



Jet Propulsion Laboratory
California Institute of Technology

DSN Aperture Enhancement Project

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DSN Aperture Enhancement Project (DAEP)

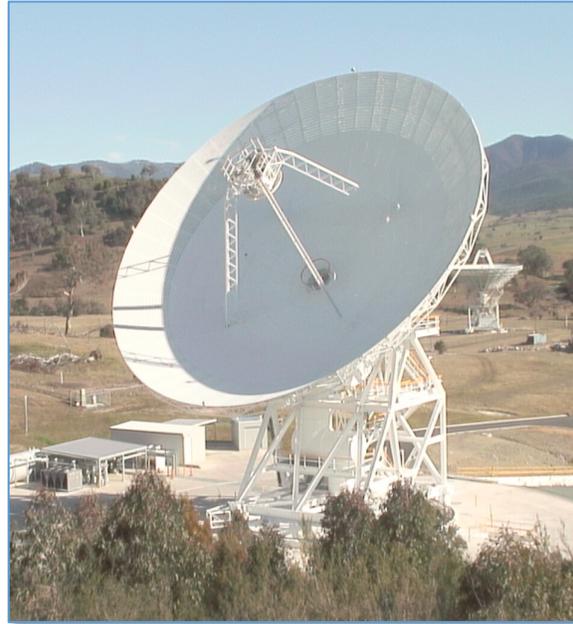
- Add capability to DSN to meet growing need.
- Construct an array of four, 34-m Beam Waveguide Antennas at each of the DSN's communications complexes.
- Can be arrayed to backup 70m capability.



DAEP Rollout Plan



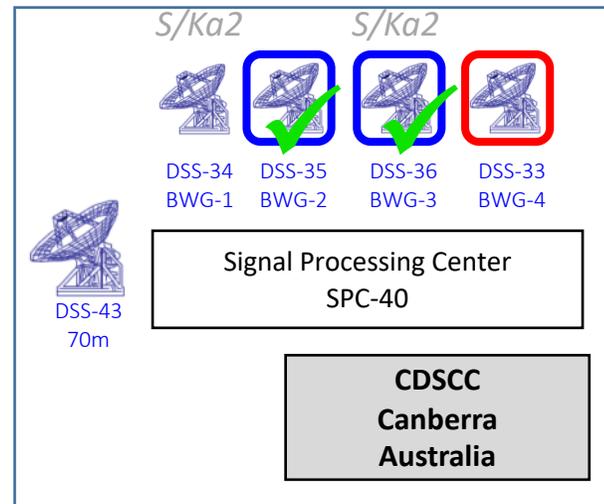
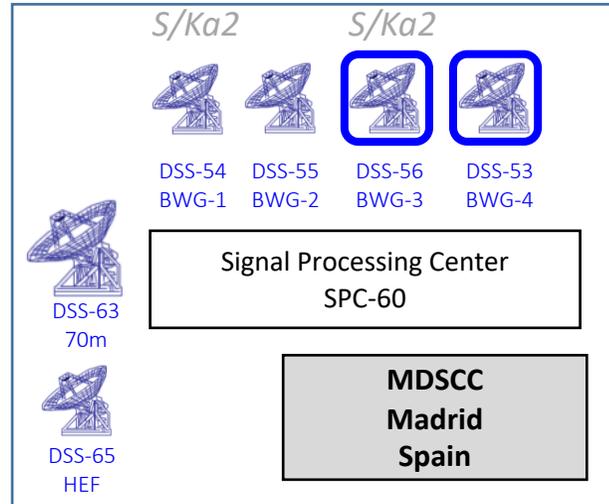
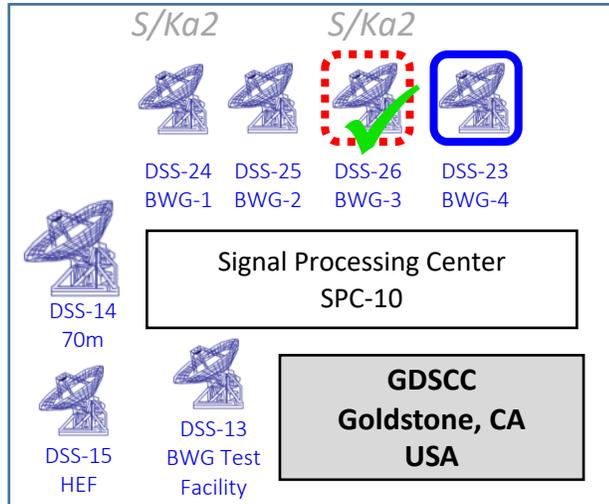
DSS-36 Delivered in 2016



