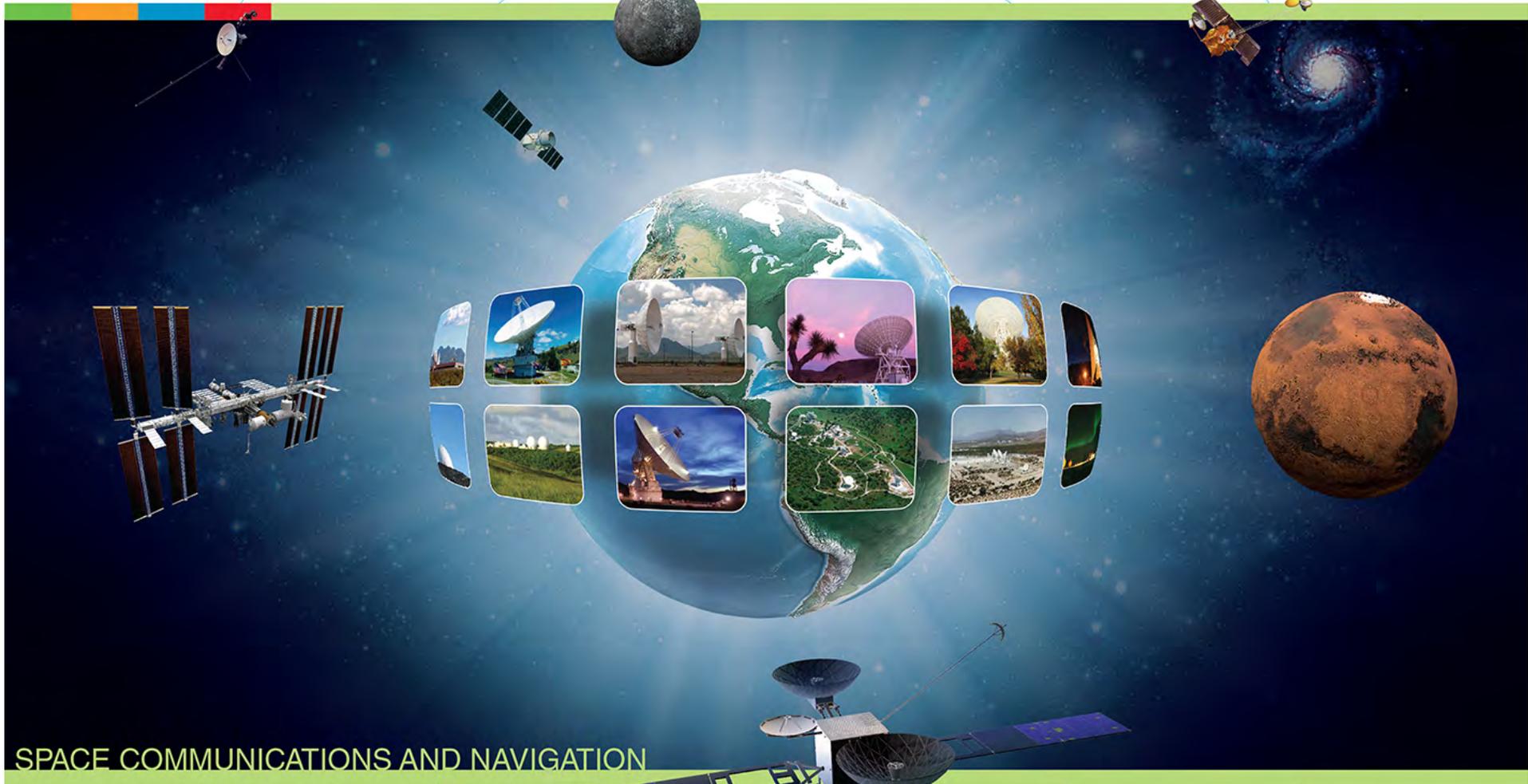


Space Communications and Navigation (SCaN) Overview Astrophysics Explorers MIDEX & MO Preproposal Conference



