Space Communications Customer Forum (SCCF)

http://scp.gsfc.nasa.gov/sccf/

October 29, 2009

Building 3 Goett Auditorium
NASA/Goddard Space Flight Center
Greenbelt, Maryland

Sponsored by:
Networks Integration Management Office, Code 450.1
(Exploration and Space Communications Projects Division, Code 450)
NASA/Goddard Space Flight Center
Greenbelt, Maryland

AGENDA

Note: Splinter Group meetings with ESC service providers (GN/SN/NIMO, SCaN, SGSS); NISN; DSMC (SN & GN) Operations Interfaces personnel; and other topics may be arranged (on request). Please contact Mr. Michael Booth (301.286.6192; e-mail: Michael.S.Booth@nasa.gov)

Timeline (approx.)	Subject / Topic	Speaker / Presenter
1:00pm	WELCOME & INTRODUCTIONS	Chris Schwartz/GSFC
1:05pm	OPENING REMARKS	Mary A. Esfandiari/GSFC
1:20pm	FEATURED TOPICS	
	• Space Communications and Navigation (SCaN)/NASA Policy Directive (NPD) 8074.1	Jim Schier/HQ
	• Space Network Ground Segment Sustainment (SGSS) Project Overview	Albert G.Vernacchio/GSFC
1:50pm	ITEMS OF INTEREST	
	• Future Users Trends	Brad Johnson/CAEL
2:00pm	MISSION / PROJECT UPDATES (Organizational Overviews; Current/Future Missions; Issues & Selected Items of Interest; Areas for More Work)	
	• Space Science Mission Operations (SSMO)	Richard D. Burns/GSFC
	• Earth Science Mission Operations (ESMO)	Chris Wilkinson/GSFC
	• Human Space Flight (HSF) Missions	Cheryl Smith/CAEL
2:45pm	STATUS UPDATES (Significant activity in ESC offices and our Partners)	
	• Reformatting of Briefing Messages, Interim Support Instructions, and Operational Notices	Donald Davenport/HTSI
	• NASA Integrated Services Network (NISN) • Mission Closed IONET Router Replacement Project	Jerry Zgonc/GSFC Christie Grant/GSFC
	• Space Network (SN) Project	Roger J. Flaherty/GSFC
	• Ground Network (GN) Project	Kevin P. McCarthy/GSFC
	• Flight Dynamics Facility (FDF)	Susan L. Hoge/GSFC
	• Network Integration and Engineering (NI&E)	John J. Hudiburg/GSFC
4:45pm	OPEN FLOOR	Chris Schwartz/GSFC
4:55pm	CLOSING REMARKS	Chris Schwartz/GSFC

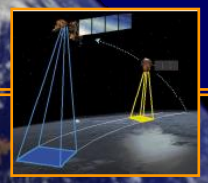
Welcome & Introductions

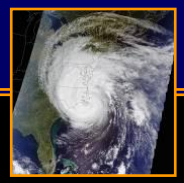
Chris Schwartz
Service Planning Manager
Networks Integration Management Office/Code 450.1
NASA/Goddard Space Flight Center

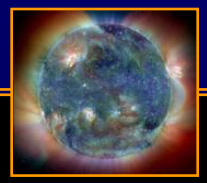
Purpose of Forum

- Foster better communication between Code 450 and potential and current customers
- Encourage dialogue
- Spark new ideas and approaches

EVOLUTION!!!







Space Communications Customer Forum

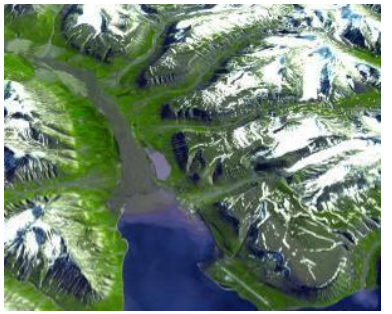
Mary Ann Esfandiari

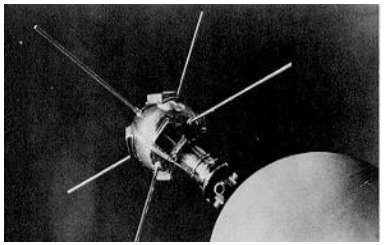
Exploration and Space Communications Division

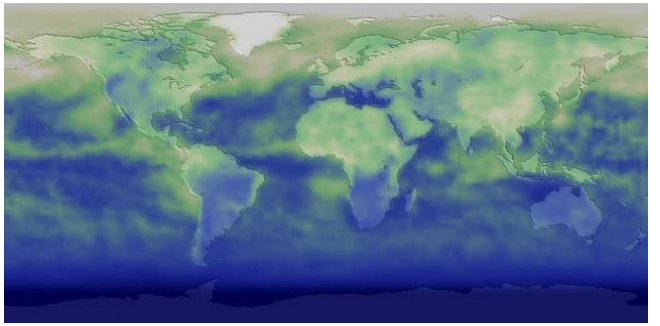
October 29, 2009

GSFC Space Communications History

- GSFC has a half century of space communications experience and has supported every NASA manned mission
  - Assumed assets and responsibility for space communication in 1959
  - Launched NASA's first on-orbit comm satellite (TDRS) in 1983
- Customers include
  - Project Vanguard (Explorer 1)
  - Systems tracked Sputnik
  - Early reentry vehicles at Wallops
  - And hundreds of space missions since
    - Mercury, Gemini, Apollo, Space Shuttle, and ISS
    - NASA, Commercial, International, and other US Government robotic missions







GSFC Manages Two of NASA's Three Space Communications Hubs

Space Network (GSFC)

Ground Network (GSFC)

Deep Space Network (JPL)

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***
- ***Surge capability through partnerships*** (e.g., NOAA)
- Optimized for ***cost-effective, high data rate services***

- Three station global network of large-scale antennas
- ***R&D organization*** focused on detecting and differentiating faint signals from stellar noise
- Optimized for ***low data rate capture from distances orders of magnitude above near earth***

KEY CUSTOMERS (EXAMPLES)

Space Network (GSFC)	Ground Network (GSFC)	Deep Space Network (JPL)
Space Shuttle	Earth Observing System	Mars Rovers
International Space Station	Lunar Recon. Orbiter	Cassini
Hubble Space Telescope	NOAA	Voyager

TODAY: Robust and Effective Support

- **Space Network**
  - Full-orbit highly reliable communications and tracking services for human and robotic spaceflight, ISS, STS, observatory class science missions, real-time operational agency support, emergency comm support
- **Near Earth Network**
  - Implementation of low cost, low risk systems, integrating off-the-shelf products, commercial services to provide near earth communications and tracking services
- **Network Integration Management**
  - One stop customer support, mission planning, orbit analyses,, communications mission design, anomaly resolution, emergency support, launch vehicle comm, compatibility testing
- **Standards and Technology for Near Earth Network users**
  - Development of high rate and bandwidth efficient communications systems
- **Systems Engineering Solutions**
  - Multi-Center support, loading studies, communications link studies, Mission Design Lab

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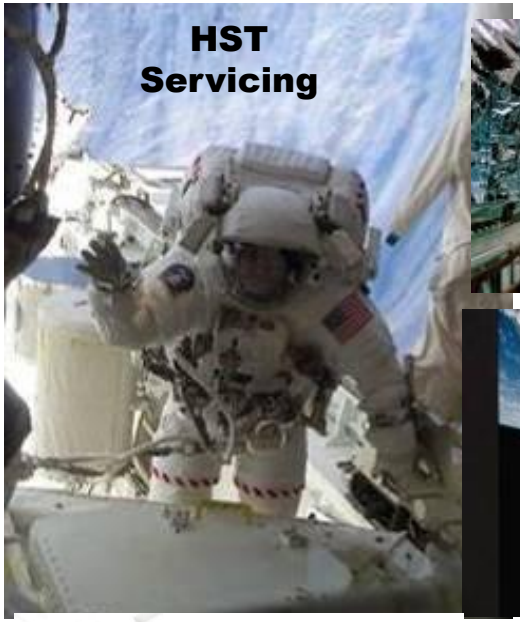
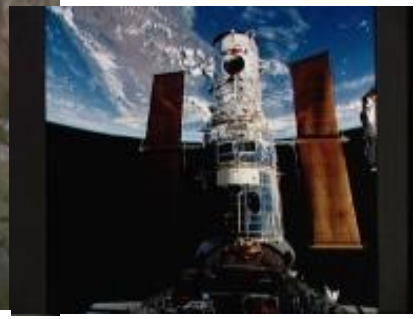
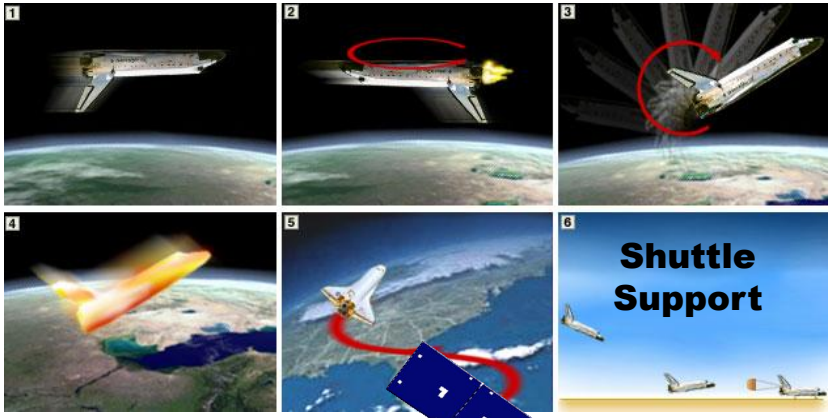
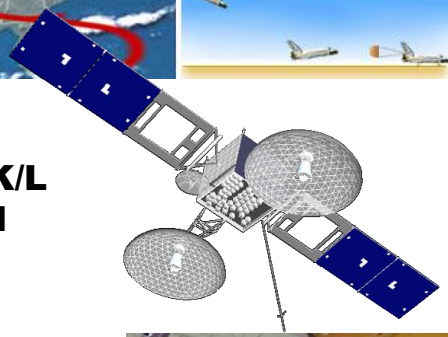
Successful Year





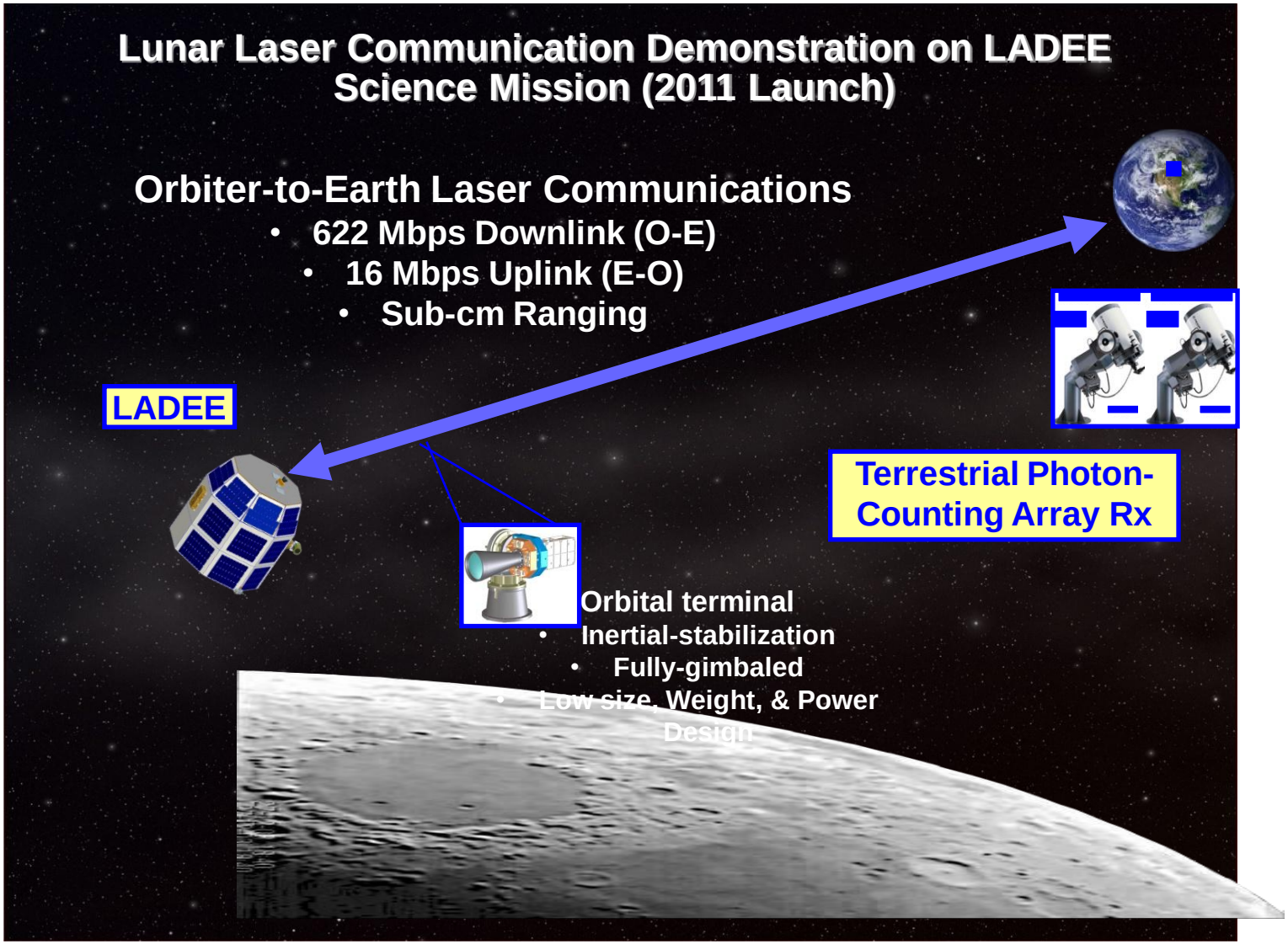




TDRS K/L
Build

ELC
Preparations
for ULF-3
Flight

GSFC Leading inclusion of Optical Payload Into LADEE



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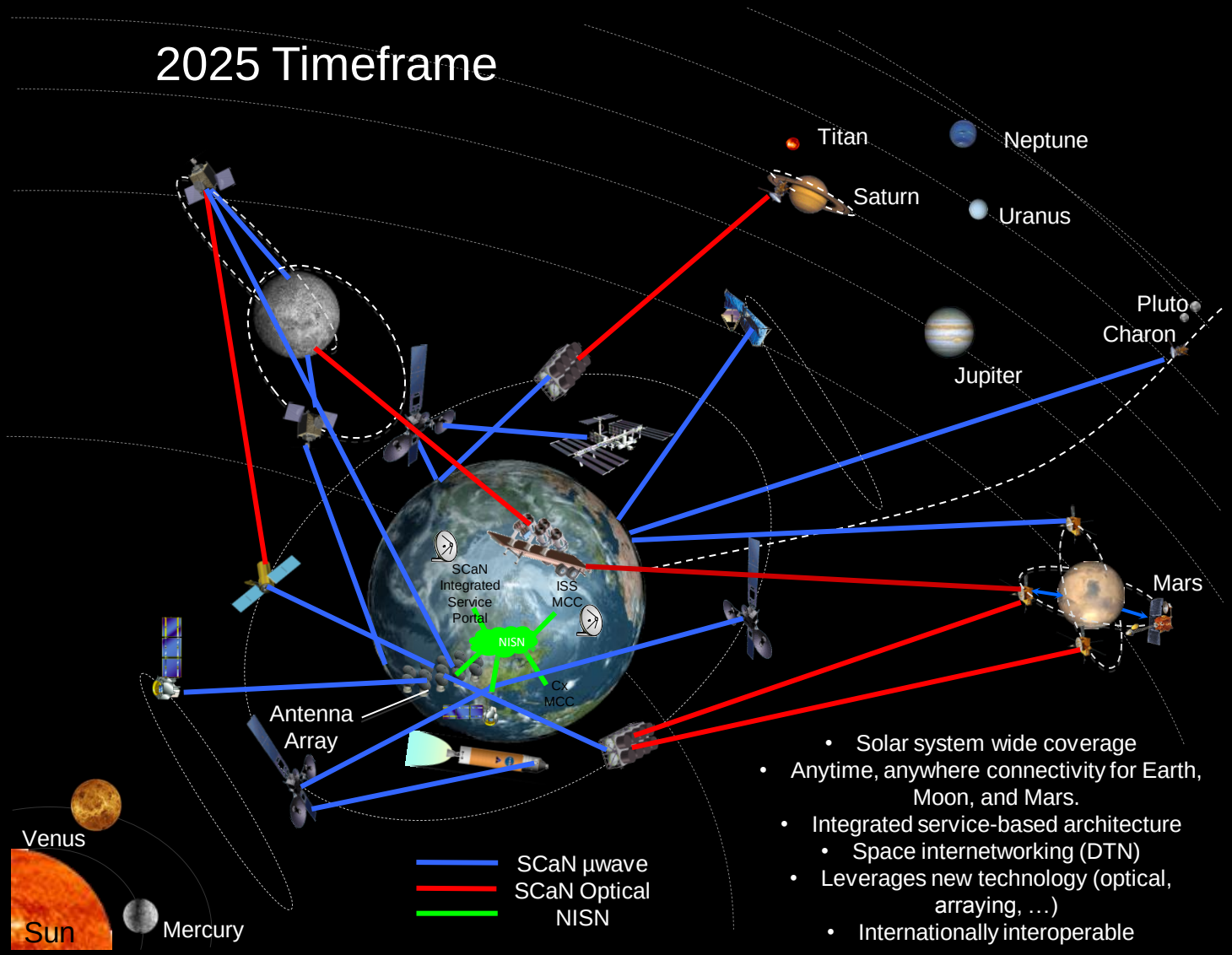
TOMORROW: Exciting Vision (with Challenges)

HQ/SCaN Integrated Space Communication Architecture Vision



- Solar system wide coverage
- Anytime, anywhere connectivity for Earth, Moon, and Mars.
- Integrated service-based architecture
- Space internetworking (DTN)
- Leverages new technology (optical, arraying, …)
- Internationally interoperable

TOMORROW: Exciting Vision (with Challenges)

- **Planning for replacement of the SN ground systems**
- **Planning for upgrades to both the NEN and SN capabilities with the integration of the advanced CCSDS/Space Link Extensions**
- **Preparations continue for Solar Dynamic Observatory launch/ Ka Band support (LRO provided 1st Ka Band support from WSC)**
- **Increasing complexity in science instruments with large data volumes driving need for Ka-band return service at highest possible downlink rates**
- **Optical communications on horizon may provide increased capability for greater volumes**
- **Ageing on-orbit fleet may dictate some changes to SN availability prior to replenishments in FY12/13**
- **Limited budgets will force prioritization of services and available resources and dictate timeline to realize integrated architecture**

Lunar Communications

- LRO, NASA's first mission in the Vision for Space Exploration, is meeting the objectives of finding safe landing sites, locating potential resources, characterizing the radiation environment, and demonstrating new technologies

- 1st Laser Ranging effort to track a spacecraft beyond low earth orbit. Results will increase precision in lunar maps

Future Human Spaceflight Communications

The NASA developed Ares rockets, named for the Greek god associated with Mars, will return humans to the moon and later take them to Mars and other destinations.