DSS-35 Delivered in 2014

- Started in 2009 with construction of 2 new antennas at the Canberra Complex, delivered in 2014 and 2016.
- Broke ground at the Madrid Complex in 2016 on 2 antennas currently under construction
- Early stages of development for one at the Goldstone Complex to be delivered in 2024
- Final delivery of this phase of development planned for Canberra in 2026.

DAEP Rollout Plan



DAEP Developments

80-kw TX Only (red dashed box)
80-kw BWG (red solid box)
20-kw BWG (blue solid box)

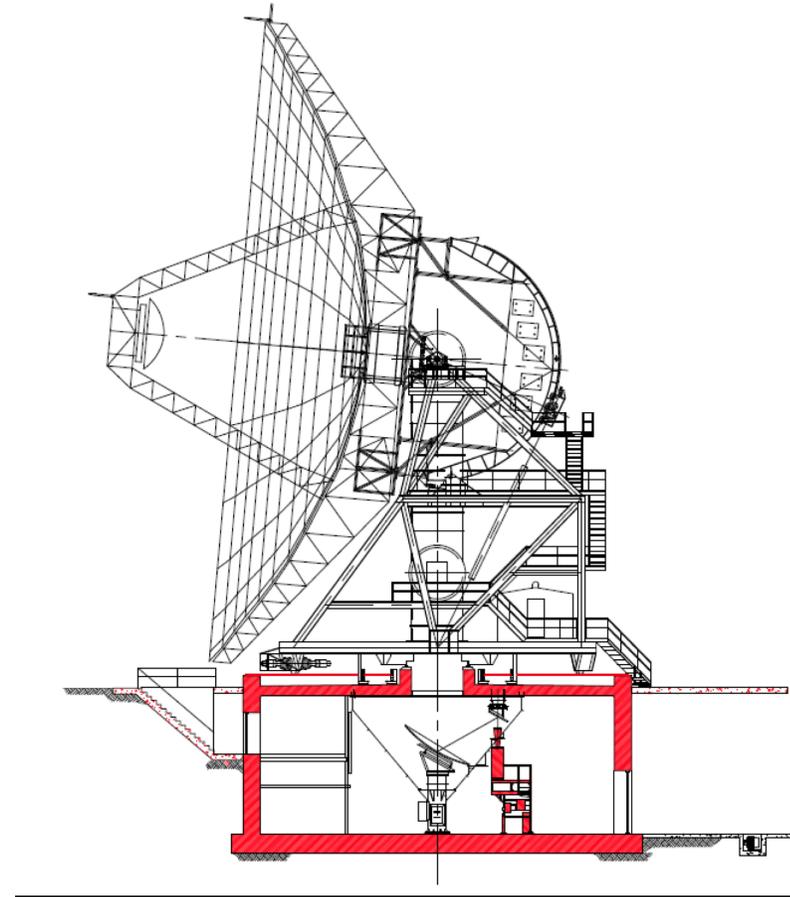
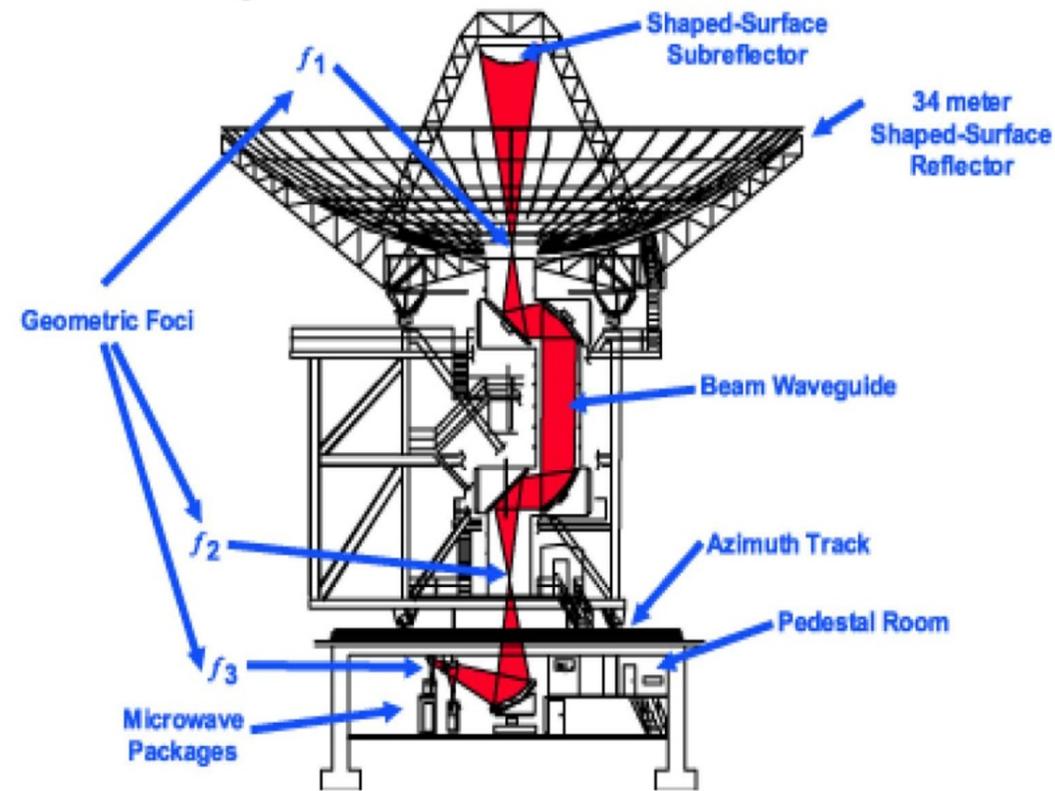
S S-Band Up/Dn
Ka2 26-GHz Dn
Complete (green checkmark)

Station	XX/Ka	S	Ka2
DSS-26		10/2017	(TBD)
DSS-35	10/2014	-	-
DSS-36	10/2016	10/2016	(TBD)
DSS-56	03/2020	03/2020	03/2020
DSS-53	10/2020	-	-
DSS-23	10/2024	-	-
DSS-33	10/2026	-	-

