts with a voice and data link to the Earth as well as relaying data to and from numerous scientific satellites.

Anticipating expanded communication requirements for current and future missions, NASA is acting to expand the fleet. TDRS K, L, & M are being built by Boeing Satellite Systems in El Segundo, CA. The trio will extend NASA's space-based tracking and communication services well into the future. The spacecraft will be launched on an Atlas V expendable launch vehicle.

TDRS K, L, & M Spacecraft:

The spacecraft have six deployable appendages: two solar arrays, two large single-access antennas, a space-to-ground link antenna, and an omni antenna. The two solar array wings each consist of three folded panels. When deployed, the satellite measures approximately 70 feet from the tip of one solar wing to the other – about the height of a 7-story building.

Payload Services:

The primary payload of each TDRS is the communications equipment with associated antennas. The communications systems of the TDRS spacecraft are designed to provide services to multiple missions simultaneously. Each TDRS has S-band and Ku-band equipment; 2nd and 3rd generation spacecraft also includes Ka-band functionality.

S-band Multiple Access (MA)

The phased array antennas are designed to receive signals from up to five spacecraft simultaneously and transmit to one. Precise knowledge of location of the spacecraft is not required for use of

the MA service due to relatively wide MA antenna beamwidth. Improvements in the multiple access performance and on-board processing have contributed to an increased return data rate that is thirty times that of the first generation spacecraft. The third generation forward (ground-to-space) service transmitting power is also increased.

S-band Single Access

Two 15-foot diameter mechanically steerable antennas offer a range of frequencies, providing high-gain support to satellites with low-gain antennas or multiple access user satellites temporarily requiring an increased data rate. The antennas support manned missions, science data missions, including the Hubble Space Telescope, and satellite data dumps.

Ku-band Single Access

The two large antennas also operate at a higher bandwidth supporting two-way high-resolution video and the ability to downlink customer science data. Recorders aboard user satellites will be able to dump large volumes of data at rates of up to 300 megabits per second (Mbps).

Ka-band Single Access

Also offered by the two large antennas, Ka-band provides higher frequency services at even faster speeds for large volumes of science data. This frequency allows users to transmit data at 800 Mbps. Originally established on the TDRS H, I, & J spacecraft, the Ka-band frequencies allow for continued international compatibility with Japanese and European space relay programs, enabling mutual support in case of emergencies.

About the Orbital Location:

Many of NASA's spacecraft are located in low-Earth orbits at altitudes between 150 and 600 miles where Earth's gravity pulls them around the Earth several times each day. They are visible to a given ground tracking and communication station for only a short period of time during each orbit.

TDRS spacecraft, located at an altitude of 22,300-miles, are in what is called a geosynchronous orbit. At that altitude, it takes one day to orbit the earth. Since Earth turns once a day, the spacecraft continuously remain at the same location above the Earth.

A portion of the TDRS fleet is always in view of NASA's ground terminal in White Sands, New Mexico. A single TDRS spacecraft can "see" nearly 50 percent of the spacecraft in low-Earth orbits. With two TDRS spacecraft, one in the East and one in the West, all low-Earth orbiting spacecraft can be seen nearly all the time. With NASA's ground terminal in Guam, TDRS spacecraft offer 100% coverage for a satellite's entire orbit.