GSFC's Space Communications Networks will support these missions from launch through the lunar regime.

NASA Policy Directive (NPD) 8074.1: Management and Utilization of NASA's Space Communication and Navigation Infrastructure

Jim Schier
SCaN SE&I Manager
SCaN Program Office
NASA/Headquarters

Background

- Space Communications & Navigation (SCaN) Program established by Administrator Griffin in July 2007
- Roles & responsibilities defined by Associate Administrator Scolese in September 2007
- "Level 0" requirements approved at Strategic Management Council in August 2008
- NPD 8074.1 approved & effective as of 11 August 2009
  - **Black text** is quoted from approved NPD & NASA Forms

1. Policy

- It is NASA's policy to maintain a single process for the development and utilization of Agency space communications and navigation (C&N) infrastructure and for the enhancement of this infrastructure to enable new capabilities for the future. C&N infrastructure includes the following:
  - a. The ground and space-based facilities and assets of what are presently known as the Near Earth Network (NEN), the Deep Space Network (DSN), and the Space Network (SN).
  - b. Communications networks around all heavenly bodies beyond Earth, including the Moon, Mars, or other planets, providing support to surface as well as orbital user missions.

5. RESPONSIBILITY

a. NASA's Space Operations Mission Directorate shall manage the space C&N infrastructure through the Space Communications and Navigation (SCaN) Program Office, as prescribed by NPD 1000.0A, NASA Governance and Strategic Management Handbook, and NPD 1000.3, The NASA Organization.

b. The SCaN Program Office shall:

1) Be the Agency's central authority for designing, developing, and implementing a single unified process for the Agency's space C&N infrastructure.

(2) Work with the Mission Directorates to identify future C&N requirements and resolve capability gaps.

(3) Develop the space C&N capabilities in anticipation of future requirements.

5. RESPONSIBILITY

b. The SCaN Program Office shall:

(4) Coordinate all technical standards used to implement C&N infrastructure with the Office of the Chief Engineer for adoption as NASA Technical Standards and inclusion in the overall set of NASA Standards, as prescribed by NPD 8070.6, Technical Standards, and OMB Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards.

(5) Provide the Agency Program Management Council (PMC) with an annual assessment of integrated, mission-based capability gaps and an update of new C&N technologies.

(6) Develop the architecture and standards necessary to enable the Agency's C&N infrastructure to be interoperable with those of other agencies and international partners.

5. RESPONSIBILITY

c. NASA Mission Directorates (MD) shall:

(1) In general, use SCaN networks to meet their communication and navigation requirements for human and robotic space missions. However, 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.

(2) Not design or develop space C&N infrastructures, to include the surface of the Moon, Mars, or other planets, independent of the SCaN Program.

(3) Work with the SCaN Program Office to identify and resolve capability gaps.

(4) In consultation with SCaN, develop space C&N technologies relevant to their operating platforms that are compatible and interoperable with SCaN infrastructure.

5. RESPONSIBILITY

d. NASA's Office of the Chief Engineer shall:

(1) Provide oversight of the process by which capability gaps can be identified and present to the PMC if needed.

(2) In consultation with SCaN, create and maintain a set of NASA Standards that include those selected for implementation within NASA's space C&N infrastructure and specify mechanisms by which their use by NASA space fight programs/missions will be required.

NF1707, Special Approvals and Affirmations of Requisitions

SECTION 4 — TECHNICAL APPROVAL - ***affirmations are to be made by the Program or Project Technical Authority***

- **THIS PROCUREMENT HAS NO REQUIREMENTS RELATED TO SPACE COMMUNICATION AND NAVIGATION (SCaN) CAPABILITIES OF NASA, OF OTHER US GOVERNMENT AGENCIES, OR OF OTHER NATIONS**
  - **OR**
- **THIS PROCUREMENT HAS REQUIREMENTS RELATED TO SPACE COMMUNICATION AND NAVIGATION CAPABILITIES OF NASA, OF OTHER US GOVERNMENT AGENCIES, OR OF OTHER NATIONS, AND THE REQUISITION HAS BEEN COORDINATED WITH THE OFFICE OF SPACE COMMUNICATION AND NAVIGATION (SCaN) IN THE OFFICE OF SPACE OPERATIONS MISSION DIRECTORATE (SOMD)**

Conclusion

- SCaN is defining an evolutionary path to unify the current networks to provide standardized C&N infrastructure from launch to LEO to Deep Space
- SCaN is developing international standards (such as CCSDS) for Spacecraft & Mission Operations Services to enable more standardized, lower cost spacecraft communication subsystems & Mission Operations Centers
- SCaN is collaborating with international space agencies to provide cross support using the same services enabling more mission flexibility & better C&N availability at no extra cost
- SCaN will work with programs/projects to define spectrum, C&N architecture, standards and services, international cross support, and technologies to provide better service at lower cost to users

SGSS Project Overview for the Space Communications Customer Forum (SCCF-17)

Albert Vernacchio

Project Manager

This presentation is provided as a courtesy to the customer, however, given the Space Network (SN) Ground Segment Sustainment (SGSS) procurement activity and associated blackout, only a top-level overview is provided.

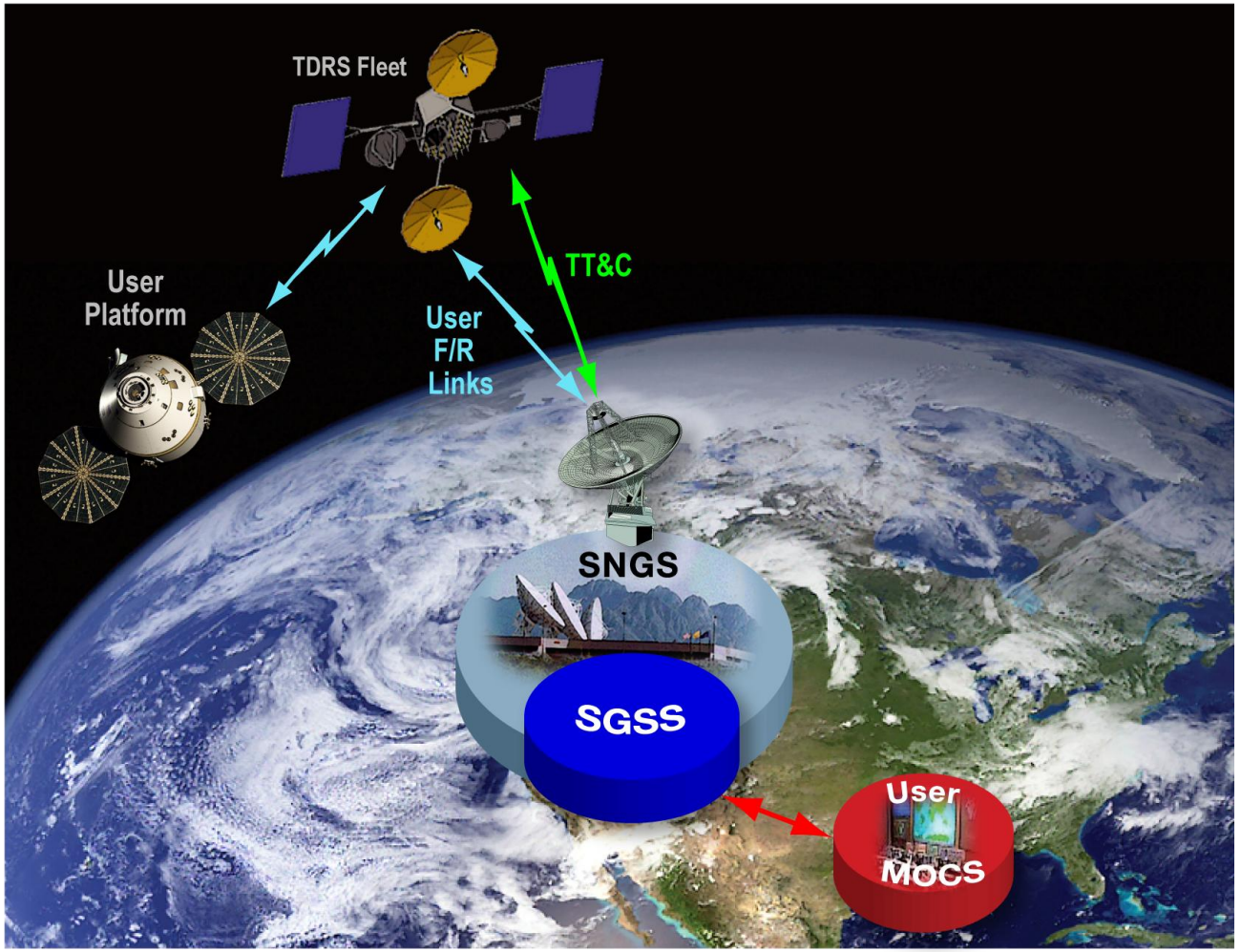
Questions related to the SGSS contract or procurement must be submitted to the SGSS Contract Officer.

Background

- The SN Ground System was built in the late 1980's and expected to last ~25 years. We are now beyond the design life for that system.
- In May 2008, the SN Ground Segment Sustainment (SGSS) project was created to develop and implement a sustainable Space Network Ground System (SNGS).
- The SGSS will support all legacy services/requirements.
- SGSS recognizes need for highly integrated transition to Ops with SN/SGSS.

The mission of the SN Ground Segment Sustainment (SGSS) Project is to "implement a modern ground segment that will enable the SN to continue delivery of high quality services to the SN community, meet Customer requirements, and reduce required operations and maintenance resources."

SGSS in the Space Network



- **The Space Network consists of the Flight Segment (TDRS Satellites) and the Ground Segment (SNGS).**
- **SGSS is updating a large portion, but not all, of the SNGS.**

SGSS Stakeholders

SN Customers (Mission Set)

- Legacy customers
  - NASA
    - Science Mission Directorate
      - HST
      - EOS (Code 407)
      - Other Science Missions
    - Space Ops Mission Directorate
      - ISS
      - Shuttle
      - ELV
  - Commercial / Academic / International
    - NSF / University Missions
      - International Partner Missions
      - Commercial Launch Providers
      - Commercial Space Missions
  - Special Programs & Missions
- Future customers
  - NASA
    - Science Mission Directorate
      - TBD
    - Exploration Systems Mission Directorate
      - CxP for Initial Capability
      - CxP for Lunar
  - Commercial / Academic / International
    - TBD
  - Special Programs & Missions

SGSS Enabling Stakeholders

- SCaN Program
  - SCaN Network Services
    - Network Integration & Engineering
- Goddard Space Flight Center
  - Code 100 Center Management
  - Code 210 Procurement
  - Code 400 Flight Projects Management
  - Code 450 – ESC
    - NENS/SCNS Contractors
  - Code 458 SGSS Project
  - Code 500 – AETD
    - Co-located Civil Servants
    - GSFC Eng Services Contractors
    - Industry
  - SGSS Implementation Contractor

SGSS Influencing Stakeholders

- SCaN Program
  - SCaN Spectrum Management
  - SCaN Systems Planning
- Goddard Space Flight Center
  - Code 240 Security
  - Code 700 IT Security
- External Entities / Activities
  - Transformational Communications Architecture (TCA) – U.S. Gov't
  - CCSDS / International Standards Org.

SGSS Cooperating Stakeholders

- Space Network
  - Code 452 SN Project
    - WSC / SNGS Management
    - USA / USSR sub-projects
    - SNGS M&O Contractor
    - Operators
    - Sustaining Engineering
  - Code 456 SNE Project
  - Code 454 TDRS K/L Project
- GSFC Code 450.1 – NIMO
- GSFC Code 453 – NEN Project
- GSFC Code 300 S&MA
- JPL / Deep Space Network
- International Space Agency Partners
- NASA OCIO - NISN

Forward Plan

- RFP Released 10/16/09.
- Currently in Procurement Blackout.
- After award, the SGSS project will have a Customer Forum Roadshow to present details of the project.

Future Trends

Brad Johnson
Advanced Missions
Code 450.1/NIMO, NENS
Goddard Space Flight Center

Space Science Mission Trends

- **Loosely coupled constellations**
- **More highly elliptical orbits**
  100's km x 10000's km
  Perigee tracking challenge
  Longer view times around apogee
- **Data volume increases**
  S- and Ka-bands
- **Lunar Missions**
- **Low inclination orbits and data volume increases are a challenge**

Earth Science Mission Trends

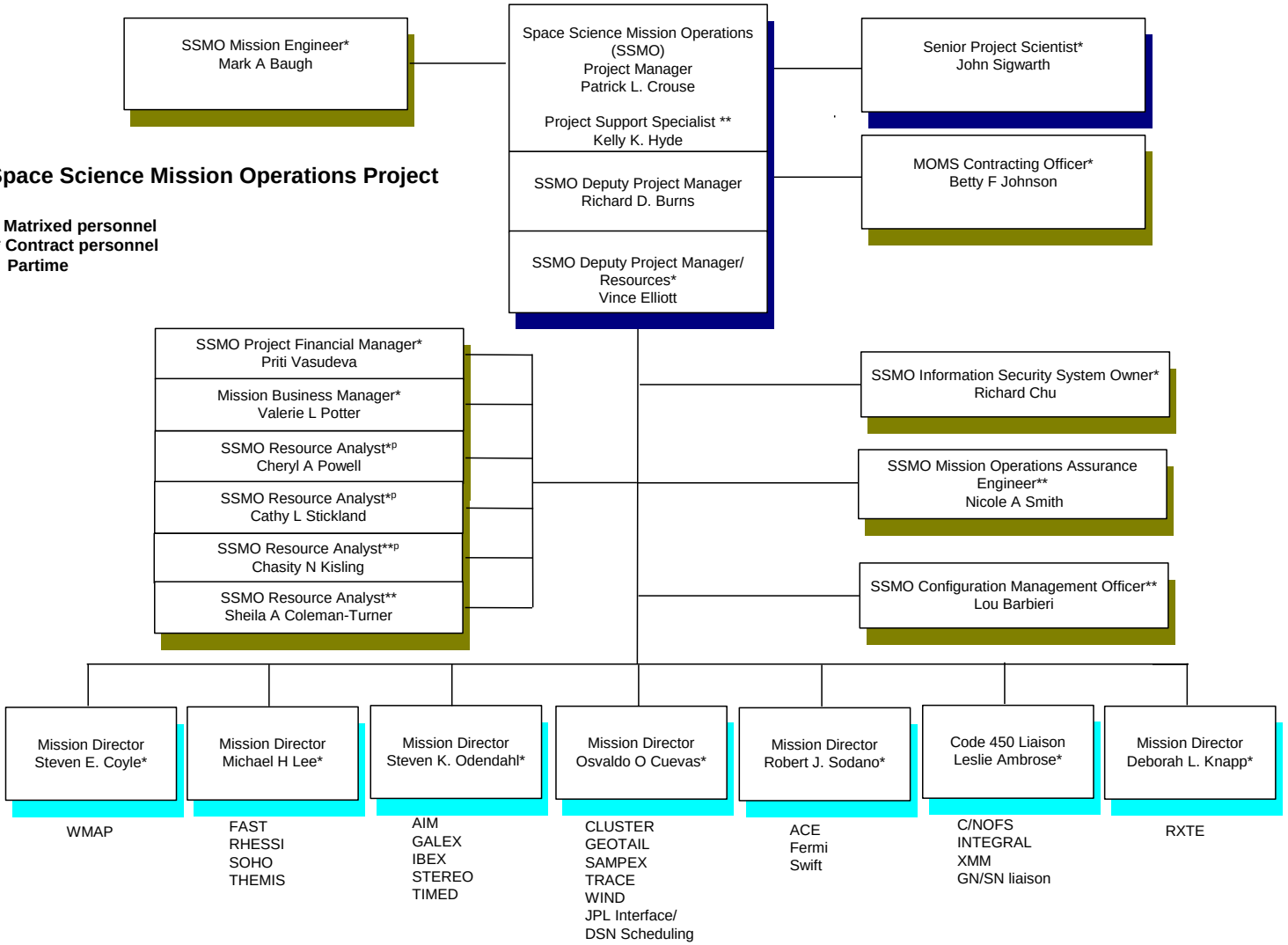
- **Decadal Survey Missions**
  2015+ operations
- **Data volumes of 40Tbits+ per day**
- **Multiple contacts per orbit**
  More “mixed” mode primary support concepts
- **Ka-band interest**
- **Numerous proposed “Swarm” mission architectures**
  10 => 100 of s/c

Other

- Volume's + latency => network bandwidth
- Both SN & NEN "ingest" system upgrades required
- Ka-band enhancements for <u>both</u> SN & NEN
- Modulation & coding scheme enhancements
- Interest in use of WS1 18m system

Space Science Mission Operations

Rich Burns
Dep. Project Manager
SSMO/444
NASA/Goddard Space Flight Center



Original signed by **October 15 2009**

Patrick L. Crouse, Space Science Mission Operations Project Manager **Date**

Missions in Operations

	Mission	Launch Year	MOC Location	Mission Director	Science Type	# s/c	Orbit Regime
1	ACE	1997	GSFC	R. Sodano	Heliophysics	1	L1
2	AIM	2007	LASP	O. Cuevas	Heliophysics	1	LEO
3	ARTEMIS*	2007	UC Berkeley	M. Lee	Heliophysics	2	HEO
4	Fermi	2008	GSFC	R. Sodano	Astrophysics	1	LEO
5	Galex	2003	Orbital	S. Odendahl	Astrophysics	1	LEO
6	IBEX	2008	Orbital	S. Odendahl	Heliophysics	1	HEO (T = 8 days)
7	LRO**	2009	GSFC	S. Odendahl	ESMD/SMD	1	Low Lunar Orbit
8	RHESSI	2002	UC Berkeley	M. Lee	Heliophysics	1	LEO
9	RXTE	1995	GSFC	D. Knapp	Astrophysics	1	LEO
10	SAMPEX	1992	GSFC	O. Cuevas	Heliophysics	1	LEO
11	SOHO***	1995	GSFC	M. Lee	Heliophysics	1	L1
12	STEREO	2006	APL	S. Odendahl	Heliophysics	2	Heliocentric
13	Swift	2004	Penn State	R. Sodano	Astrophysics	1	LEO
14	THEMIS	2007	UC Berkeley	M. Lee	Heliophysics	5	HEO
15	TIMED	2001	APL	S. Odendahl	Heliophysics	1	LEO
16	TRACE	1998	GSFC	O. Cuevas	Heliophysics	1	LEO
17	WIND	1994	GSFC	O. Cuevas	Heliophysics	1	L1
18	WMAP	2001	GSFC	S. Coyle	Astrophysics	1	L2

* ARTEMIS is a bifurcation of the THEMIS extended mission.
** LRO will transition to SSMO upon dissolution of the LRO Project Office.
*** SOHO is a is a cooperative program between ESA and NASA.