Under Construction

DSN 34m Beam Waveguide Antenna

Beam Waveguide
Antenna Design



Madrid Construction Process



Pour Concrete Foundation



Add concrete Walls to Pedestal Structure

Madrid Construction Process



Complete Pedestal construction



Backfill around pedestal

Madrid Construction Process

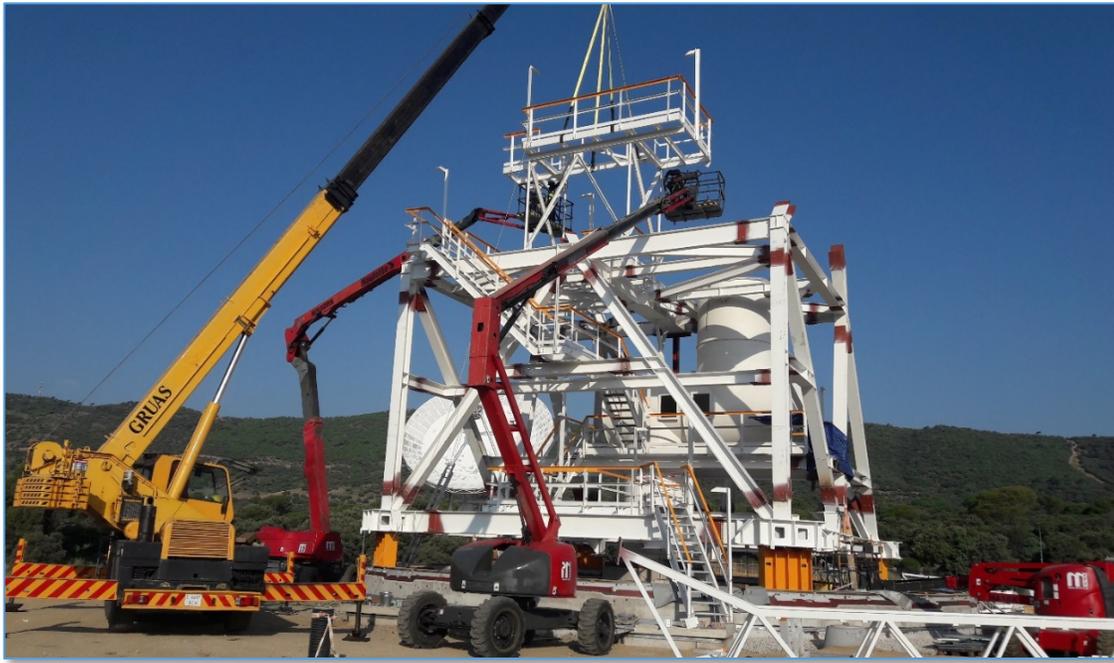


Install Azimuth Track



Construct Steel Base frame

Madrid Construction Process



Complete Base frame



Assemble Reflector

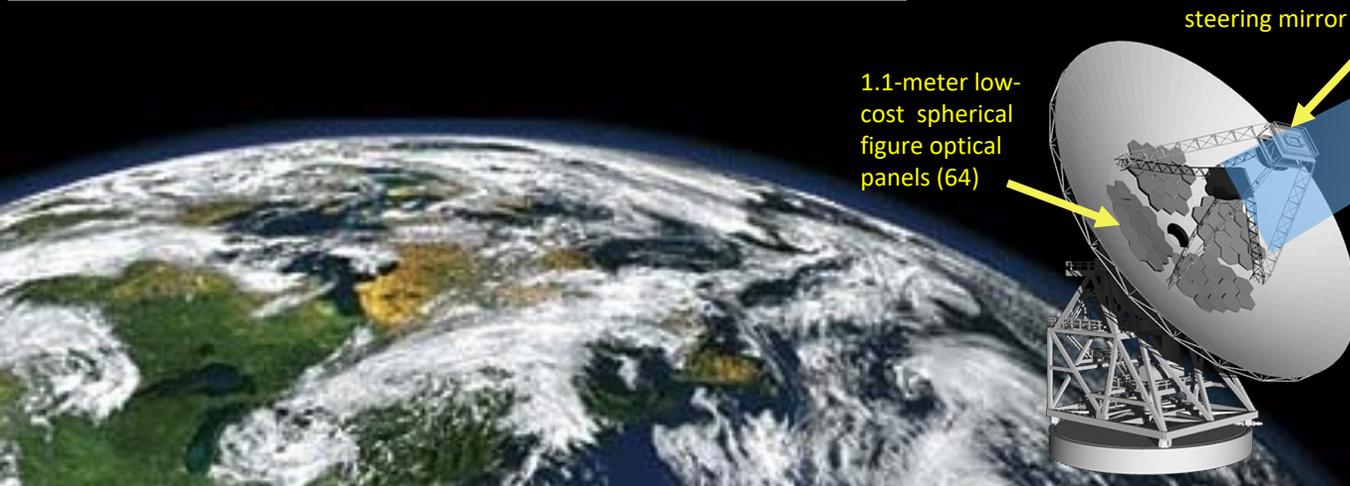
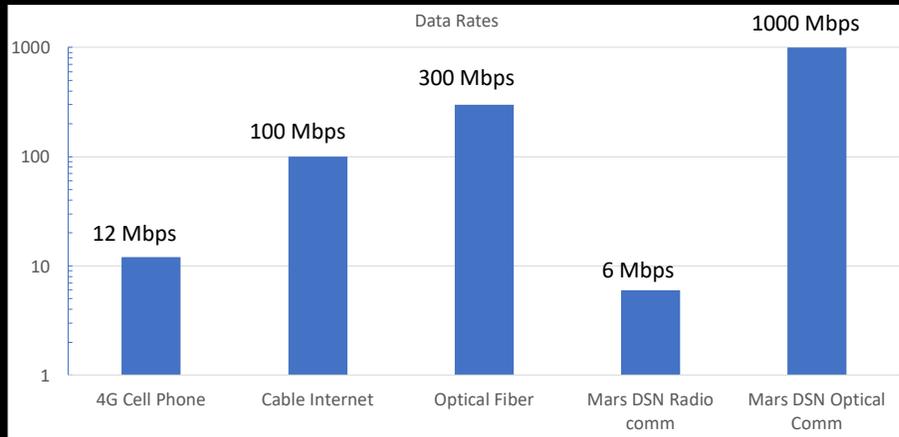
Unique Challenges