SPACE COMMUNICATIONS AND NAVIGATION

Gary A. Morse
October 6, 2016

www.nasa.gov





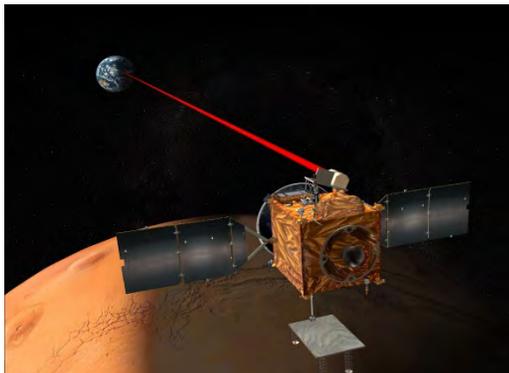
Agenda



- Space Communications and Navigation (SCaN) overview
- AO considerations
- Points of contact



SCaN is Responsible for all NASA Space Communications



- Responsible for Agency-wide operations, management, and development of all NASA space communications capabilities and enabling technology.
- Expand SCaN capabilities to enable and enhance robotic and human exploration.
- Manage spectrum and represent NASA on national and international spectrum management programs.
- Develop space communication standards as well as Positioning, Navigation, and Timing (PNT) policy.
- Represent and negotiate on behalf of NASA on all matters related to space telecommunications in coordination with the appropriate offices and flight mission directorates.



NASA Networks Span the Globe



Deep Space Network
 Near Earth Network
 Space Network



Space Network



SPACE NETWORK CONFIGURATION



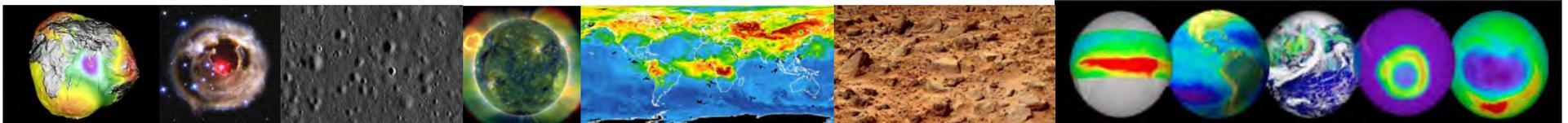
The Space Network consists of space segment, the Tracking and Data Relay Satellite (TDRS) and the ground stations based in White Sands, NM and Guam Island.