Other SSMO Mission Involvement

	Mission	Mission Director	Science Type	SSMO Responsibility
1	Cluster II	O. Cuevas	Heliophysics	DSN Scheduling
2	Geotail	O. Cuevas	Heliophysics	Science Data Processing
3	INTEGRAL	L. Ambrose	Astrophysics	Communications Coordination
4	XMM	L. Ambrose	Astrophysics	Communications Coordination

Missions in Development

	Mission	Launch Year	MOC Location	Mission Director	Science Type	# s/c	Orbit Regime
1	SDO	2009	GSFC	TBD	Heliophysics	1	GEO
2	MMS	2013	GSFC	TBD	Heliophysics	4	HEO

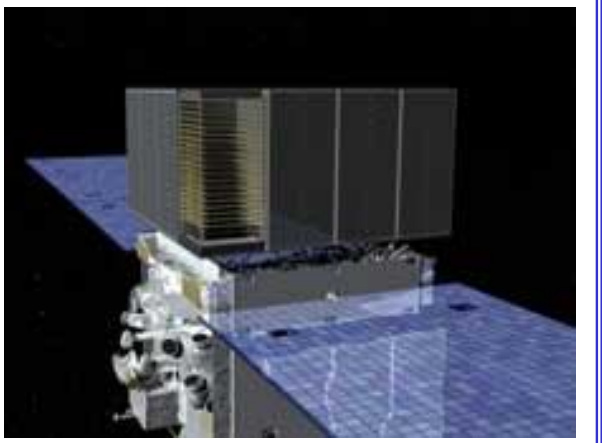
Decommissioned Spacecraft

	Mission	Launch Year	Decom. Year	# s/c	Orbit Regime
1	FAST	1996	2009	1	HEO (e=0.2)
2	FUSE	1999	2007	1	LEO
3	IMAGE	2000	2007*	1	HEO
4	IMP-8	1973		1	HEO
5	Polar	1996	2008	1	HEO
6	SWAS	1998	2004	1	LEO
7	WIRE	1999	2008	1	LEO

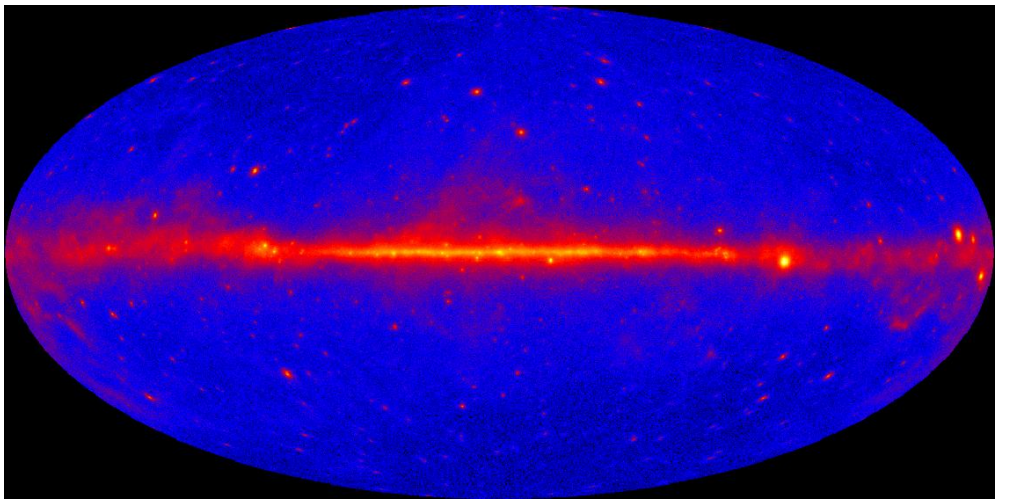
SSMO Overview

- **SSMO Mission Diversity**
  - in every phase of operations (prime ➔ extended, extended)
  - in a variety of orbital regimes (LEO, HEO, LLO, Lagrange points)
  - using each communications network (NEN, SN, DSN)
  - operated at GSFC and remotely (UCB, LASP, OSC)

SSMO Additions

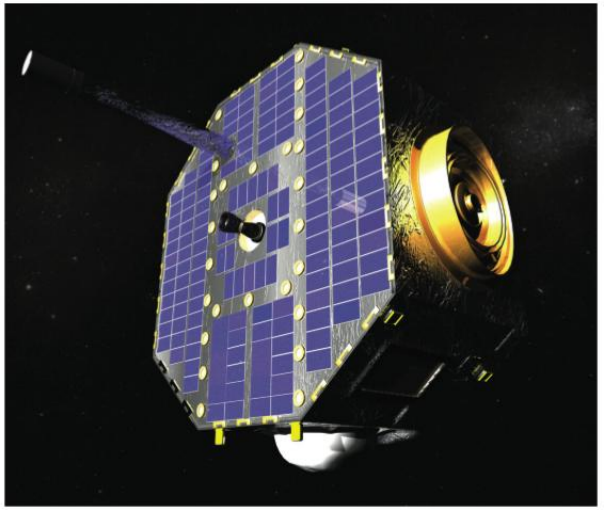


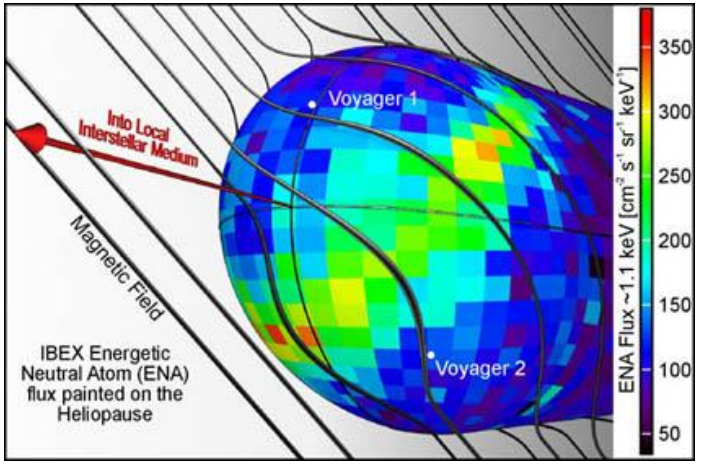
- Fermi Gamma Ray Space Telescope
  - Operated at GSFC
  - Launched in 2008 into LEO (i=25.6º, 560 km)
  - 3-axis stabilized
  - Primarily use SN for T&C
  - GN utilized as backup



SSMO Additions

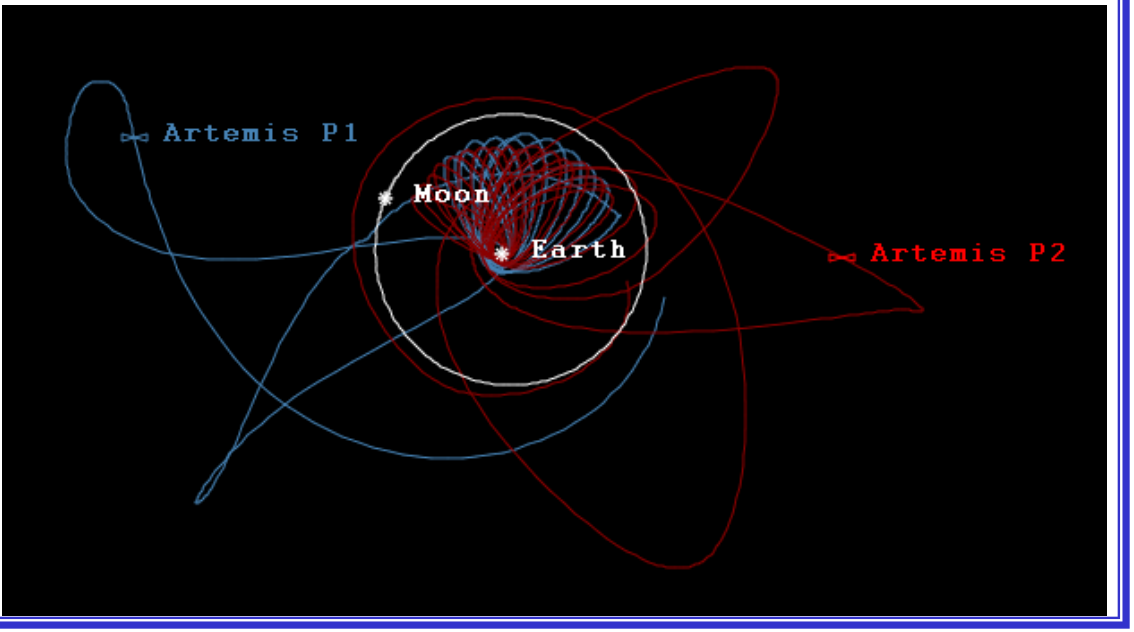
- Interstellar Boundary EXplorer (IBEX)
  - Operated at OSC - Dulles
  - Launched in 2008
  - HEO (8 day orbit)
  - Spin-stabilized
  - Primarily use USN for TT&C





SSMO New Directions

- THEMIS/ARTEMIS
  - Two outer probes in transit to moon
  - Weak stability boundary transfer
  - Now with DSN!

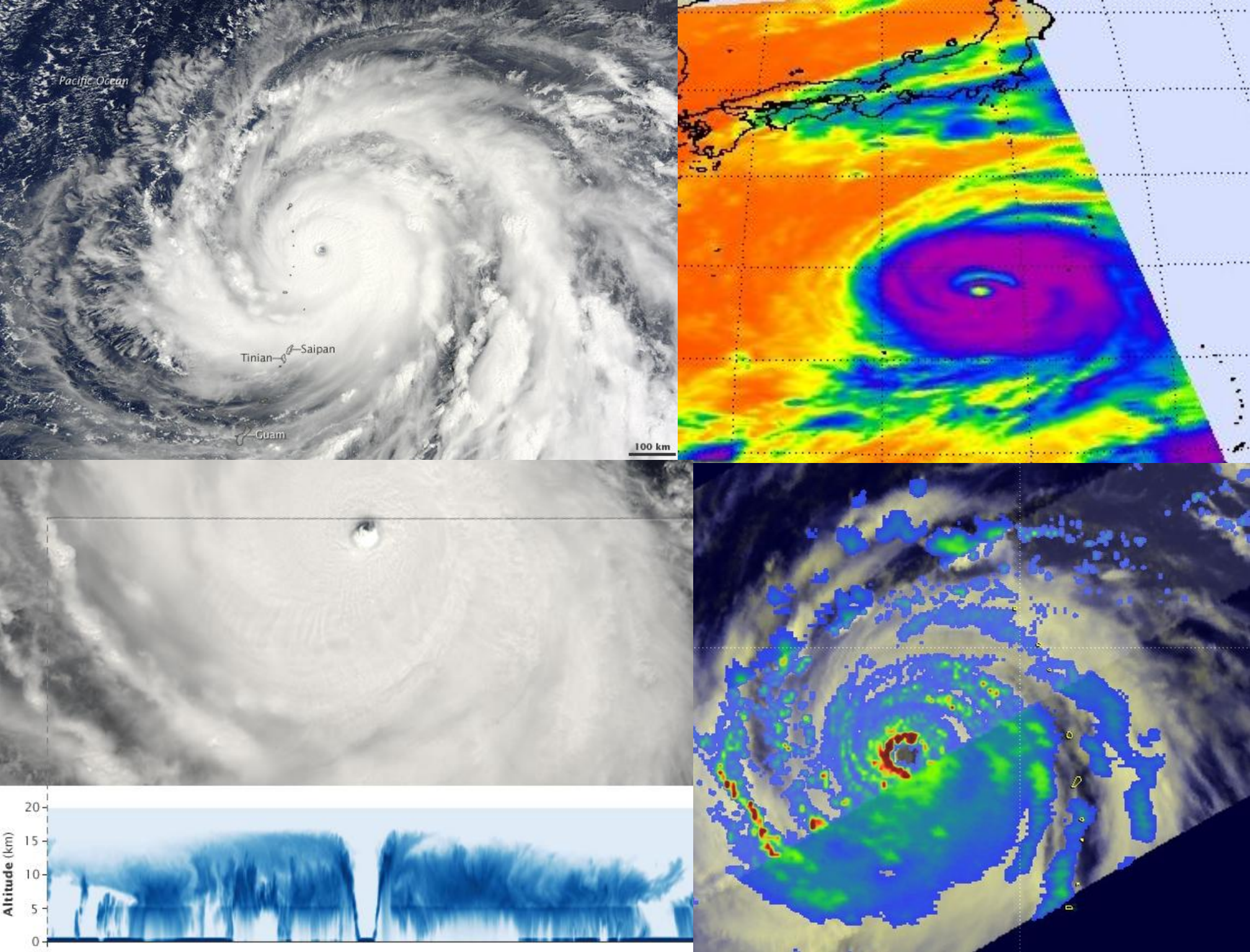


Earth Sciences Mission Operations

EOS Data and Operation System

(EDOS)

Chris Wilkinson
Deputy Project Manager
Earth Science Mission Operations (ESMO) Project
Code 428
NASA/Goddard Space Flight Center


Pacific Ocean
Tinian
Saipan
Guam
100 km
Altitude (km)
20
15
10
5
0

EDOS Today (1)

EDOS - High-Rate, Multi-Mission System

- Autonomously captures science data at 4 remote stations (12 antennas)
- Transfers science data to GSFC over NASA's high-rate network (~60 Mbps per ground station)
- Performs initial level zero science data processing
- Delivers approximately 1/2 Terabyte of products daily to 18 data centers worldwide

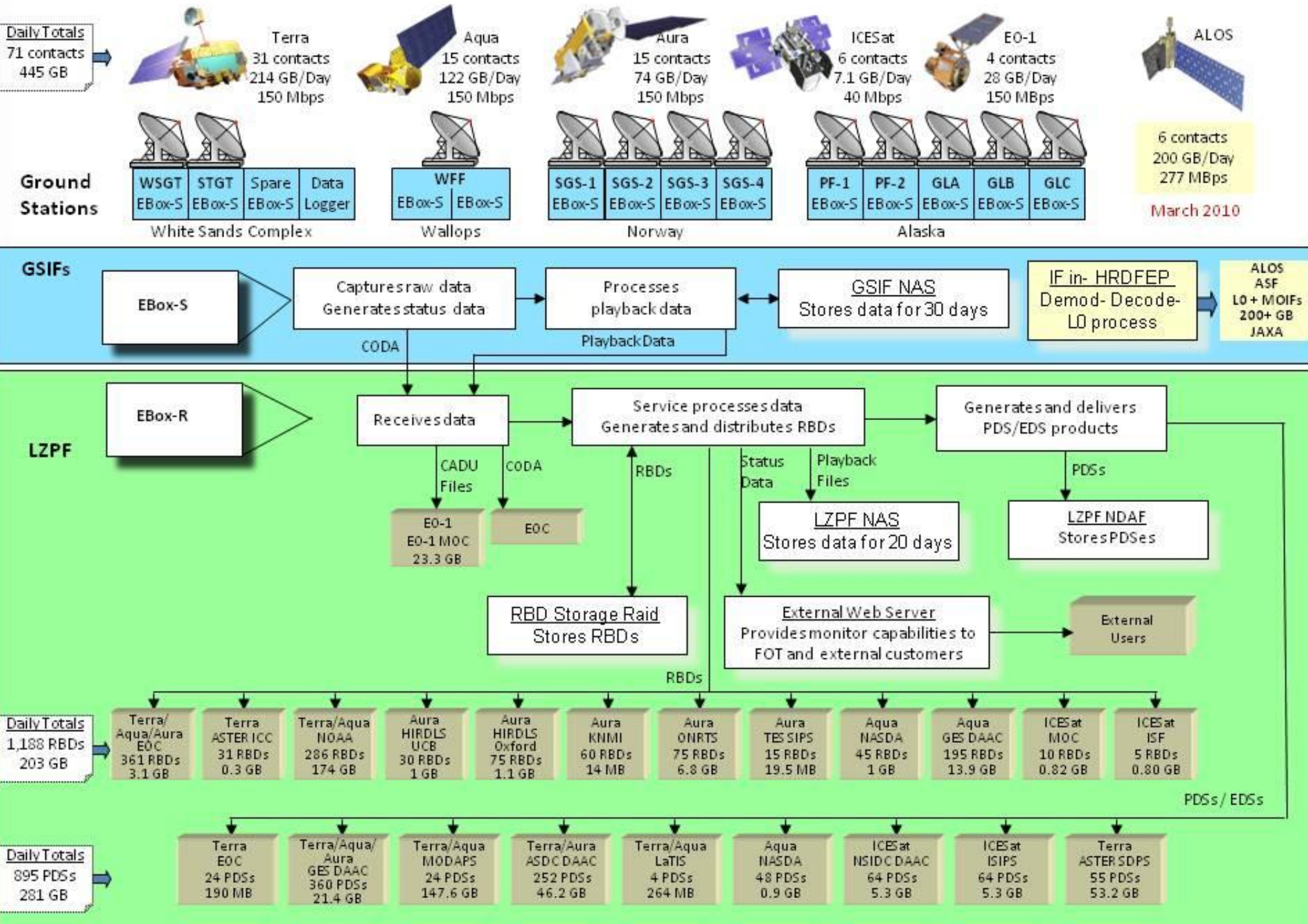
Key Features

- Data-driven system (no schedules or pre-pass setup required)
- Supports spacecraft downlink rates of 150 Mbps; ALOS at 280 Mbps
- Nominal functions automated; operation intervention only for anomalies
- Worldwide customer access to web-based displays providing real-time monitoring of mission data quality
- Evolutionary design enables cost effective support for new missions by leveraging existing NASA infrastructure

EDOS Today (2)

- Currently supports 5 spacecraft ; ALOS Mar. 2010, SMAP 2015
- Capacity exists to add Decadal missions
- Ground station support at Norway, Alaska, White Sands, and Wallops
- Data-driven X-band high-rate capture system dedicated to each antenna
- The Level Zero Processing Facility consists of 4 processing environments: ---
  - ♦ Operations ♦ Development ♦ Int & Test ♦ off-site Backup System
- 24x7 multi-mission support team for anomaly resolution, telemetry analysis
- Delivers over 2000 products to 18 data centers daily with various latencies:
  - *real-time products* < ***5 seconds***
  - *near real-time products* < ***3 hours***
  - *non-real-time products* < ***24 hours***
- Upon request can archive all products for life of mission

EDOS Multi-Mission Data-Driven Architecture



EDOS Upgrades since 2006 (1)

GSIF sites

- New programmable (FPGA) FEP boards that can be easily modified for any data stream characteristics, higher data rates (500 Meg)
- Upgraded hardware platforms to HP 570 server

LZPF

- Replaced SGI/IBM equipment with HP 570 servers
- Converted application software from SGI proprietary operating system to Linux. Major porting effort from large to small Endian platforms
- Streamlined system architecture (3 functional platforms into 1), reducing software interface complexity and reallocated DAF tape function

GUI workstations and Middleware

- Upgraded workstation hardware to Linux based PC architecture
- Converted GUI application software from X-windows to JAVA
- Added a Middleware layer to the system
- Introduced Web-based displays for authorized external users

Network

- Deployed the QOS capability to support multiple data streams (prioritized)

EDOS Upgrades since 2006 (2)

Design for OCO mission support

(capabilities retained for potential OCO 2)

- Data capture, product generation, GUI displays, and summary reports
- Delivery interface (Drop Box) for OCO MOC
- Specialized near real-time interface for engineering data

Data Archive Facility (DAF) modernization

- Accomplished for operational, reliability, maintainability and cost benefits.
- Faster turnaround time for archive data requests delivered electronically from WSC to EDOS LZP
- Moved from Sony tape drives to a non-proprietary, cost effective tape medium with multivendor support, Linear Tape-Open Version 4 (LTO4).
- Maintained capability to read and generate proprietary Sony tapes, (old DAF medium).
- Tape media costs will decrease by at least $66000 a year, $71000 vs. $5000.

