Space Communications and Navigation Overview

Explorer Workshop

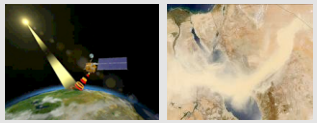
July 13, 2010

SCaN Networks

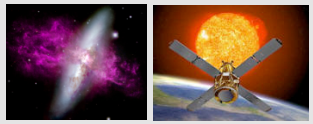
Manned Missions

Sub-Orbital Missions

Earth Science Missions



Space Science Missions



Lunar Missions

Solar System Exploration

- ***DSN***
- ***NEN/NASA***
- ***NEN/Commercial***
- ***NEN/Partner***
- ***SN***

Alaska Satellite Facility
Fairbanks, Alaska

Partner Station:
Gilmore Creek, Alaska

USN Alaska
Poker Flat & North Pole, Alaska

Madrid Complex
Madrid, Spain

Kongsberg Satellite Services (KSAT)
Svalbard, Norway

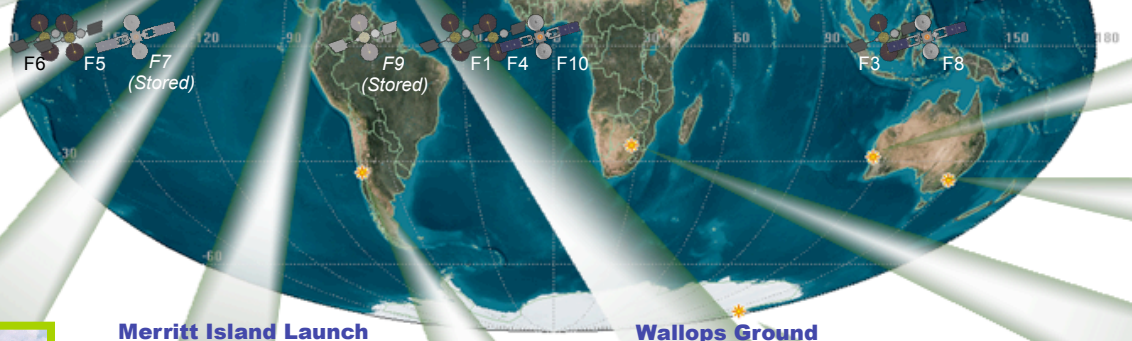
Swedish Space Corp. (SSC)
Kiruna, Sweden

German Space Agency (DLR)
Weilheim, Germany

Goldstone Complex
Fort Irwin, California

Guam Remote Ground Terminal
Guam, Marianna Islands

USN Hawaii
South Point, Hawaii



USN Australia
Dongara, Australia

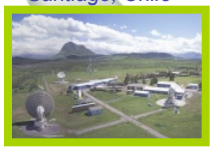
Canberra Complex
Canberra, Australia

White Sands Complex
White Sands, New Mexico

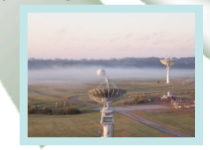
White Sands Ground Terminal,
White Sands, New Mexico

Merritt Island Launch Annex
Merritt Island, Florida

University of Chile
Santiago, Chile



Wallops Ground Station
Wallops, Virginia



McMurdo Ground Station
McMurdo Base, Antarctica

Satellite Applications Center
Hartebeesthoek, Africa

SCaN Networks- (cont'd)

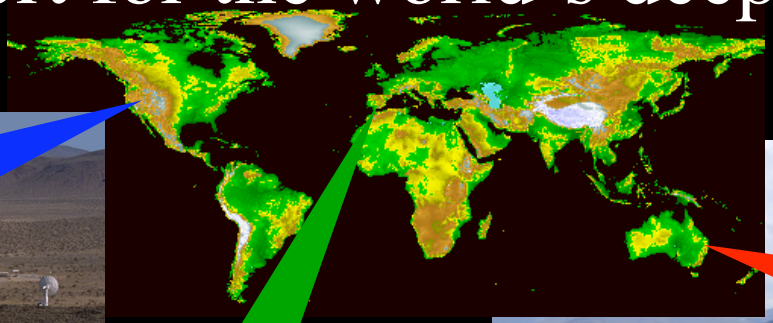
Space Network	Near Earth Network	Deep Space Network
		