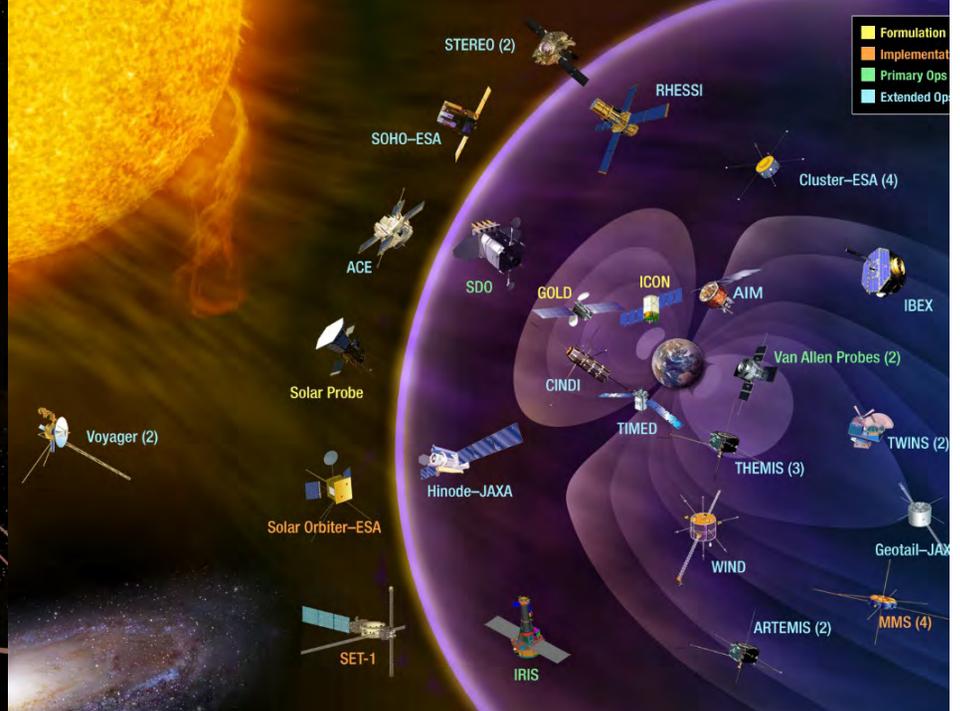
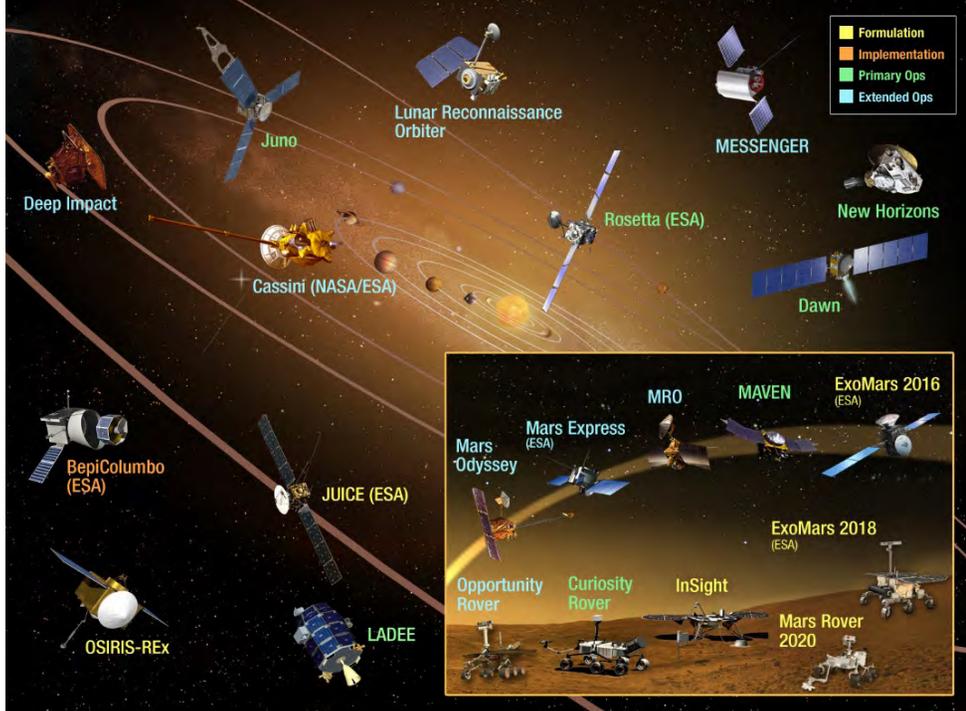