EDOS ALOS Support

2008

✓ Supported technical/planning meetings between NASA and JAXA ALOS teams
✓ Implemented Mod 4 decoding function on EDOS Front-End Processor board using SN baseband ground configuration
✓ Implemented highly successful backup interface to receive IF signal on a built-in receiver to demodulate, decode, and perform frame processing
✓ Supported successful May/June 2008 TDRS Demonstration Test at 277 Mbps with 0 bit errors

2009

- EDOS implementing infrastructure for ALOS operational support including:
  - level zero processing to create of level zero products and browse data
  - high rate data delivery of products to ASF and JAXA over NISN SIP
- EOS operational interface for ALOS scheduling

2010

- Testing NASA operational support for ALOS with ASF and JAXA
- Transition to operational support in March timeframe

FY 10 Planned initiatives

- Network-wide upgrade of OS to SUSE Linux Enterprise 11
- ALOS systems test and transition to operations
- SMAP Operations Concept, ICD development and software implementation
- Assessment of changes needed for EDOS connection to ASF station
- Implementation of new Product Distribution System for EDOS Modernization *
- Assessment of CFDP Class 1 and 2 capability for Decadal mission support
- Assessment of higher capture rates & error correction (LDPC)
- EDOS Web server enhancements for improved user access and security *
- EDOS automation for product delivery verification and report generation *
- Integration of Ebox-S and Ebox-R for standalone portable Ebox test system
- “Auto-Ops” Overlap Capability for Aqua and Aura *

Human Space Flight (HSF) Integrated Network Status

Cheryl Smith
Advanced Mission Planning – Lead
Human Space Flight Group
Caelum Research Corporation/ NENS
Goddard Space Flight Center

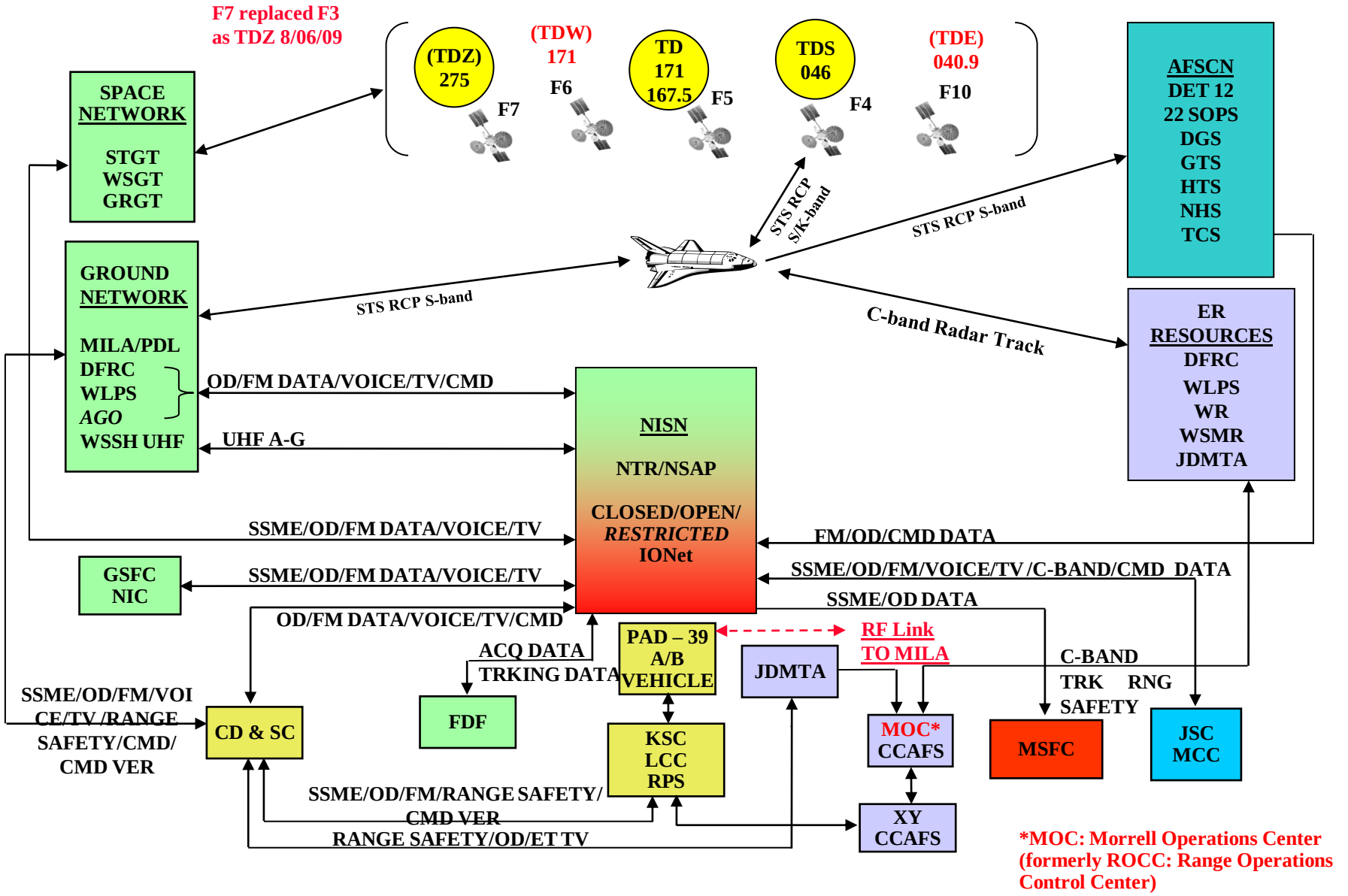
Integrated Networks

- **Major Elements**
  - Space Network (SN)
  - Ground Network (GN)
  - NASA Integrated Services Network (NISN)
  - Flight Dynamics Facility (FDF)
  - KSC Communications Distribution & Switching Center (CD&SC)
  - Dryden Western Aeronautical Test Range (WATR)
  - Eastern Range (ER)/Western Range (WR)
  - Air Force Satellite Control Network (AFSCN)

NENS Human Space Flight (HSF) Team

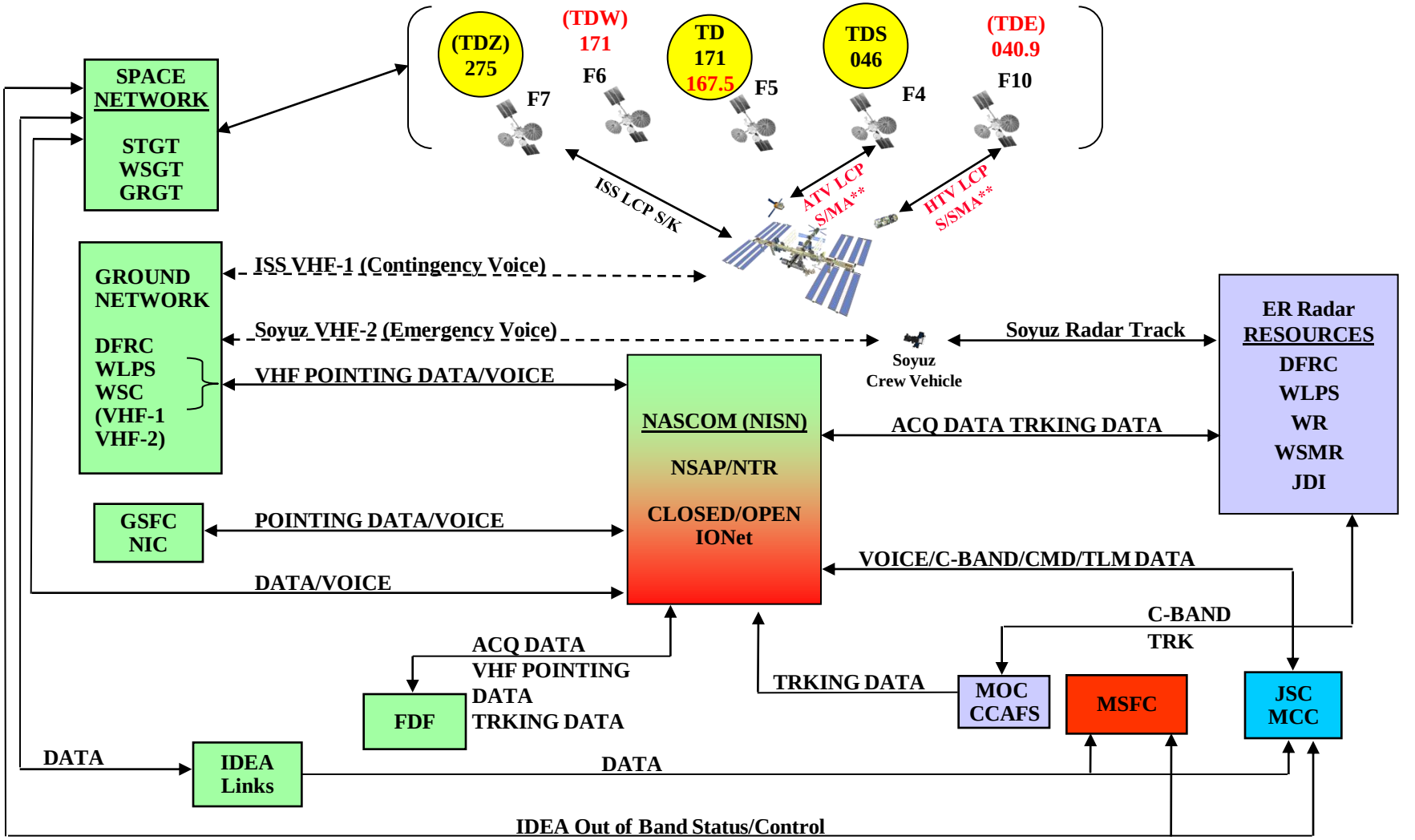
- **GSFC Support Functions:**
  - STDN Mission Managers (SMM)
  - Ground Network Operations Managers (GNOM)
  - Advanced Mission Planning
  - Requirements Management
  - Mission Documentation Development/Maintenance
  - Mission Support Planning
  - Mission Integration, Test, and Verification
  - Sustaining Engineering Services
  - Operations and Maintenance

Space Shuttle Integrated Networks Overview



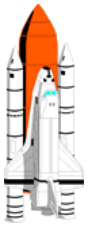
*MOC: Morrell Operations Center (formerly ROCC: Range Operations Control Center)

ISS Integrated Network Support

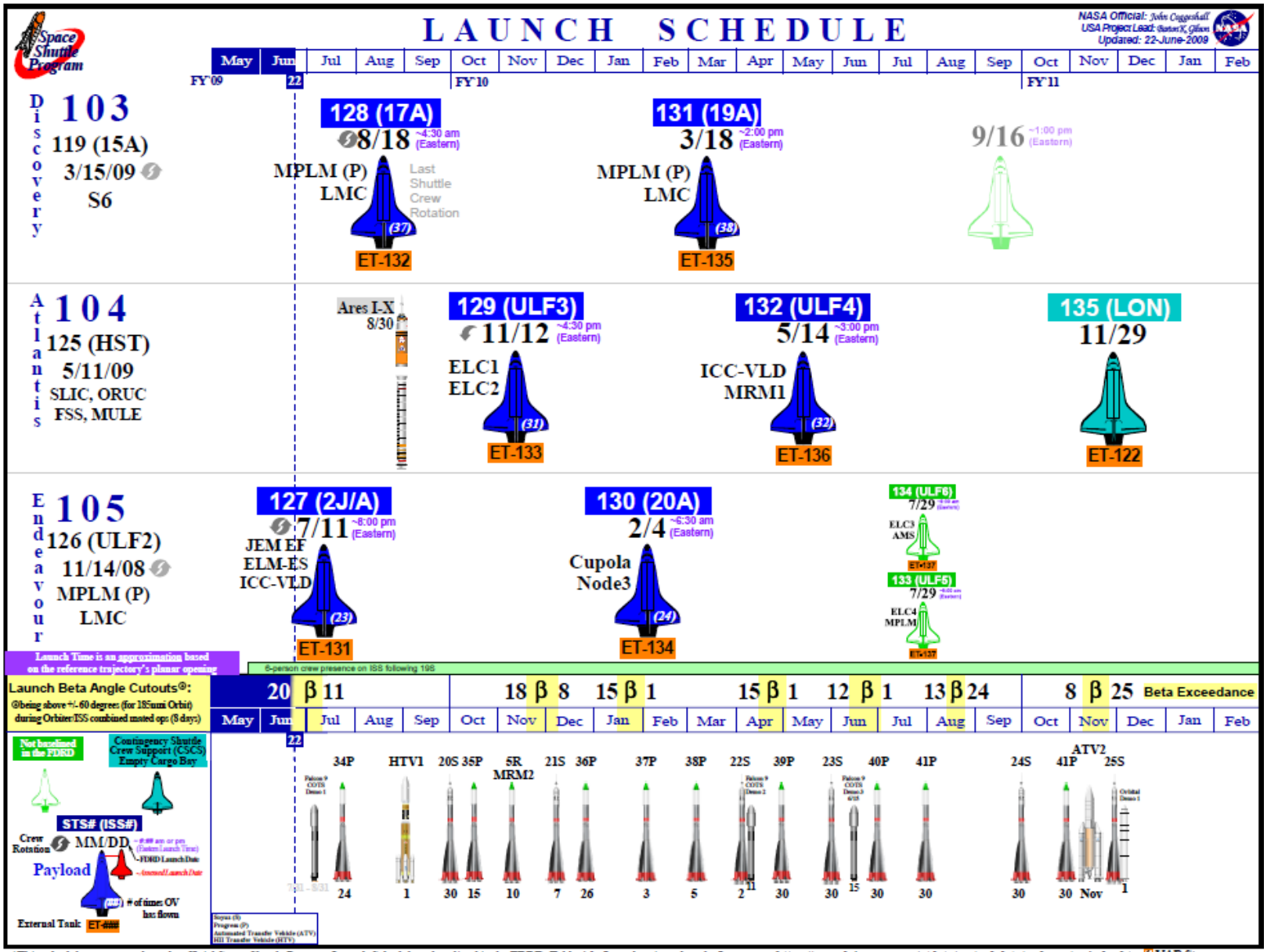


Note: ATV and HTV will not be on orbit in same time frame

Upcoming Human Spaceflight Mission Activities

October 2009	November 2009	December 2009	January 2010	February 2010	March 2010	April 2010
35P Progress 10/15/09	 ULF3 STS-129 11/12/09	Soyuz 21 12/07/09		20A STS-130 02/04/10	38P Progress 03/05/10	Soyuz 22 04/02/10
	EVA 11/24/09	36P Progress 12/26/09	EVA 01/25/10	37P Progress 02/2010	19A STS-131 03/18/10	

Launch Schedule



*This schedule represents the only official Space Shuttle Program Launch Schedule as baselined in the FDRD, Table 4.1. It can be viewed on the Internet at: https://sspweb.jsc.nasa.gov/ntdata/ssp/webdata/mchome/sspindex.htm VAB Storage

STS and ISS Status

- **STS-129/ ISS ULF-3 scheduled for launch 11/16/09 (2:28 pm)**
  - Payload Express Logistics Carriers 1 and 2
- **There are 5 missions left on the manifest, Shuttle program scheduled to end 2010**
  - Last mission currently scheduled STS-133/ISS ULF-5 09/16/10
- **ISS**
- **6 assembly sequences left in construction of ISS (does not include STS-129)**
  - 4 STS missions and one Soyuz mission
  - ODAR (Obsolence Driven Avionics Replacement)
    - Replacing equipment on board station
    - Increasing forward and return services

Visiting Vehicle Status

- **European Space Agency (ESA) Automated Transfer Vehicle (ATV)**
  - ATV-1 launched on 03/09/08 with docking on 04/03/08
  - ATV-1 undocking occurred on 09/05/08 followed by reentry on 09/29/08
  - ATV-2 scheduled for launch 11/2010
- **Japanese Space Exploration Agency's (JAXA) H-II Transfer Vehicle (HTV)**
  - HTV-1 launched 09/11/09 with docking on 09/17/09
  - HTV-1 undocking 10/30/09 with reentry scheduled for 11/01/09
  - HTV-2 scheduled for launch 02/2011

Visiting Vehicle Status

- **Constellation Program ARES 1X Vehicle**
  - Two-stage ELV for crew exploration vehicle Orion
  - Launch scheduled for 10/27/09
- **Constellation/ORION**
  - HSF has begun supporting the advanced mission planning efforts for the program