DESCRIPTION		
• Global orbital satellite communications fleet • Optimized for *continuous, high data rate* communications • Critical for *human spaceflight safety & critical event coverage*	• World-wide network of stations • Evolved from fully NASA-owned to portfolio of *owned assets and procured commercial services (greater than 50%)* • *Surge capability through partnerships* (e.g., NOAA) • Optimized for *cost-effective, high data rate services*	• Three station global network of large-scale antennas • Focused on detecting and differentiating faint signals from stellar noise • Optimized for *data capture from deep space distances orders of magnitude above near Earth*
SAMPLE MISSIONS		
Space Shuttle International Space Station Hubble Space Telescope	Aqua, Aura Lunar Recon. Orbiter QuikSCat	Mars Rovers Cassini Spitzer Space Telescope

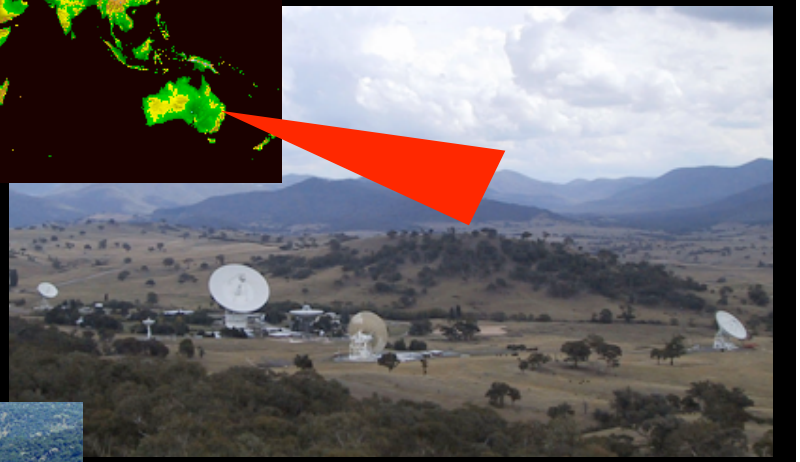
NASA Telecommunications Policy

- NASA Policy Directive 8074.1, Management and Utilization of NASA's Space Communication and Navigation Infrastructure, states NASA Mission Directorates shall:
  - Use SCaN networks to meet their communication and navigation requirements for human and robotic space missions
  - Where appropriate and cost-effective for the Agency, MDs, in coordination with the SCaN Program Office, may use pre-existing infrastructure external to NASA for this purpose, as long as no new facilities are constructed using NASA funds
  - Not design or develop space C&N infrastructures independent of SCaN NASA is planning on transitioning to Ka-band in the future due to congestion in other bands
- NASA is planning on transitioning to Ka-band in the future due to congestion in other bands
  - SMD decision to do so starting with missions launching in 2015
  - Thus the AO specifies the use of Ka-band for science telemetry, unless the bandwidth used for science data downlink conforms to SFCG Recommendation 23-1 (<12 MHz bandwidth in deep space, <8 MHz at Mars)
  - In preparation for the retirement of the 70m dishes, SMD has decided on a single 34m policy (see AO for details)

The Deep Space Network

Comprises three major tracking sites around the globe to provide continuous communication and navigation support for the world's deep space missions