Supporting Over 100 Missions



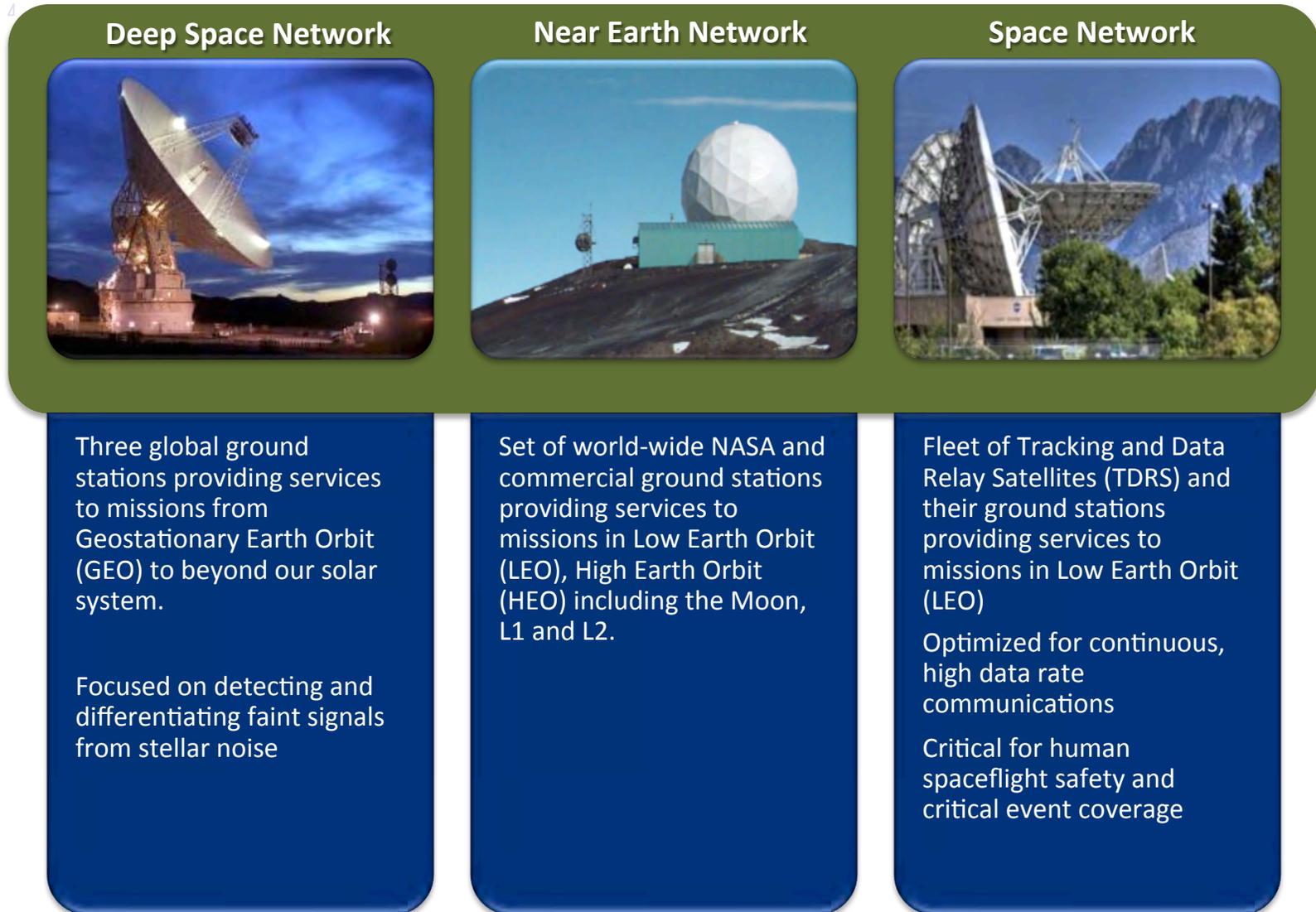
- SCaN supports over 100 space missions with the three networks.
 - Which includes every US government launch and early orbit flight
- **Earth Science**
 - Earth observation missions – Global observation of climate, Land, Sea state and Atmospheric conditions.
 - Aura, Aqua, Landsat, Global Precipitation Mission (GPM), Orbiting Carbon Observatory (OCO-2)
- **Heliophysics**
 - Solar observation-Understanding the Sun and its effect on Space and Earth.
 - Solar Dynamics Observer (SDO), Solar Terrestrial Relations Observatory (STEREO)
- **Astrophysics**
 - Studying the Universe and its origins.
 - Hubble Space Telescope, Chandra X-ray Observatory, WFIRST
- **Planetary**
 - Exploring our solar system's content and composition
 - Voyagers-1/2, JUNO, New Horizons, Mars Atmosphere and Volatile Evolution (MAVEN), InSight
- **Human Space Flight**
 - Human tended Exploration missions, Commercial Space transportation and Space Communications.
 - Exploration missions, Soyuz, Commercial crew, International Space Station (ISS) and Visiting vehicles (Soyuz, SpaceX, Boeing, Sierra Nevada)