Visiting Vehicle Status

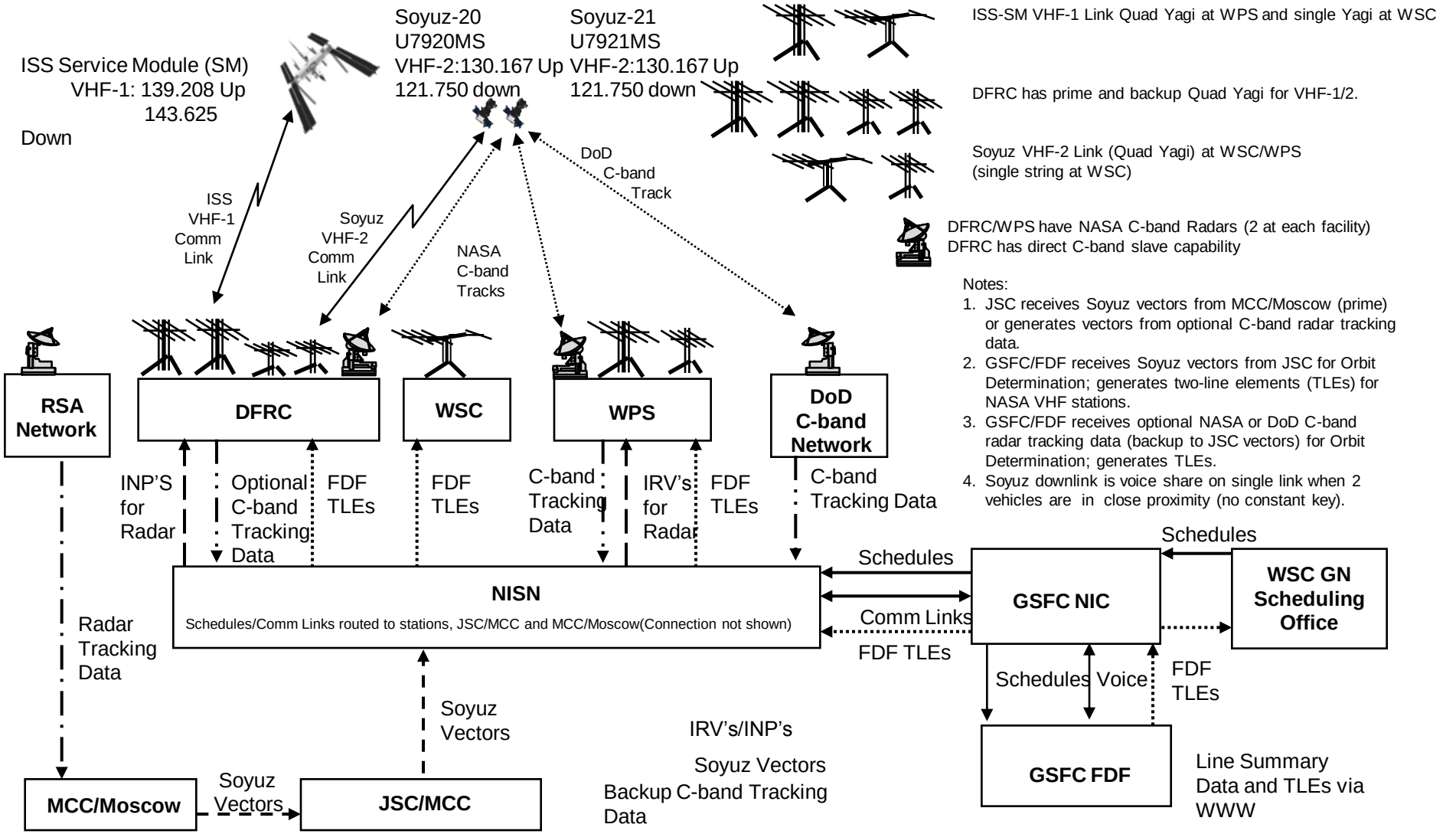
- **Space-X (COTS) Commercial Orbit Transportation System**
  - First commercial entity to re-supply ISS and bring back waste future plans for program to support Human transfers to and from Station
  - Three demo flights to demonstrate the ability to approach, berth and deliver cargo
  - Demo C1 launch scheduled 01/2010
  - Demo C2 launch scheduled 04/2010
  - Demo C3 launch scheduled 06/2010
- **OSC (Orbital Sciences Corporation) (COTS)**
  - Second commercial entity slated for re-supply of ISS
  - First launch scheduled 03/2011

Soyuz/Expedition Mission Status

- **Soyuz 21S/Expedition 22**
  - Launch scheduled 12/21/09 time TBD
  - Dock with ISS 12/23/09
  - Payload: Crew , logistics/supplies
  - 3 more Soyuz missions on manifest with last 09/2010
  - Progress re-supply vehicles are scheduled in between STS and Soyuz

Backup Slides

ISS Six Crew Two Soyuz Evacuation



Notes:

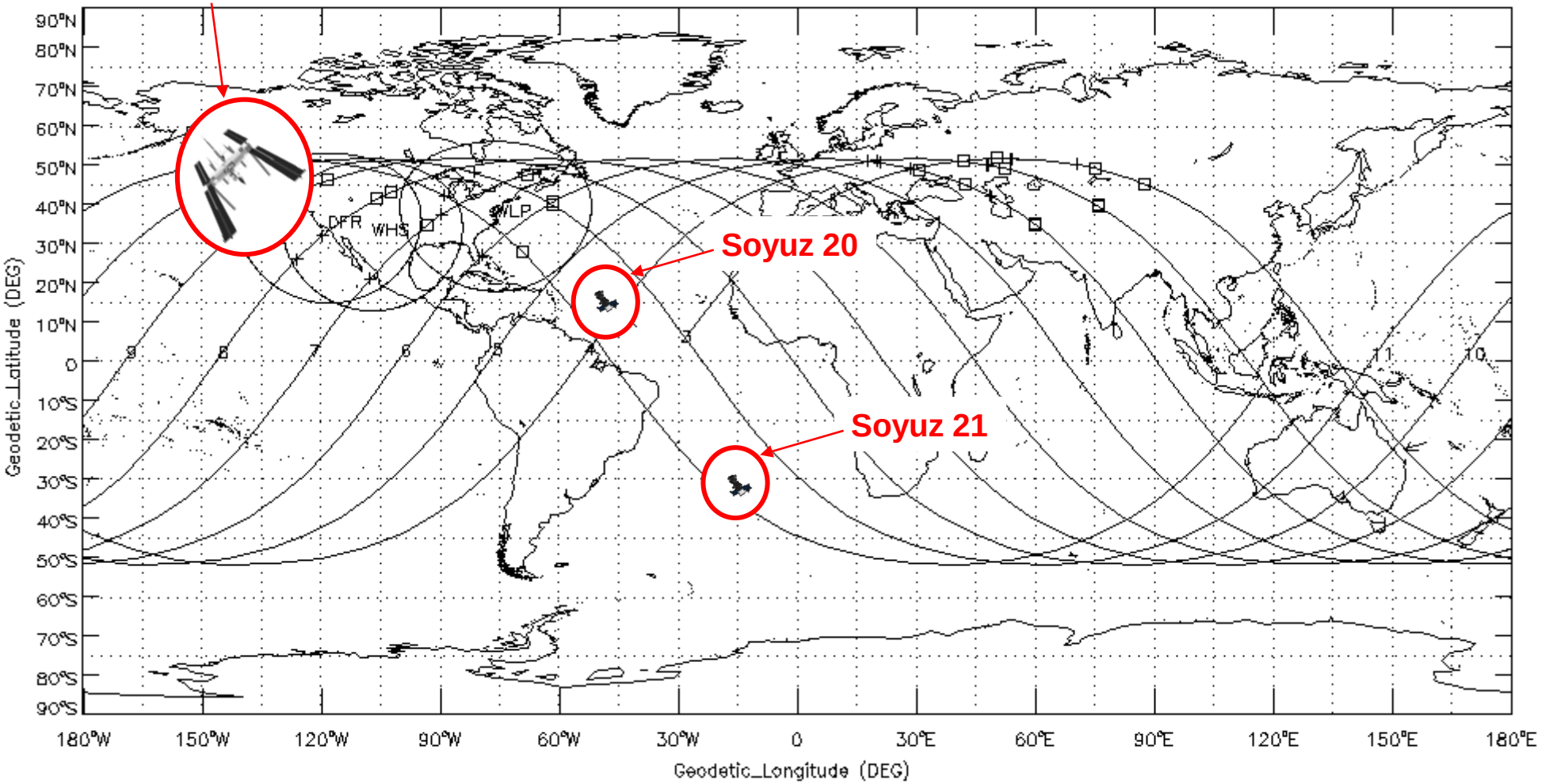
1. JSC receives Soyuz vectors from MCC/Moscow (prime) or generates vectors from optional C-band radar tracking data.
2. GSFC/FDF receives Soyuz vectors from JSC for Orbit Determination; generates two-line elements (TLEs) for NASA VHF stations.
3. GSFC/FDF receives optional NASA or DoD C-band radar tracking data (backup to JSC vectors) for Orbit Determination; generates TLEs.
4. Soyuz downlink is voice share on single link when 2 vehicles are in close proximity (no constant key).

Soyuz and VHF Communications Changes

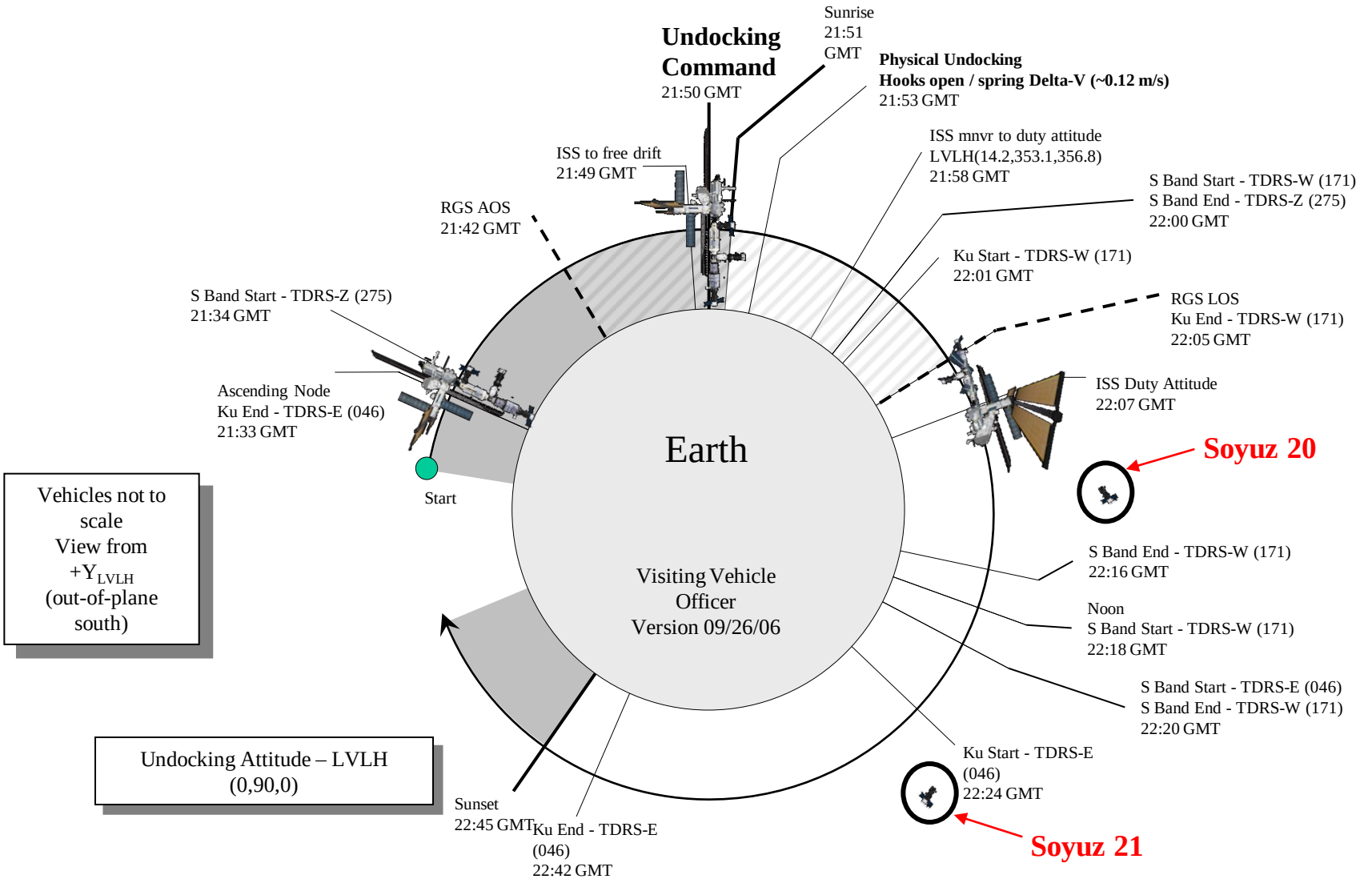
- **ISS/Soyuz VHF Emergency Communications Services**
  - Increase to six man crew support required a plan in the event of an evacuation
  - Crew six increased with Increment 20 (Soyuz 19S launched 05/27/09)
  - Missions increased to 4 per year vice 2
  - NASA VHF stations support 2 vehicles in close proximity with restrictions
    - Downlink time and voice sharing
    - Both vehicles receive, one vehicle transmits (no constant key)
    - Separated vehicles require turnaround time (approx. 15 minutes)
  - VHF-2 Voice support
    - Coordination in work with US Airway to use their emergency frequency
    - Quarterly testing planned

ISS Six Crew Two Soyuz Evacuation

Based on previous undocking charts Soyuz will lead the ISS



ISS Six Crew Two Soyuz Evacuation



Reformatting of Briefing Message, Interim Support Instruction, and Operational Message

Donald Davenport
Manager
NENS Network Operations and Requirements
Goddard Space Flight Center

Background

- Current message format is based on TTY usage
- All upper case format is difficult to read, causes additional effort for "cut and paste"
- Header information is irrelevant to current distribution system
- Proposal is to use normal sentence case, eliminate unused TTY artifacts
- Proposed change does not affect other entities that generate message traffic (HST, GOES, NOAA) if they do not wish to change formats

Current Briefing Message (BM) Format

```
AMS115A  103:14:00:50   Mon Apr 13 09:00:50 2009

>From gceb@comm.gsfc.nasa.gov  Mon Apr 13 14:00:45 2009
Return-Path: <gceb@comm.gsfc.nasa.gov>
Received: from comm.gsfc.nasa.gov (comm.gsfc.nasa.gov [128.183.140.139]) by
amds.nascom.nasa.gov (8.14.3/8.14.3) with ESMTP id n3DE0jP0018837 for
<gcen@amds.nascom.nasa.gov>; Mon, 13 Apr 2009 14:00:45 GMT
Received: from comm.gsfc.nasa.gov (localhost [127.0.0.1]) by comm.gsfc.nasa.gov
(8.14.3/8.14.3) with ESMTP id n3DIxCAW013869; Mon, 13 Apr 2009 14:59:12 -0400
Received: from localhost (gceb@localhost) by comm.gsfc.nasa.gov
(8.14.3/8.14.3/Submit) with ESMTP id n3DIxC5f013866; Mon, 13 Apr 2009 14:59:12 -
0400
Date: Mon, 13 Apr 2009 14:59:12 -0400 (EDT)
From: "gceb.comm.gsfc.nasa.gov" <gceb@comm.gsfc.nasa.gov>
To: gcen <gcen@amds.nascom.nasa.gov>, commgr <commgr@mail.nascom.nasa.gov>,
        gwsc <gwsc@ncc-comm.gsfc.nasa.gov>, ggfd <ggfd@ncc-comm.gsfc.nasa.gov>,
        cds_note <cds_note@cds04.gsfc.nasa.gov>
Subject: BM FOR SEALAUNCH-42 VECTOR/VERIFICATION TEST
Message-ID: <Pine.LNX.4.33.0904131457420.13798-100000@comm.gsfc.nasa.gov>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=ISO-8859-1
Content-Transfer-Encoding: 8BIT

13/1400Z
FM NIC NASA GSFC GREENBELT MD
TO COMMGR/OPS
GWSC/OPS
GGFD/OPS
cds_note@cds04.gsfc.nasa.gov
DLD/sea@ncc-comm
```

Current BM Format (cont.)

```
BRIEFING MESSAGE FOR THE H3335LS SEA LAUNCH-42/SICRAL VECTOR VERIFICATION TEST

1.  GENERAL INFORMATION:
    NONE

2.  PURPOSE:
    TO VERIFY SN VECTOR PROCESSING IN PREPARATION FOR THE SEA
    LAUNCH-42/S1CRAL LAUNCH SUPPORT.

3.  PARTICIPANTS:
    NISN, NIC, FDF, WSC

4.  OBJECTIVES:
    TO VERIFY VECTOR TRANSMISSION PROCEDURES BETWEEN FDF AND WSC.

5.  TEST DATE/TIMES:
    APRIL 11, 2009
    101/1405-1410Z VOICE/CIRCUIT CONFIGURATION
    101/1430-1455Z H3335LS 171 SHO
    101/1520-1630Z H3335LS TDE SHO

6.  CALL SIGNS:
    NOM
    VECTOR CONTROLLER
    FDF

    SITE CONFIGURATION:
    N/A

    ALL REQUIREMENTS:
```

Current BM Format (cont.)

7. NIC REQUIREMENTS:
   A. COORDINATE AND MONITOR TEST ACTIVITIES.
   B. THE NOM WILL BE ACTING RC AND SIMULATE THE RC FUNCTIONS.
   C. GENERATE POST TEST REPORT.

8. NISN REQUIREMENTS:
   NOT REQUIRED FOR THIS TEST.

9. WSC REQUIREMENTS:
   A. SCHEDULE THE FOLLOWING TDRSS EVENTS.
      101/1430-1455Z TDRS-171 I06 T06 H3335LS 512 KBPS
      101/1520-1630Z TDRS-TDE I06 T06 H3335LS 512 KBPS
   B. RECEIVE AND TRANSMIT VECTORS AND VECTORS SEQUENCES ACCORDING TO TEST TIMELINE IN SECTION 5 SEQUENCES WILL BE TRANSMITTED BY THE WSC VC VIA NCCDS AND WSC OPS VIA CANNED SHO EDITOR.
   C. PROVIDE A PRINTOUT OF VECTOR CANNED SHO EDITOR INPUTS FOLLOWING TEST SUPPORT.
   D. MONITOR VECTOR RECEIPT AND DISABLE AUTOTHROUGHPUT AT CONCLUSION OF THE TEST.