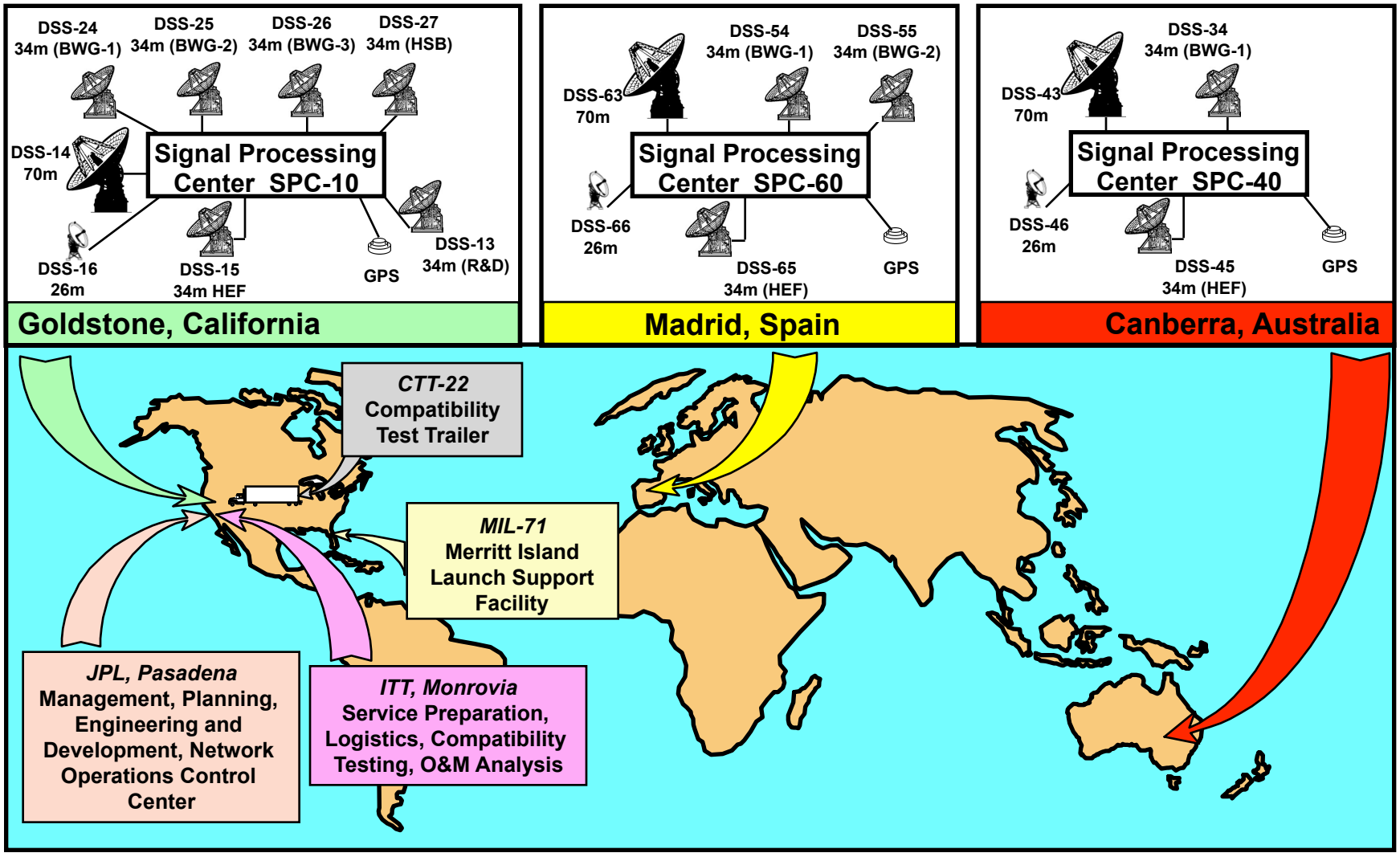


Goldstone
Operated by
ITT for JPL

Madrid
Operated by
INSA for INTA

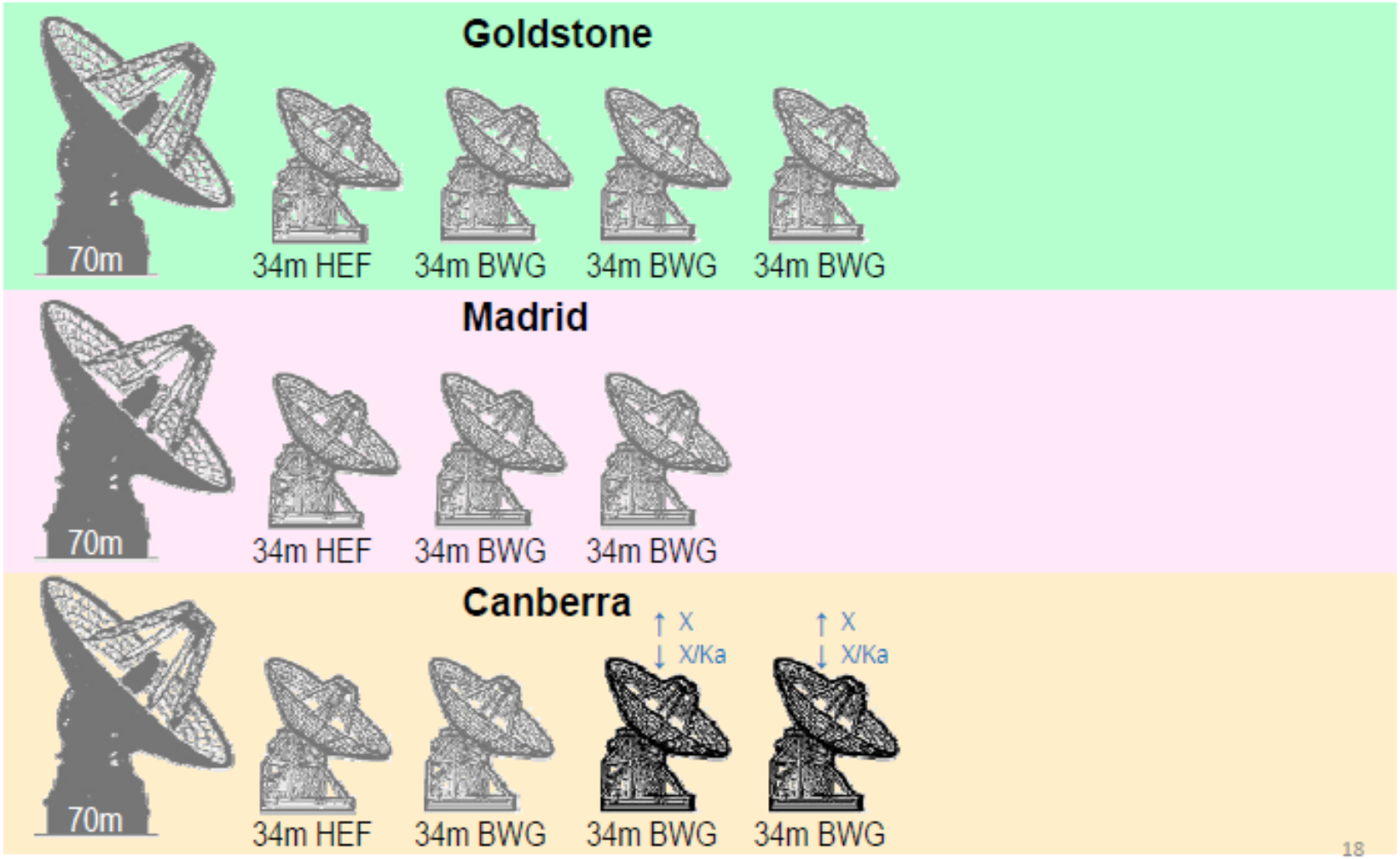
Canberra
Operated by
Raytheon
for CSIRO

DSN Sites

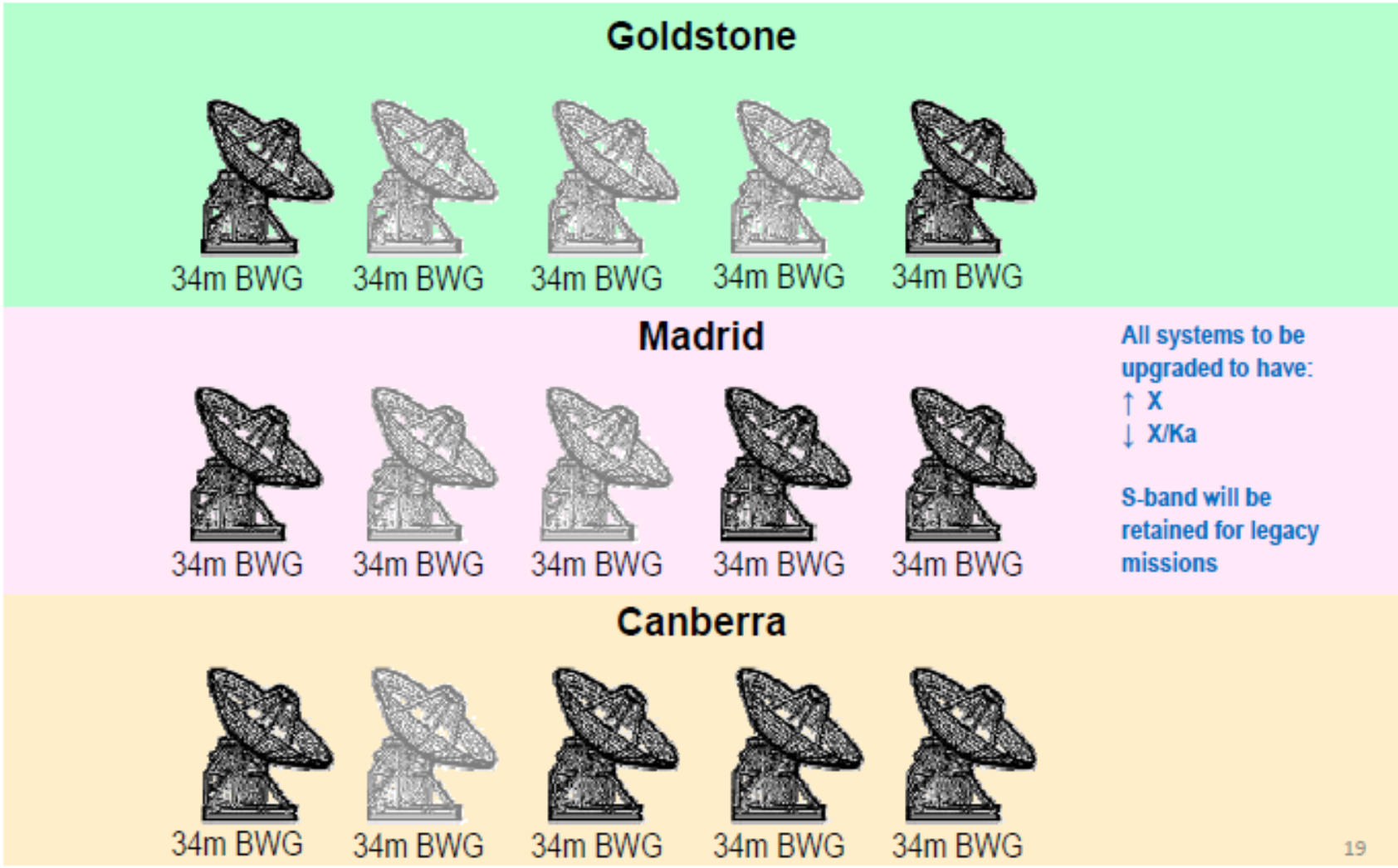

DSS-24
34m (BWG-1)
DSS-25
34m (BWG-2)
DSS-26
34m (BWG-3)
DSS-27
34m (HSB)
DSS-14
70m
Signal Processing
Center SPC-10
DSS-16
26m
DSS-15
34m HEF
GPS
DSS-13
34m (R&D)
Goldstone, California
DSS-54
34m (BWG-1)
DSS-55
34m (BWG-2)
DSS-63
70m
Signal Processing
Center SPC-60
DSS-66
26m
DSS-65
34m (HEF)
GPS
Madrid, Spain
DSS-34
34m (BWG-1)
DSS-43
70m
Signal Processing
Center SPC-40
DSS-46
26m
DSS-45
34m (HEF)
GPS
Canberra, Australia
CTT-22
Compatibility
Test Trailer
MIL-71
Merritt Island
Launch Support
Facility
JPL, Pasadena
Management, Planning,
Engineering and
Development, Network
Operations Control
Center
ITT, Monrovia
Service Preparation,
Logistics, Compatibility
Testing, O&M Analysis