Overview of the Three Networks





Deep Space Network



Canberra

LOCATION: Tidbinbilla,
~35 km southwest of Canberra,
Australia

Managed and operated:
Commonwealth Scientific
Industrial Research Organization
(CSIRO)

Operational Antennas: one 70 m,
one 34 m HEF, two 34 m BWG, one
34 m BWG under construction

COMPLEX SIZE: roughly 0.425
square kilometers

STAFF: approximately 100



Goldstone

LOCATION: Fort Irwin,
~55 km northeast of Barstow, CA

Operated: ITT Exelis Corp
Managed: NASA Jet Propulsion Lab

Operational Antennas:
One 70 m, three 34 m BWG, one
34 m HEF, one 34 m HSB, one 34
m R&D antenna, two 34 m
educational antennas

COMPLEX SIZE: roughly 134
square kilometers

STAFF: approximately 165



Madrid

LOCATION: Robledo de Chavela,
~60 km west of Madrid, Spain

Operated: Ingeniería de Sistemas
para la Defensa de España (ISDEFE)
Managed: Instituto Nacional de
Técnica Aeroespacial (INTA)

Operational Antennas: one 70 m,
one 34 m HEF, two 34 m BWG, one
34 m educational antenna

COMPLEX SIZE: roughly 0.490
square kilometers

STAFF: approximately 105



Near Earth Network



NASA Stations

- Alaska Satellite Facility, Alaska (two 11 meter, one 10 meter antennas)
- McMurdo Grounds Station, Antarctica (one 10 meter antenna)
- Wallops Ground Station, Virginia (one 5 meter, one 11 meter antennas)
- White Sands Complex, New Mexico (one 18 meter antenna)



Commercial

- Dongara, Australia (Universal Space Network) (one 13 meter antenna)
- Hatebeesthoek, Africa (Satellite Application Center) (one 18 meter antenna)
- Kiruna, Sweden (Swedish Space Corporation – SSC) (two 13 meter antennas)
- North Pole, Alaska (Universal Space Network) (four antennas – 5.4, 7.3, 11, and 13 meter)
- Santiago, Chile (Swedish Space Corporation – SSC) (one 12 meter, one 13 meter antennas)
- Singapore, Malaysia (Kongsberg Satellite Services – KSAT) (one 9 meter antenna)
- South Point, Hawaii (Universal Space Network) (two 13 meter antennas)
- Svalbard, Norway (Kongsberg Satellite Services – KSAT) (two 11 meter, one 13 meter antennas)
- TrollSat, Antarctica (Kongsberg Satellite Services – KSAT) (one 7.3 meter antenna)
- Weilheim, Germany (Universal Space Network) (two 15 meter antennas)



Partner

- Gilmore Creek, Alaska (National Oceanic and Atmospheric Administration – NOAA) (three 13 meter antennas) and International space agencies (ESA, JAXA, CNES, ASI, ISRO, EIAST ,KARI and SANSA)



Near Earth Network (NEN)



Svalbard Ground Station



McMurdo Ground Station



WS1 Antenna at White Sands



Wallops Ground Station (WGS)



Space Network Ground Terminals



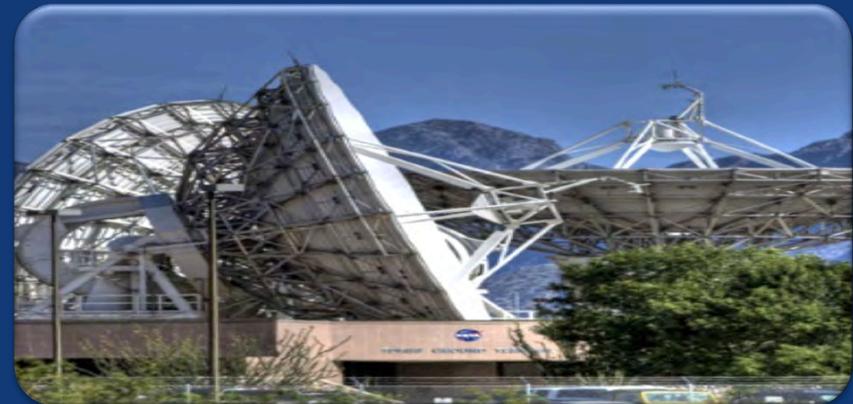
White Sands Ground Terminal

Location: White Sands, NM

Operated by: Harris Corporation

Antennas: three 18.3 meter, one 10 meter, two 4.5 meter, one 1 meter

Area: ~90,000 square feet (16 buildings)