   FDF REQUIREMENTS:
   A. GENERATE AND TRANSMIT NOMINAL SEQUENCES AND BACKUP SUPPORT VECTORS TO NCCDS/WSC. SEND BACKUP CONTINTGENCY SUPPORT VECTORS TO WSC OPS.
   B. EVALUATE TDMS TO VERIFY CORRECT VECTOR PROCESSING DURING TEST.
   C. VERIFY CANNED SHO EDITOR INPUTS PROVIDED FROM WSC.

Current BM Format (cont.)

```
10. TEST TIMELINE:
    1405Z CIRCUIT INTERFACE/START OF VECTOR TEST
    1410Z INITIATE AUTO-THROUGHPUT FOR SIC 3335
    1410Z FDF TRANSMITS TEST VECTOR
    1430Z T-5 MIN FDF TRANSMITS LAUNCH SUPPORT SEQUENCE
    1430Z TDRS-171 SHO START
    1435Z T-0/LIFTOFF
    1444Z BURN 1 IGNITION
    1448Z WSC INPUT SET 2 FROM CANNED SHO EDITOR
    1452Z BURN 1 SHUTDOWN
    1455Z TDRS-171 SHO END
    1500Z WSC INPUT SEQUENCE TWO FROM DSMC DIS
    1520Z TDRS TDE SHO START
    1610Z BURN 2 IGNITION
    1613Z BURN 2 SHUTDOWN
    1624Z SPACECRAFT SEPARATION
    1630Z TDRS TDE SHO END
    1632Z DISABLE AUTOTHROUGHTPUT FOR SIC 3335
    1635Z DEBRIEFING/END OF TEST

11. POINTS OF CONTACT:
    EVETTE CONWELL, SEA LAUNCH NIM          301.286.9809
    SONJA HARDING, SEA LAUNCH MCE           301.805.3302
    MATTHEW VINCENT, TDRSS NOM              301.805.3024
    CYNTHIA STARKS, TDRSS NOM               301.805.3331
    DEVIN BITNER, TDRSS NOM                 301.805.3304
    FDF COMM                                301.286.8191
    VECTOR CONTROLLER                       505.527.7185
    JEREMIAH JOHNSON, RANGE COORDINATOR     206.770.4400 X2910
    BRITTON WIENS, WSC ENGINEERING          575.527.7273
    LARRY MOORE, WSC ENGINEERING            575.527.7144
    NOM CONSOLE                             301.286.1821/1876

TDRSS NETWORK OPERATIONS MANAGER SENDS
```

Proposed BM Format

```
13/1400Z
FM NIC NASA GSFC Greenbelt Maryland
TO COMMGR/OPS
DLD/sea@ncc-comm

Briefing Message for the H3335LS Sea Launch-42/SICRAL Vector Verification Test

1.  General Information:
    None

2.  Purpose:
    To Verify SN vector processing in preparation for the Sea
    Launch-42/S1CRAL launch support.

3.  Participants:
    NISN, NIC, FDF, WSC

4.  Objectives:
    To verify vector transmission procedures between FDF and WSC.

5.  Test Date/Times:
    April 11, 2009
    101/1405-1410Z Voice/Circuit Configuration
    101/1430-1455Z H3335LS 171 SHO
    101/1520-1630Z H3335LS TDE SHO

6.  Call Signs:
    NOM
    Vector Controller
    FDF

    Site Configuration:
    N/A

    All Requirements:
```

Proposed BM Format (cont.)

7. NIC Requirements:
   A. Coordinate and monitor test activities.
   B. The NOM will be acting RC and simulate the RC functions.
   C. Generate Post Test Report.

8. NISN Requirements: Not required for this test.

   WSC Requirements:
   A. Schedule The Following TDRSS events.
      101/1430-1455Z TDRS-171 I06 T06 H3335LS 512 KBPS
      101/1520-1630Z TDRS-TDE I06 T06 H3335LS 512 KBPS
   B. Receive and transmit vectors and vectors sequences according to test timeline in section 5 sequences will be transmitted by the WSC VC via NCCDS and WSC OPS via canned SHO Editor.
   C. Provide a printout of vector canned SHO Editor inputs following test support.
   D. Monitor vector receipt and disable auto-throughput at conclusion of the test.

9. FDF Requirements:
   A. Generate and transmit nominal sequences and backup support vectors to NCCDS/WSC. Send backup contingency support vectors to WSC OPS.
   B. Evaluate TDMS to verify correct vector processing during test.
   C. Verify canned SHO Editor inputs provided from WSC.

Proposed BM Format (cont.)

```
10. Test Timeline:
    1405Z Circuit interface/start of vector test
    1410Z Initiate auto-throughput for SIC 3335
    1410Z FDF transmits test vector
    1430Z T-5 min FDF transmits launch support sequence
    1430Z TDRS-171 SHO start
    1435Z T-0/Liftoff
    1444Z Burn 1 Ignition
    1448Z WSC input set 2 from canned SHO Editor
    1452Z Burn 1 shutdown
    1455Z TDRS-171 SHO end
    1500Z WSC input sequence 2 from DSMC DIS
    1520Z TDRS TDE SHO start
    1610Z Burn 2 ignition
    1613Z Burn 2 shutdown
    1624Z Spacecraft Separation
    1630Z TDRS TDE SHO end
    1632Z Disable auto-throughtput for SIC 3335
    1635Z Debriefing/end of test

11. Points Of Contact:
    Evette Conwell, Sea Launch NIM          301.286.9809
    Sonja Harding, Sea Launch MCE           301.805.3302
    Matthew Vincent, TDRSS NOM              301.805.3024
    Cynthia Starks, TDRSS NOM               301.805.3331
    Devin Bitner, TDRSS NOM                 301.805.3304
    FDF COMM                                301.286.8191
    Vector Controller                       505.527.7185
    Jeremiah Johnson, Range Coordinator     206.770.4400 X2910
    Britton Wiens, WSC Engineering          575.527.7273
    Larry Moore, WSC Engineering            575.527.7144
    NOM Console                             301.286.1821/1876

TDRSS Network Operations Manager Sends
```

Current Interim Support Instruction (ISI) Format

```
AMS087A  107:11:30:02   Fri Apr 17 06:30:02 2009

>From gceb@comm.gsfc.nasa.gov  Fri Apr 17 11:29:57 2009
Return-Path: <gceb@comm.gsfc.nasa.gov>
Received: from comm.gsfc.nasa.gov (comm.gsfc.nasa.gov [128.183.140.139]) by
amds.nascom.nasa.gov (8.14.3/8.14.3) with ESMTP id n3HBTv52008508 for
<gcen@amds.nascom.nasa.gov>; Fri, 17 Apr 2009 11:29:57 GMT
Received: from comm.gsfc.nasa.gov (localhost [127.0.0.1]) by comm.gsfc.nasa.gov
(8.14.3/8.14.3) with ESMTP id n3HGSJdj018008 for <gcen@amds.nascom.nasa.gov>;
Fri, 17 Apr 2009 12:28:19 -0400
Received: from localhost (gceb@localhost) by comm.gsfc.nasa.gov
(8.14.3/8.14.3/Submit) with ESMTP id n3HGSJuS018005 for
<gcen@amds.nascom.nasa.gov>; Fri, 17 Apr 2009 12:28:19 -0400
Date: Fri, 17 Apr 2009 12:28:19 -0400 (EDT)
From: "gceb.comm.gsfc.nasa.gov" <gceb@comm.gsfc.nasa.gov>
To: gcen <gcen@amds.nascom.nasa.gov>
Subject: ISI NO. 004 H3335LS SEA LAUNCH-42/SICRAL-1B H/W S/W FREEZE
Message-ID: <Pine.LNX.4.33.0904171227230.17990-100000@comm.gsfc.nasa.gov>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII

17/1130Z
   FM NIC NASA GSFC GREENBELT MD
   TO COMMGR/OPS
   GWSC/OPS
   GGFD/OPS
   CDS_NOTE@CDS04.GSFC.NASA.GOV
   DLD/SEA@NCC-COMM
```

Current ISI Format (cont.)

```
ISI
ISI NO. 004 H3335LS SEA LAUNCH-42/SICRAL-1B
SUBJECT: HARDWARE ENGINEERING CHANGES (EC) AND SOFTWARE FREEZE
ACTION:  STADIR/OPSR

   IN ACCORDANCE WITH ESTABLISHED AGREEMENTS, ALL FACILITIES
   ARE REQUESTED TO IMPLEMENT THEIR RESPECTIVE FREEZE PLANS
   AS FOLLOWS FOR SEA LAUNCH-42/SICRAL-1B THRU END OF MISSION.
   THIS FREEZE WILL BE EFFECTIVE FROM APRIL 16, 2009 UNTIL
   END OF MISSION.

   THE FOLLOWING SYSTEMS AT WSC WILL BE FROZEN FOR SUPPORT:
   NCCDS
   WSGT DIS ADPE
   SGLT-1:
   SA 1 USS GROUND EQUIPMENT, EXEC ADPE, KTTC ADPE
   SGLT-2:
   SA 1 USS GROUND EQUIPMENT, EXEC ADPE, KTTC ADPE

   ALL DEVIATIONS FROM THIS ISI MUST BE COORDINATED WITH MS. EVETTE
   CONWELL, SEA LAUNCH NIM.

POINTS OF CONTACT:
EVETTE CONWELL, SEA LAUNCH NIM              301.286.9809
SONJA HARDING, SEA LAUNCH MCE               301.805.3302
CYNTHIA STARKS, TDRSS NOM                   301.805.3331
DEVIN BITNER, TDRSS NOM                     301.805.3304
MATTHEW VINCENT, TDRSS NOM                  301.805.3024
JEREMIAH JOHNSON, RANGE COORDINATOR         206.770.4400 X2991
BRITTON.WIENS, WSC ENG                      575.527.7273
LARRY MOORE, WSC ENGINEERING                575.527.7144
FDF COMM                                    301.286.8191
VECTOR CONTROLLER                           505.527.7185

TDRSS NETWORK OPERATION MANAGER SENDS
```

Proposed ISI Format

```
17/1130Z
   FM NIC NASA GSFC Greenbelt Md
   TO Commgr/Ops
   DLD/sea@ncc-comm

   ISI
   ISI NO. 004 H3335LS Sea Launch-42/SICRAL-1B
   Subject: Hardware Engineering Changes (EC) and Software Freeze
   Action:  STADIR/OPSR

      In accordance with established agreements, all facilities
      are requested to implement their respective freeze plans
      as follows for Sea Launch-42/SICRAL-1B thru end of mission.
      this freeze will be effective from April 16, 2009 until
      end of mission.

      The following systems at WSC will be frozen for support:
      NCCDS
      WSGT DIS ADPE
      SGLT-1:
      SA 1 USS Ground Equipment, EXEC ADPE, KTTC ADPE
      SGLT-2:
      SA 1 USS Ground Equipment, EXEC ADPE, KTTC ADPE

      All deviations from this isi must be coordinated with Ms. Evette
      Conwell, Sea Launch NIM.

   POINTS OF CONTACT:
   Evette Conwell, Sea Launch NIM              301.286.9809
   Sonja Harding, Sea Launch MCE               301.805.3302
   Cynthia Starks, TDRSS NOM                   301.805.3331
   Devin Bitner, TDRSS NOM                     301.805.3304
   Matthew Vincent, TDRSS NOM                  301.805.3024
   Jeremiah Johnson, Range Coordinator         206.770.4400 X2991
   Britton Wiens, WSC ENG                      575.527.7273
   Larry Moore, WSC Engineering                575.527.7144
   FDF COMM                                    301.286.8191
   Vector Controller                           505.527.7185

   TDRSS Network Operation Manager Sends
```

Current Operational Message (OPN) Format

```
AMS087A  107:11:30:02   Fri Apr 17 06:30:02 2009

>From gceb@comm.gsfc.nasa.gov  Fri Apr 17 11:29:57 2009
Return-Path: <gceb@comm.gsfc.nasa.gov>
Received: from comm.gsfc.nasa.gov (comm.gsfc.nasa.gov [128.183.140.139])
by amds.nascom.nasa.gov (8.14.3/8.14.3) with ESMTP id n3HBTv52008508 for
<gcen@amds.nascom.nasa.gov>; Fri, 17 Apr 2009 11:29:57 GMT
Received: from comm.gsfc.nasa.gov (localhost [127.0.0.1]) by
comm.gsfc.nasa.gov (8.14.3/8.14.3) with ESMTP id n3HGSJdj018008 for
<gcen@amds.nascom.nasa.gov>; Fri, 17 Apr 2009 12:28:19 -0400
Received: from localhost (gceb@localhost) by comm.gsfc.nasa.gov
(8.14.3/8.14.3/Submit) with ESMTP id n3HGSJuS018005 for
<gcen@amds.nascom.nasa.gov>; Fri, 17 Apr 2009 12:28:19 -0400
Date: Fri, 17 Apr 2009 12:28:19 -0400 (EDT)
From: "gceb.comm.gsfc.nasa.gov" <gceb@comm.gsfc.nasa.gov>
To: gcen <gcen@amds.nascom.nasa.gov>
Subject: ISI NO. 004 H3335LS SEA LAUNCH-42/SICRAL-1B H/W S/W FREEZE
Message-ID: <Pine.LNX.4.33.0904171227230.17990-100000@comm.gsfc.nasa.gov>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII

10/1015Z
FM NIC GSFC GREENBELT MARYLAND
TO ALL
COMMGR/OPS
GGFD/OPS
GWDS/OPSR/SCHEDULING
GWPS/STADIR/OPSR/JR HENDRICKSON M HARRIS GTAS/FF-R-C GTOS/SOCC SHFTSUP
DLD/GOES@NCC-COMM.GSFC.NASA.GOV, SDO@NCC-
COMM.GSFC.NASA.GOV,MICHAEL.ANDERSON@HONEYWELL.COM,
MARCO.M.MIDON@NASA.GOV,EVANS.JONES@HONEYWELL.COM,
TGREGOR@MAIL.WSC.NASA.GOV,HOLLYS.ALLEN@HONEYWELL.COM
```

Current OPN Format (cont.)

```
OPN M2023MS STS-23
MILA ADVERSE WEATHER REPORT


THE CENTER OF THE STORM TRACK IS PREDICTED TO BE WELL SOUTH OF THE CAPE.
HOWEVER, AS A CONSEQUENCE OF THE STORM, INTERMITTENT BANDS OF HEAVY RAIN ARE
FORECAST TO SWEEP ACROSS  MILA THROUGH THE END OF THE ZULU DAY ON 4 OCTOBER
2008.

MILA OPS SUPVR                          321.286.3518
WSC OPS                                 575.757.7152
NETWORK OPERATIONS MANAGER SENDS
```

Proposed OPN Format

```
10/1015Z
FM NIC GSFC Greenbelt Maryland
TO ALL
Commgr/Ops

OPN M2023MS STS-23
MILA Adverse Weather Report


The center of the storm track is predicted to be well south of the Cape.
However, as a consequence of the storm, intermittent bands of heavy rain are
Forecast to sweep across MILA through the end of the Zulu day on 4 October
2008.

MILA Ops Supvr                          321.286.3518
WSC Ops                                 575.757.7152
Network Operations Manager Sends
```

Future Actions

- Distribute examples of the new format to all customers by 10/30/09
- Solicit comments from customers by 11/20/09
- If no significant issues arise, modify documentation and implement change by 12/11/09.

NASA Integrated Services Network (NISN) & Local Mission Communications(Code 760)

Jerry Zgonc
NISN Service Manager
Code 761
NASA/Goddard Space Flight Center

Agenda

- NISN and GSFC Code 760 Mission Requirement Point-of-Contacts
- Local Mission Communication(LMC) GSFC/Code 760 funding requirements
- MOVE project Status

Communications Services Branch Code 761

Project	Mission Service Manager(MSM's)	Contact Information	NISN/UNITES Customer Service Representatives
Constellation Project	Christie Grant (NISN) (301 286-4811)	Angela.C.Grant@nasa.gov	Angela Culley (301)902-6033
	Mike Richter (NISN) (301 286-6376)	Mike.Richter@nasa.gov	
Earth Science Exploration	Jerry Zgonc (NISN) (301 286-7160)	Jerry.Zgonc@nasa.gov	Heather Kobin (301) 902-6009
Human Space Flight (ISS & Shuttle)	Seaton Norman (NISN) (301 286-8676)	Seaton.B.Norman@nasa.gov	Angela Culley (301) 902-6033
	Brad Butts (NISN) (301 286-3266)	Bradford.Butts-1@nasa.gov	
Space Science Exploration	Mike Richter (NISN) (301)286-6376)	Mike.Richter@nasa.gov	Mike Eder (301)902-6014
Other NASA projects	ALL	ALL	Michael Bradley(256) 961-9492
Other GSFC/Wallops Center Requirements	ALL	ALL	Heather Kobin (301) 902-6009

Engineering & Security Services Branch Code 762

Project	Engineer	Contact Information
Various	Chris Spinolo (301 286-7552)	Michael.c.spinolo@nasa.gov
Various	Jim Cameron (301 286-6287)	james.m.cameron@nasa.gov
Various	Chi Le (301 286-2555)	Chi.m.le@nassa.gov
Center Infrastructure(code 703)	George Kientz (301 286-7314)	George.l.kientz@nasa.gov
Various	Brian Drake (301 286-3470)	Brian.c.drake@nasa.gov
Various	(TBD) assigned Engineer	

What projects/customers must pay for at GSFC/Wallops for local communication services:

- All new cabling and associated communications equipment for voice/data/video services that will be extended between buildings on-site for any new requirement. A one-time charge.
- A cost estimate will be provided first. When agreed to by the customer and funding transferred to Code 760, the new service will then be installed.
- Project or customer can contact NISN(WAN) or GSFC Code 760(LAN) representatives for any requirements.
- A yearly charge for an IONet IP port assignment that is extended to another building on-site at GSFC or Wallops.
- A yearly charge for a Small Conversion Device (SCD) port that is extended to another building on-site at GSFC or Wallops.
- A yearly charge for each Voice Distribution System (VDS) Keyset instrument that is connected to the GSFC Voice Distribution System(VDS) and extended to another building at GSFC or Wallops.
- A new MOVE project keyset will cost $6,500.00. This includes the cost of the keyset and connection to the new MOVE Switch. (A MOVE keyset yearly port charge has not been determined for FY10)
- Once new service has been installed, the yearly funding charge will then be tracked by the Local Mission Communication(LMC) database for each FY it is required for each project or program.

