JWST Communications Subsystem

The JWST communication subsystem provides two-way communications with the observatory via the NASA Deep Space Network.

Introduction

Parent pages: Observatory Hardware → JWST Spacecraft Bus

JWST's communications subsystem is the part of the spacecraft bus that provides two-way communications to and from the observatory during certain ground testing activities and throughout the operational phase. S-band frequencies are used for command uplink, low-rate telemetry downlink, and ranging. Ka-band frequencies are used for high-rate downlink of science data and telemetry. All communications are routed through NASA's Deep Space Network, with three ground stations located in Canberra (Australia), Madrid (Spain), and Goldstone (USA). There are limits on the onboard data volume and data accumulation rates.

Onboard antennas

JWST has a 0.6 m Ka-band high-gain antenna (HGA) as well as a 0.2 m S-band medium-gain antenna (MGA). Both are mounted on a common articulated platform, generally referred to as the HGA platform. The HGA platform can be articulated to point at the Earth for any orientation of the observatory. The broad beam pattern of the MGA ensures that 40 kbps real-time S-band telemetry is available with any visible ground station. S- and Ka-band links can be operated simultaneously and support all communications for commissioning and normal operations.

The Ka-band downlink data rate has three selectable speeds: 0.875, 1.75, and 3.5 Mbytes/s. The highest speed is the default. The lower rates can be selected when needed to account for bad weather at the ground station.

High-gain antenna

Routine two-way communications, including downlink of science data from the solid-state recorder, can occur during science observations and during slews. As seen from Sun-Earth L2, the Ka-band downlink has a beam width about the same angular size as the Earth. As such, the HGA pointing must be periodically adjusted to keep Earth centered. The HGA repointing maneuvers are expected to result in a small but measurable pointing disturbance, so they are planned not to occur during science integrations. The HGA must be moved every 10,000 s, which sets a limit on the maximum nominal duration of a science integration. There is an exception to this for certain observing modes requiring long uninterrupted integrations but where small gaps in the science data stream from a pointing disturbance is acceptable.

Some observatory engineering activities can only take place during a real-time communications contact and require the suspension of science observations.

This article uses the S.I. definitions of gigabyte and megabyte: 1 Gbyte = 10^9 bytes, and 1 Mbyte = 10^6 bytes.