Second TDRS Ground Terminal

Location: White Sands, NM

Operated by: Harris Corporation

Antennas: three 19 meter, one 10 meter, three 4.5 meter, one 1 meter

Area: ~80,000 square feet (5 buildings)



Space Network Remote Stations and Backup Facility



Guam Remote Station

Location: Guam Island

Operated by: Harris Corporation

Antennas: one 11 meter, two 16.5 meter, one 4.5 meter, one 5 meter



Blossom Point Remote Station

Location: near La Plata, MD

Operated by: Harris Corporation

Antennas: two 20 meter, one 5.5 meter



Australian TDRS Facility

Location: Dongara, Australia

Maintained by: Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Antenna: one 11 meter



TDRS Launch History and Plans



TDRS	Launch Date
TDRS-A (TDRS-1)	April 4, 1983 <i>(Retired Fall 2009, Disposal June 2010)</i>
TDRS-B	Destroyed January 28, 1986 in Challenger explosion
TDRS-C (TDRS-3)	September 29, 1988
TDRS-D (TDRS-4)	March 13, 1989 <i>(Retired December 2011, Disposal April 2012)</i>
TDRS-E (TDRS-5)	August 2, 1991
TDRS-F (TDRS-6)	January 13, 1993
TDRS-G (TDRS-7)	July 13, 1995 (replacement for TDRS-B)
TDRS-H (TDRS-8)	June 30, 2000
TDRS-I (TDRS-9)	March 8, 2002
TDRS-J (TDRS-10)	December 4, 2002
TDRS-K (TDRS-11)	January 30, 2013
TDRS-L (TDRS-12)	January 23, 2014
TDRS-M (TDRS-14)	Available for launch in 2017



TDRS 1 – 7 were delivered via Space Shuttle



TDRS 8 – 14 were/will be launched by EELVs



AO considerations



- NASA Telecommunications policy
 - NASA Policy Directive 8074.1, Management and Utilization of NASA's Space Communication and Navigation Infrastructure, states NASA Mission Directorates (MDs) 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 Communications & Navigation infrastructures independent of SCaN