DSN Configuration Today

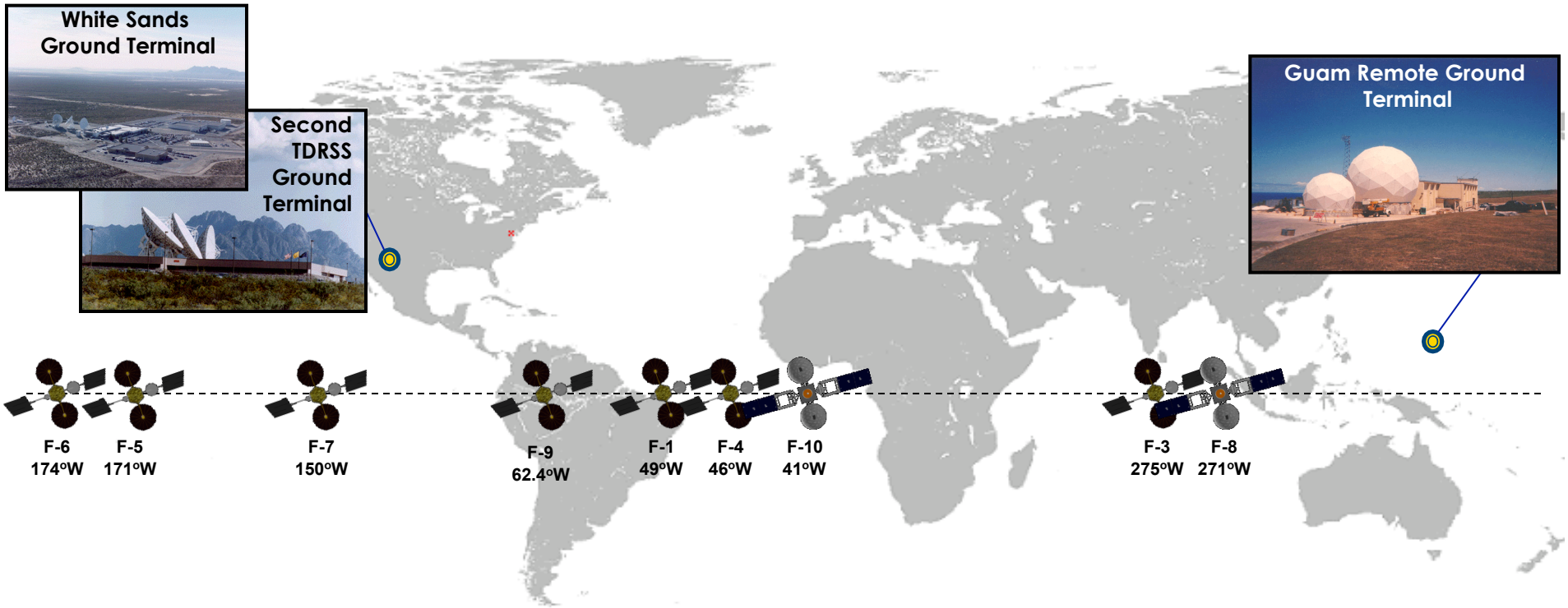
DSN Configuration 2016

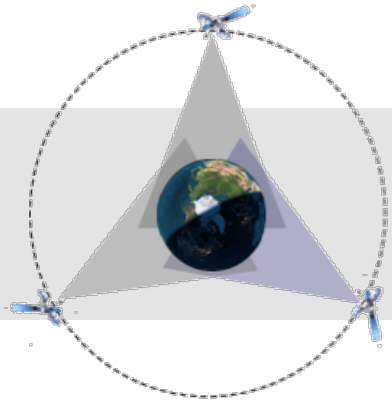


DSN Configuration 2025



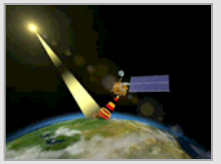
Space Network (SN) Overview












TDRSS Ground Segment (White Sands Complex)

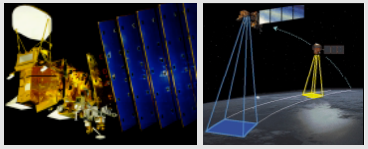
White Sands Ground Terminal (WSGT) 19m antennas

- The Space Network Project operates two functionally identical, geographically separated ground terminals at the White Sands Test Facility
- The White Sands Complex has five Space to Ground Link Terminals (SGLT)
- Remotely controlled ground unit at Guam and Western Australia

Second TDRSS Ground Terminal (STGT) 18m antennas

Near Earth Network Overview

Earth Science Missions



Space Science Missions

Shuttle Launch and Landing

Sub-Orbital Missions

Lunar Missions

Alaska Satellite Facility
Fairbanks, Alaska

Partner Station:
NOAA CDA Station
Gilmore Creek, Alaska

USN Alaska (1)
Poker Flat, Alaska

USN Alaska (2)
North Pole, Alaska

Kongsberg Satellite Services
Svalbard, Norway

Swedish Space Corp. (SSC)
Kiruna, Sweden

White Sands Complex
White Sands, New Mexico

German Space Agency (DLR)
Weilheim, Germany

USN Hawaii Station
South Point, Hawaii

USN Australia
Dongara, Australia

Merritt Island Launch Annex
Merritt Island, Florida

Wallops Ground Station
Wallops, Virginia

University of Chile
Santiago, Chile

McMurdo Ground Station
McMurdo Base, Antarctica

Satellite Applications Center
Hartebeesthoek, Africa

NASA
Commercial
Partner

SCaN Customer Commitment Offices

- JPL/DSN Commitments Future Planning Office
  - Deep Space Network mission design, proposal support, service agreements and compatibility testing
  - http://deepspace.jpl.nasa.gov/advmiss
- GSFC/Network Integration Management Office (NIMO)
  - Space Network and Near Earth Network mission design, proposal support, service agreements and compatibility testing
  - http://scp.gsfc.nasa.gov/nimo

SCaN Points of Contact

- SCaN Program Office/NASA HQ
  - Margaret Caulfield/SCaN Mission Commitment Manager
  - Margaret.I.Caulfield@nasa.gov
  - (202) 358-3971
- JPL/DSN Commitments Future Planning Office
  - Stefan Waldherr/Commitments Engineer
  - Stefan.Waldherr@jpl.nasa.gov
  - (818) 354-3416
- GSFC/Network Integration Management Office (NIMO)
  - Scott Greatorex/Chief, NIMO
  - Scott.A.Greatorex@nasa.gov
  - (301) 286-6354