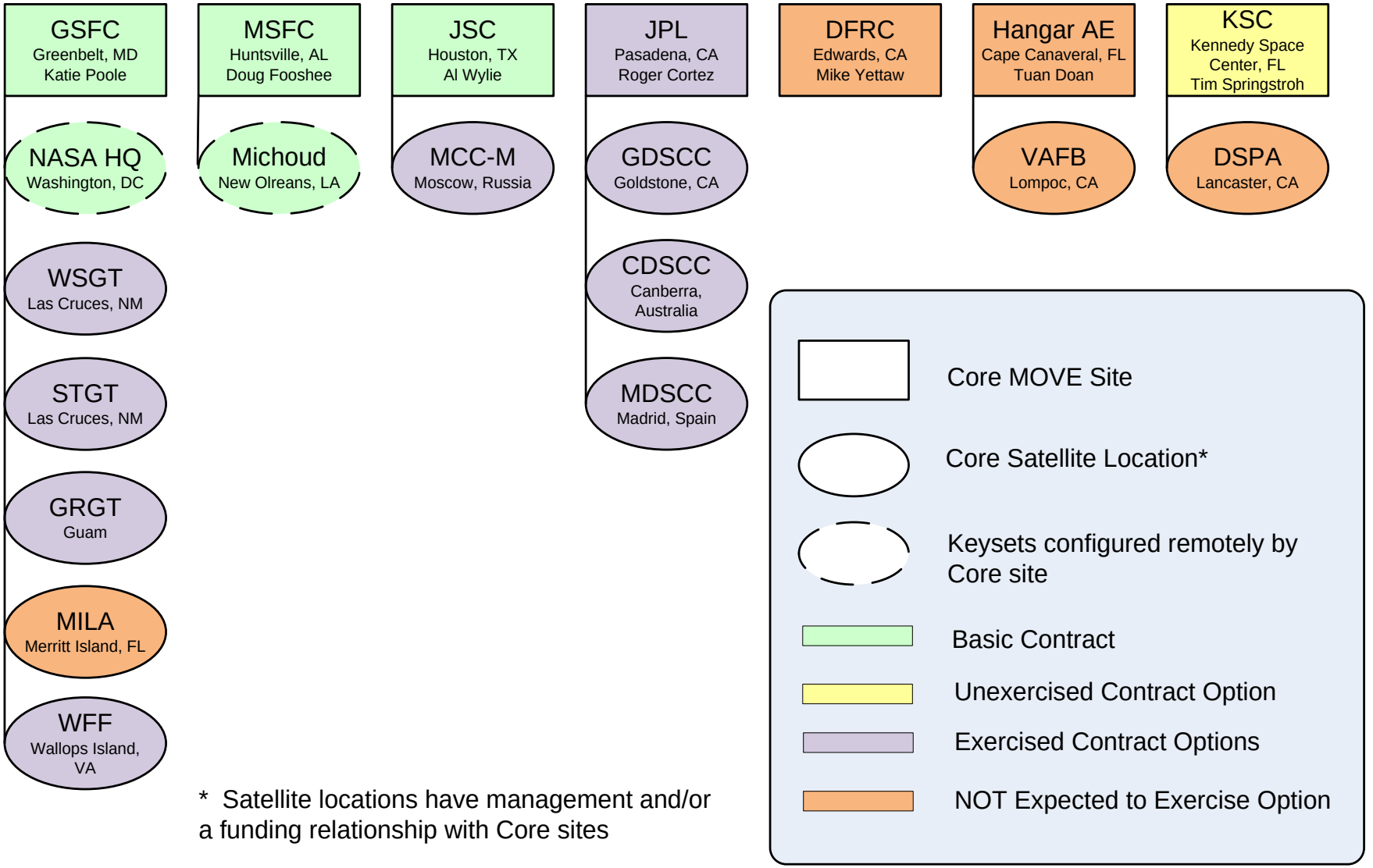
Mission Operations Voice Enhancement (MOVE) Project Update

Katie Poole
MOVE-GSFC Lead
Code 761
NASA/Goddard Space Flight Center

MOVE Project Update (Basic Sites)

- GSFC
  - First Article/Factory Acceptance Testing (FAT) completed.
  - GSFC-1 and GSFC-2 installed and Site Acceptance Testing (SAT) completed
  - Transition/Cutover expected to begin December 2009 and end April 2010
- MSFC
  - FAT completed
  - MSFC switch installed and SAT completed
  - Transition/Cutover completed
- JSC
  - FAT completed
  - JSC-P and JSC-B installed and SAT completed
  - Transition/Cutover expected to begin September 2009 and end September 2010

MOVE Sites and Site Leads



* Satellite locations have management and/or a funding relationship with Core sites

MOVE Project Update (Exercised Option Sites)

Site	Site Survey	SAR	FA/FAT	On-Dock	SAT
JPL	09/24/08	10/22/08	6/4/09 – 6/8/09	7/9/09	7/20/09 – 7/22/09
WSGT	6/1/09	6/23/09	9/11/09 – 9/15/09	10/23/09	11/13/09 – 11/17/09
STGT	6/1/09	6/23/09	9/16/09 - 9/18/09	10/23/09	11/4/09 – 11/6/09
GRGT	6/1/09	6/23/09	9/21/09 – 9/23/09	11/13/09	12/8/09 – 12/10/09
MCC-M	6/3/09	7/1/09	10/13/09 – 10/15/09	11/16/09	11/17/09 – 11/19/09
CDSCC	9/16/09	10/1/09	2/3/10 – 2/5/10	3/30/10	4/9/10 – 4/13/10
GDSCC	7/8/09	8/11/09	11/16/09 – 11/18/09	12/22/09	1/12/10 – 1/14/10

(Shaded blocks indicate completed milestones)

MOVE Project Update (Exercised Option Sites) – Cont.

Site	Site Survey	SAR	FA/FAT	On-Dock	SAT
MDSCC	**12/2/09**	**12/15/09**	**4/13/10 – 4/15/10**	**6/8/10**	**6/18/10 – 6/22/10**
WFF	**10/20/09**	**11/17/09**	**3/9/10 – 3/11/10**	**4/6/10**	**4/16/10 – 4/20/10**

Mission Closed IONet Router Replacement Project

A. Christie Grant
Project Manager
ITCD/Code 760
NASA/Goddard Space Flight Center

Project Objective and Scope

- Project Objective
  - Migrate from MOSPF multi-cast protocol utilized by end-of-life Nortel routers that will not be supported **after June 1, 2012**.

- Scope
  - Migrate to an alternate Multicast Routing protocol in the MOSPF Multicast Portion of the NISN Closed IONetwork
  - Replace existing Nortel Routers, 3 Comm hubs and Fiber Distributed Data Interface (FDDI) on the closed IONet
  - Assess, select, procure and install (new) leased equipment including cabling, racks, etc.
  - Implement network augmentation, as required, at 14 NASA Centers and associated sites

Schedule and Considerations

- Schedule (Best Case)
  - 11/01/10: Procurement
  - 01/15/11: Implementation Commences
  - 09/30/11: Implementation Complete
  - 05/30/12: Transition Complete

- Considerations
  - Vendor support may end before **June 1, 2012** target Project completion date
  - NISN has procured Nortel parts to support identified sparing levels should replacement equipment be needed prior to project completion date

Implementation Strategy

- Implementation of new/parallel network
  - No vendor interoperability with MOSPF is available
  - Existing services will be transitioned to this network
  - Supports customer ability to test data flows under parallel operations prior to "accepting" transition to new network (new network will be tested to the current SLA's of the mission network)
  - Supports "back-out" requirement
  - No disruptions to daily activity
  - No possibility of data loss/flows

- Lack of MOSPF support is a driver to adopt a more current, standard multi-cast protocol
  - Requires all existing routers and associated network equipment be replaced

Projects on the MOSPF Multicast Portion of the NISN Closed IONet (in process of being updated)

	Networks								
	Space Network (SN) Mux-DeMux (MDM)	**SN – WDISC and DAS**	**GN (MILA, DFRC, WFF, AGO)**	**Polar GN**	**Deep Space Network (DSN)**	**Flight Dynamics Facility (FDF)**	**Onizuka Air Force Station (OAS)**	**Universal Space Network (USN)**	**Network Control Center Data System (NCCDS)**
Projects	HST	Swift	GOES	POES	SOHO	TDRSS	STS	TDRSS	RXTE
	STS	LDBP and ULDBP	HST	CHAMP	MAP	ISS	GOES	GOES	HST
	RXTE	JASON	TDRSS	SORCE	KEPLER	STS	POES	POES	STS
	TRMM		STS	GRACE	TRMM	MAP	ACE	HST	FDF
	LSAT5		CHAMP		HST	ACE		SOC	ISS
	HTV		LSAT5		RXTE	WIND		ELV	
	Dragon		ELV		IBEX	POLAR		RIFCA	
	Sub-Tec III				ACE			CHAMP	
	SOAREX				WIND			GRACE	
	H-IIA				POLAR				
	HEX								
	ELV								
	TDRSS								
	RF SOC								
	RIFCA								

Project and Support Team Members

- NASA
  - Project Manager: A. Christie Grant
    Christie.Grant@nasa.gov -or- Angela.C.Grant@nasa.gov
  - Lead Engineer: Scott Douglas

- Contractors
  - Project Lead: W. Bill Ihnat
  - Deputy Project Lead: Vince Turner
  - Engineering: C. Jermann, A. Wells, B. Dixon, M. Puffett, T. Clark, J. Anokye, K. Mulcahy, D. Solomon, J. Bankert
  - Operations: A. Nesbitt, C. Rhys, P. Hill
  - Implementation Manager: V. Turner
  - Transition Manager: A. Nesbitt
  - Security: A. Abbay

Space Network (SN) Project

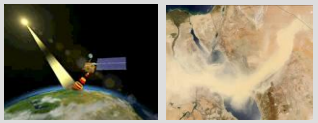
Roger J. Flaherty
Project Manager
Space Network Project/Code 452
NASA/Goddard Space Flight Center

SCaN Networks

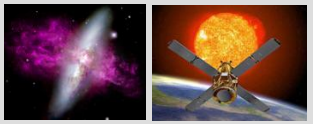
Manned Missions

Sub-Orbital Missions

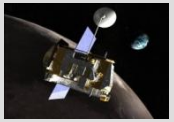
Earth Science Missions



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

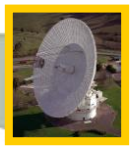
Swedish Space Corp. (SSC)
Kiruna, Sweden

German Space Agency (DLR)
Weilheim, Germany

Goldstone Complex
Fort Irwin, California

USN Hawaii
South Point, Hawaii

USN Australia
Dongara, Australia



Canberra Complex
Canberra, Australia

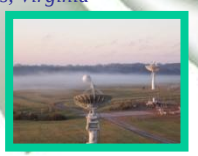
White Sands Complex
White Sands, New Mexico

White Sands Ground Terminal,
White Sands, New Mexico

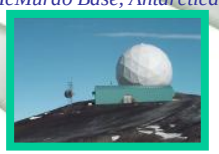
Merritt Island Launch Annex
Merritt Island, Florida

University of Chile
Santiago, Chile

Wallops Ground Station
Wallops, Virginia

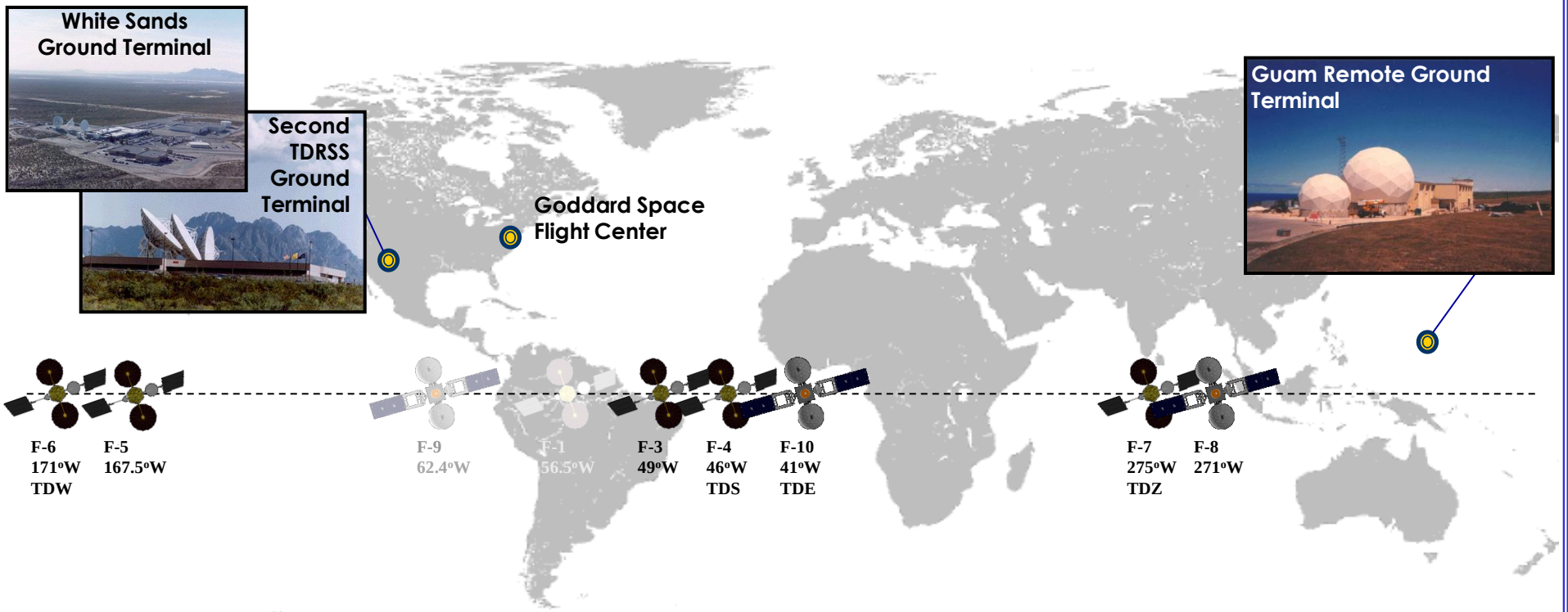


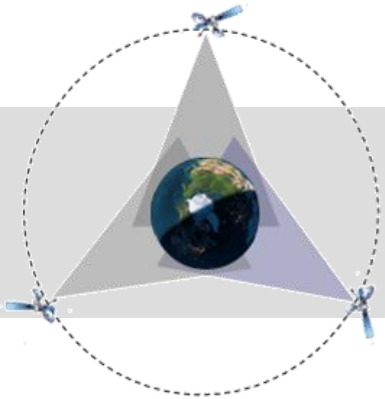
McMurdo Ground Station
McMurdo Base, Antarctica

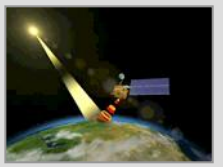


Satellite Applications Center
Hartebeesthoek, Africa

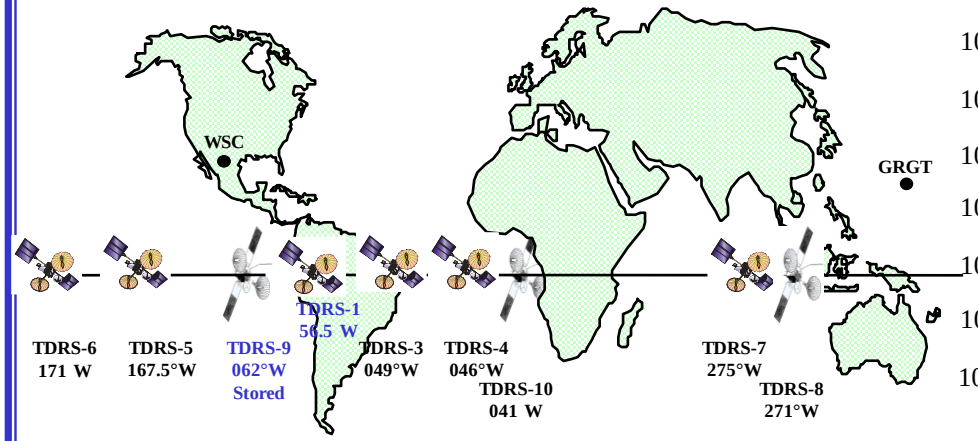
SN Overview

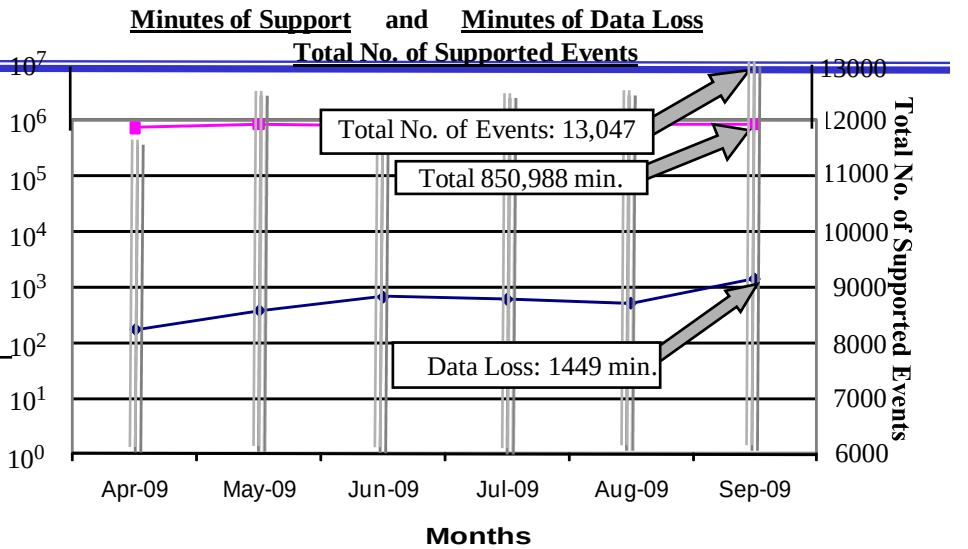

White Sands Ground Terminal
Second TDRSS Ground Terminal
Goddard Space Flight Center
Guam Remote Ground Terminal
F-6 171°W TDW
F-5 167.5°W
F-9 62.4°W
F-1 56.5°W
F-3 49°W
F-4 46°W TDS
F-10 41°W TDE
F-7 275°W TDZ
F-8 271°W