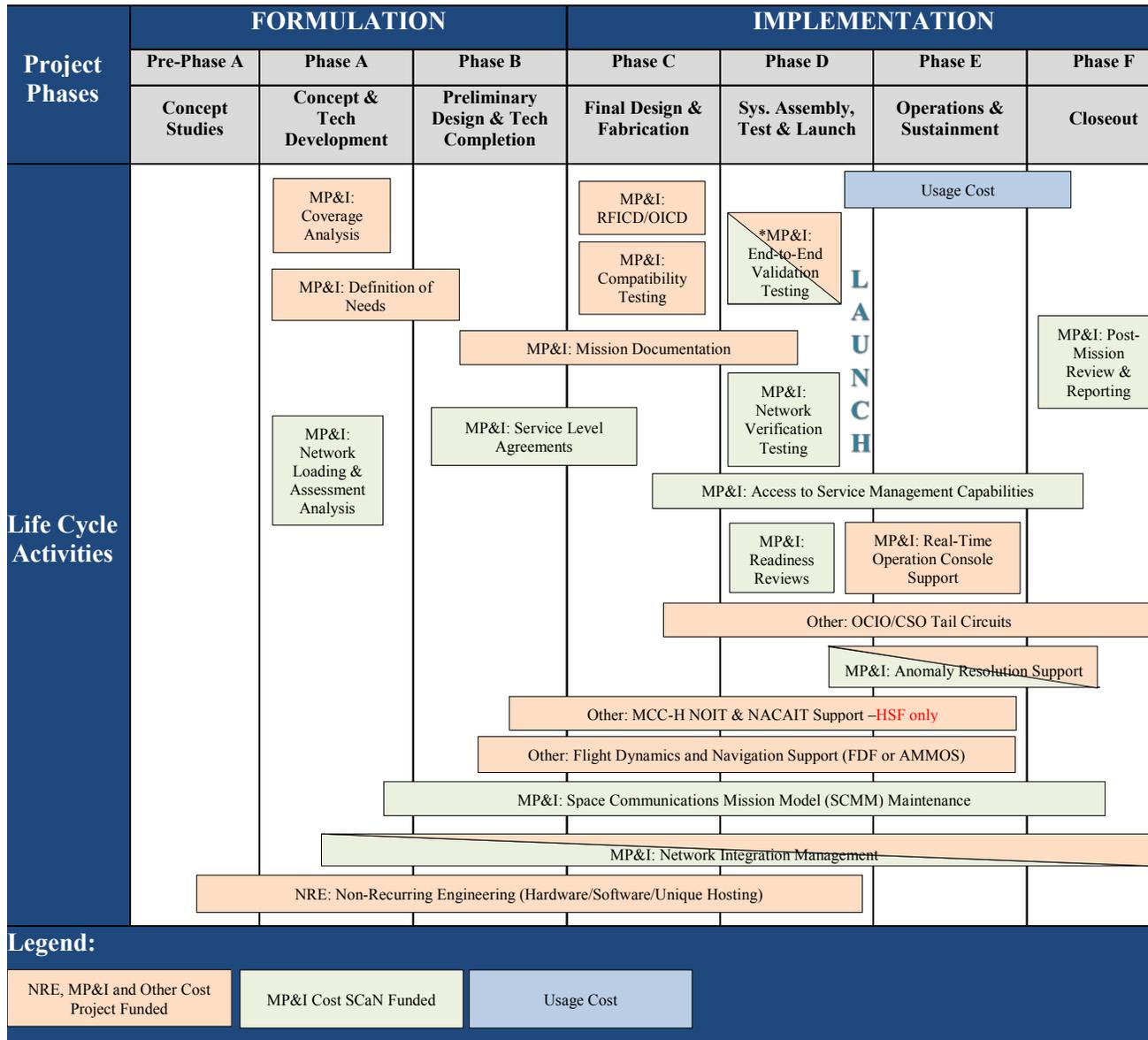
NASA Telecommunications Requirements



- Announcement of Opportunity: Astrophysics Explorers MIDEX & MO Telecommunications, Tracking, and Navigation
- NASA's **Mission Operations and Communications Services (MOCS)** document in the program Library and posted on the AO web site.
 - Network Support Costs (breakout on next chart)
 - Usage fee calculated value (Used for evaluation purposes only)
 - AO focused information
 - Required Proposal Information
 - Points of Contact



NASA/SCaN – SMD Cost Model





SCaN Customer Commitment Offices



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



SCaN Points of Contact



- SCaN Program Office/NASA HQ
 - Gary A. Morse/SCaN Mission Integration & Commitments Manager
 - Gary.a.Morse@nasa.gov
 - (202) 358-0504
- GSFC/Network Integration Management Office (NIMO)
 - Scott Greatorex/Chief, NIMO
 - Scott.A.Greatorex@nasa.gov
 - (301) 286-6354
- JPL/DSN Commitments Future Planning Office
 - Stefan Waldherr/Commitments Engineer
 - Stefan.Waldherr@jpl.nasa.gov
 - (818) 354-3416

A large satellite dish antenna is the central focus, set against a dramatic sunset sky with orange and blue hues. The dish is mounted on a complex metal structure. In the background, there are other smaller antennas and a fenced-in area with buildings.

NASA

www.nasa.gov

Space Communications and Navigation

www.nasa.gov/scan

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Keeping the Universe Connected