- Precise construction of a very large instrument
- Stringent pointing, tracking, and stability requirements
- Specially designed electronics
 - Receive weak downlink signals
 - Uplink to distant spacecraft requires



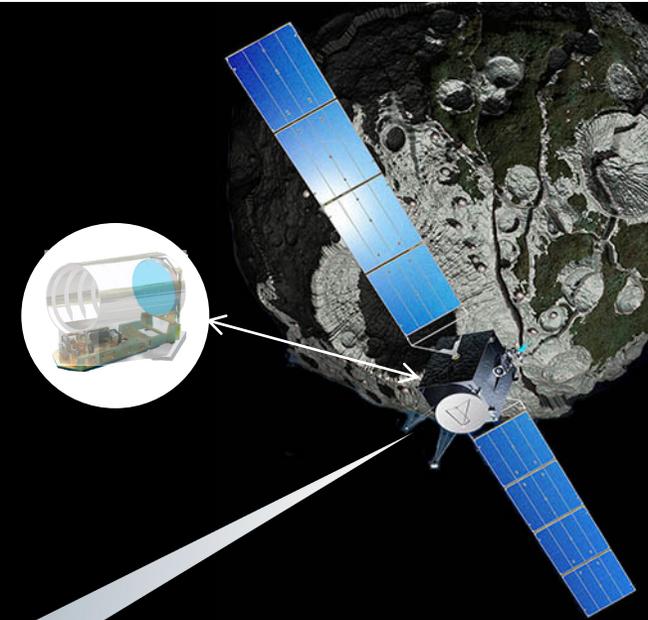
Next Generation DSN with High-Rate Optical Communications

- Inexpensive, small, actuated spherical glass mirrors synthesize 8-meter optical aperture inside DSN radio dish
- More than x100 higher data rates versus radio frequency
- Prototype 2019-2020; Implementation 2021-2023; Testing 2023-2025; Operational system at Goldstone in 2025



Spherical aberration corrector and fast steering mirror

1.1-meter low-cost spherical figure optical panels (64)



First DSN Hybrid RF-Optical Antenna available in 2023-2025 for early testing with NASA's Psyche and crewed missions