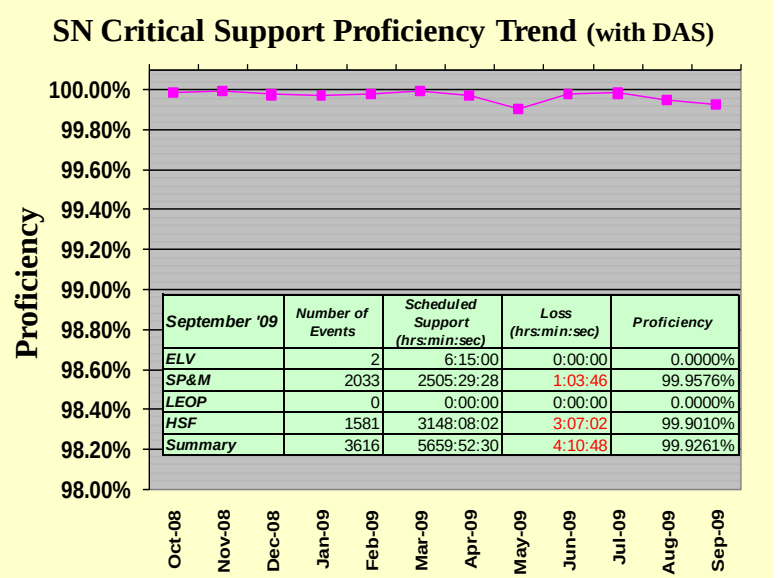




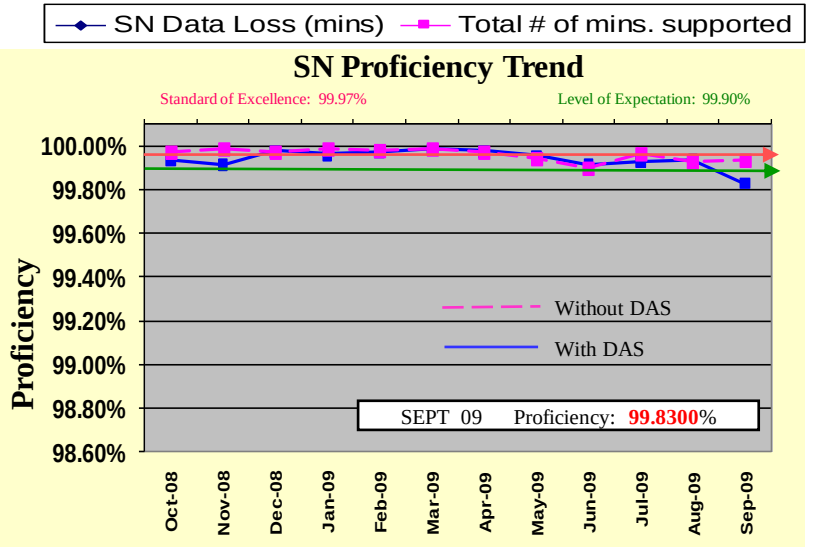
SN Metrics Summary







September '09	Number of Events	Scheduled Support (hrs:min:sec)	Loss (hrs:min:sec)	Proficiency
ELV	2	6:15:00	0:00:00	0.0000%
SP&M	2033	2505:29:28	1:03:46	99.9576%
LEOP	0	0:00:00	0:00:00	0.0000%
HSF	1581	3148:08:02	3:07:02	99.9010%
Summary	3616	5659:52:30	4:10:48	99.9261%



Missions	Total No. of Supported Events	Service Stat.	Proficiency (%)	Level of Expectation (%)
AIM, Aqua, ATV, Aura, CNOFS, GP-B, HST, ISS, L-5, L-7, SP&M, SPTR, Swift, TERRA, THEMIS, TRMM, XTE	13047	14,207 hrs. sched. 14,183 hrs. actual 24 hrs. 9 min. lost	99.8%	99.90%

TDRS Constellation Status

- TDRS-1 has been deactivated
  - Its last downlink TWTA has failed
  - It has been moved to 56.5 degrees W longitude
  - Plan to deorbit (supersync) it next summer 2010
- TDRS-3 moved into 49 degree W longitude slot
- TDRS-4 has battery issues
  - Results in service curtailment during eclipse periods (next one is January-March 2010)
  - TDRS-3 has been positioned nearby to take over in event of TDRS-4 failure
- TDRS-4 and TDRS-10 are active in the Atlantic Ocean Region
- TDRS-5 and TDRS-6 are active in the Pacific Ocean Region
- TDRS-7 replaced TDRS-3 in the Indian Ocean Region
- TDRS-8 has been activated in the Indian Ocean Region
- TDRS-9 is a stored spare
- TDRS-K/L project is underway
  - Code 454 is managing the project
  - Boeing is the prime contractor
  - TDRS-K launch is planned for April 2012
  - TDRS-L launch is planned for February 2013

ATF Operational

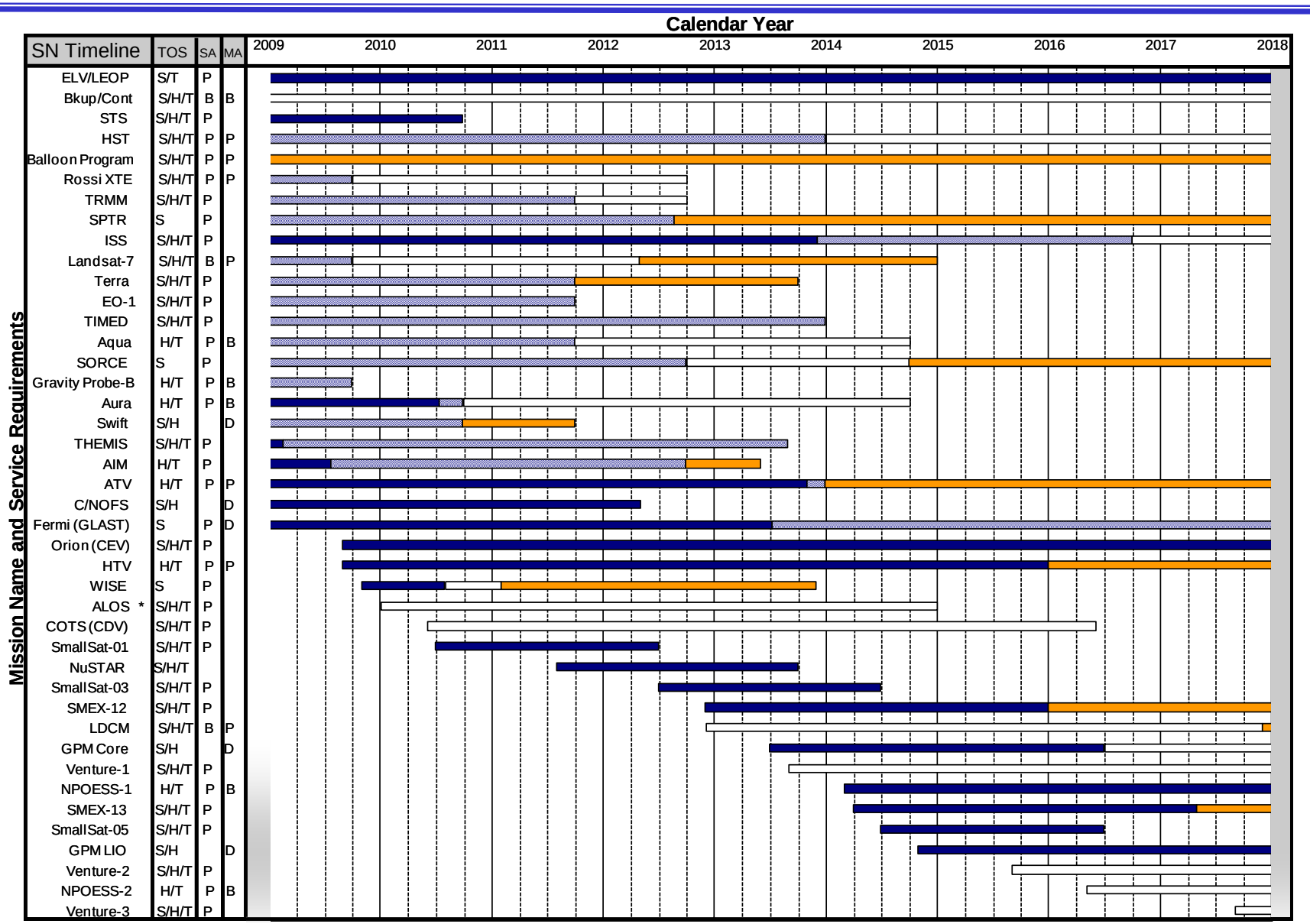
Antenna pad form and rebar, note bolts for antenna

Shelter intermediate roof panel curing

Final site configuration

- **The Australian TDRSS Facility (ATF) provides backup TDRS T&C over the Indian Ocean region**

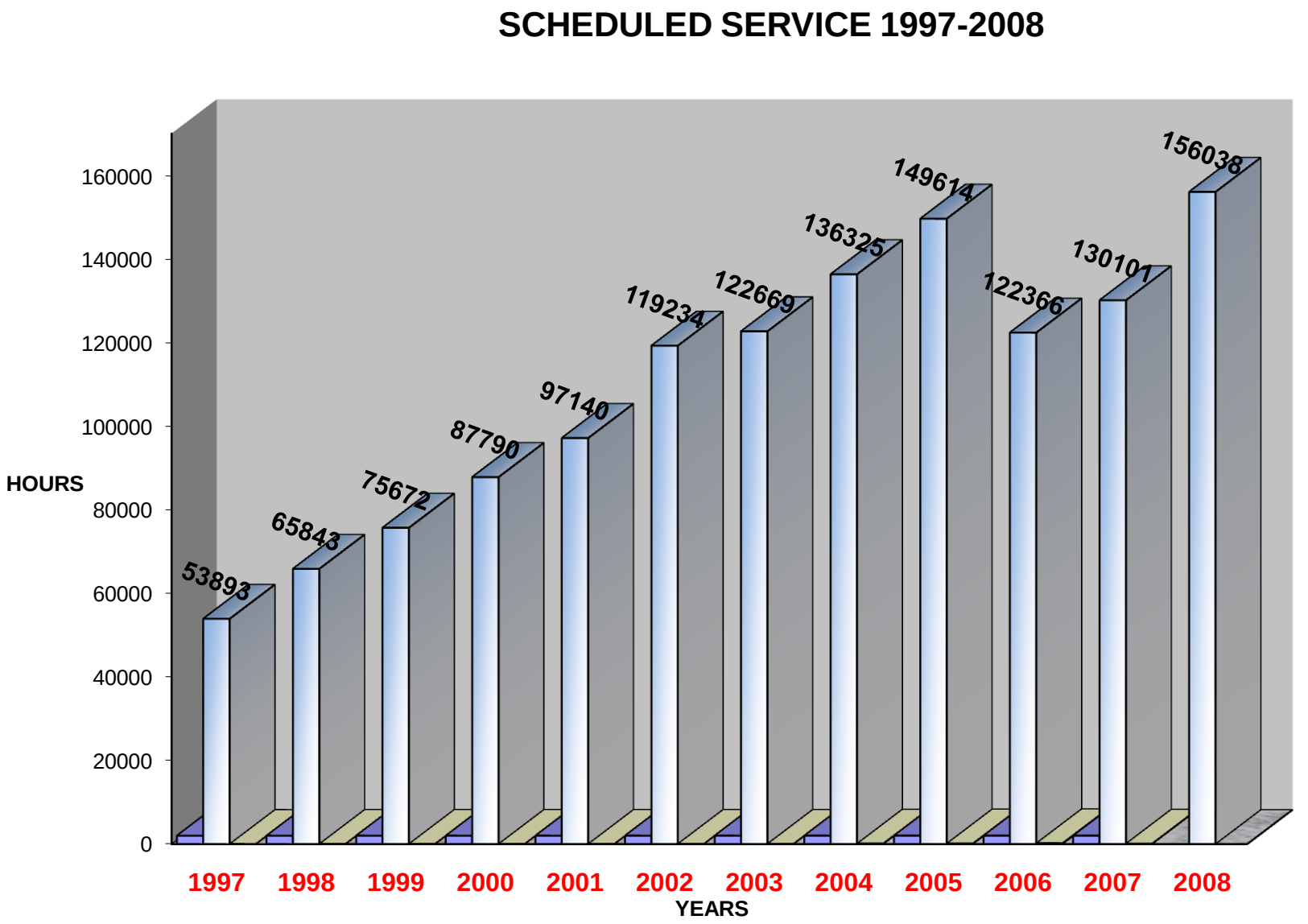
SN Mission Model (2009-2017)

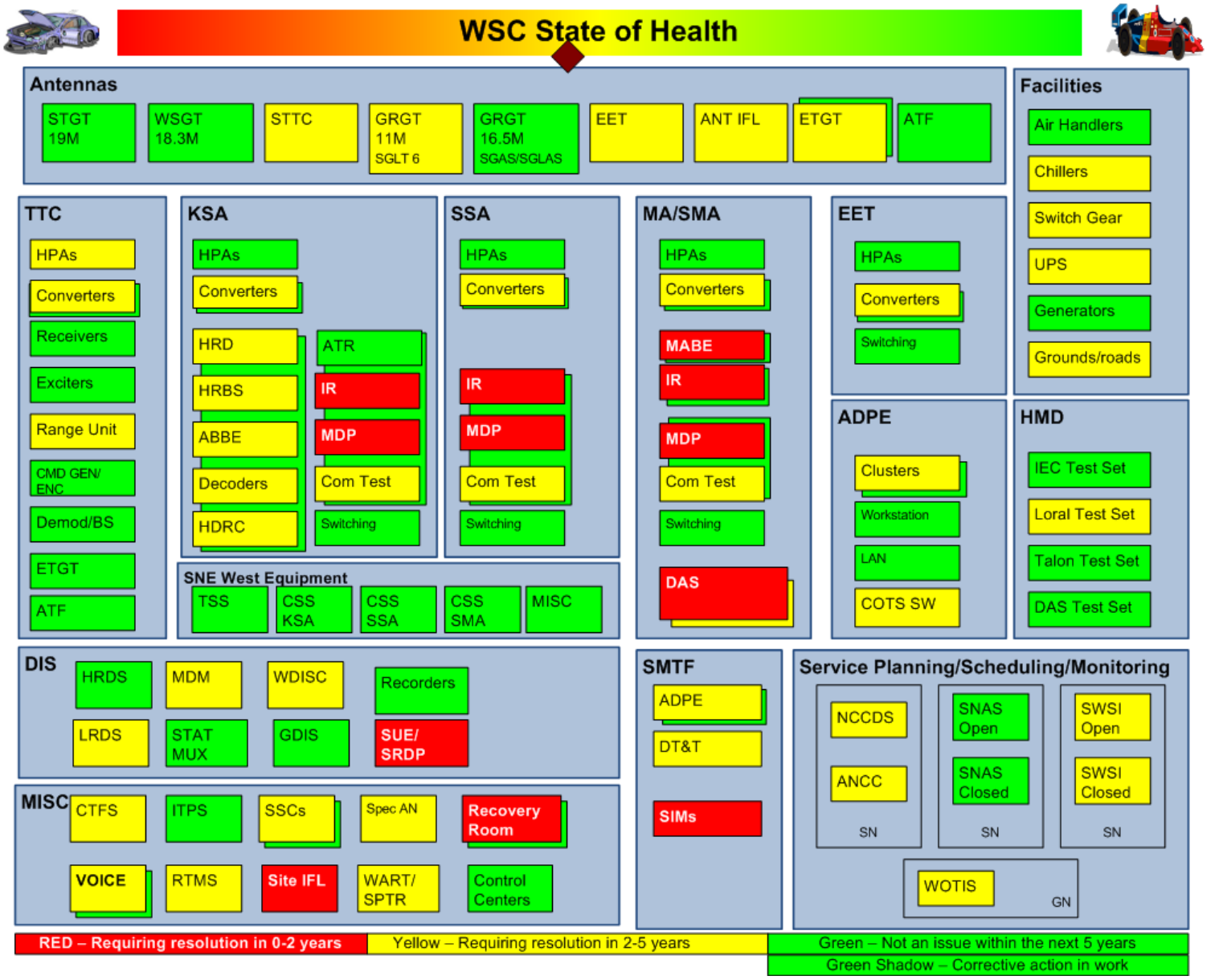


P = Prime Support, B = Backup Support, D = DAS; * = Not in Approved GSFC Mission Set
TOS = Type of Service: S = Science, H = Housekeeping, T = Tracking

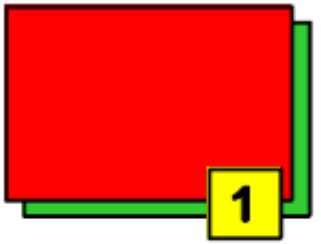
Committed Extended Potential Estimated

SN Support Summary




WSC State of Health
Antennas
STGT 19M
WSGT 18.3M
STTC
GRGT 11M SGLT 6
GRGT 16.5M SGAS/SGLAS
EET
ANT IFL
ETGT
ATF
Facilities
Air Handlers
Chillers
Switch Gear
UPS
Generators
Grounds/roads
TTC
HPAs
Converters
Receivers
Exciters
Range Unit
CMD GEN/ ENC
Demod/BS
ETGT
ATF
KSA
HPAs
Converters
HRD
HRBS
ABBE
Decoders
HDRC
ATR
IR
MDP
Com Test
Switching
SSA
HPAs
Converters
IR
MDP
Com Test
Switching
SNE West Equipment
TSS
CSS KSA
CSS SSA
CSS SMA
MISC
MA/SMA
HPAs
Converters
MABE
IR
MDP
Com Test
Switching
DAS
EET
HPAs
Converters
Switching
ADPE
Clusters
Workstation
LAN
COTS SW
HMD
IEC Test Set
Loral Test Set
Talon Test Set
DAS Test Set
DIS
HRDS
MDM
WDISC
Recorders
LRDS
STAT MUX
GDIS
SUE/ SRDP
MISC
CTFS
ITPS
SSCs
Spec AN
Recovery Room
VOICE
RTMS
Site IFL
WART/ SPTR
Control Centers
SMTF
ADPE
DT&T
SIMs
Service Planning/Scheduling/Monitoring
NCCDS
ANCC
SN
SNAS Open
SNAS Closed
SN
SWSI Open
SWSI Closed
SN
WOTIS
GN
RED – Requiring resolution in 0-2 years
Yellow – Requiring resolution in 2-5 years
Green – Not an issue within the next 5 years
Green Shadow – Corrective action in work

WSC State of Health Legend

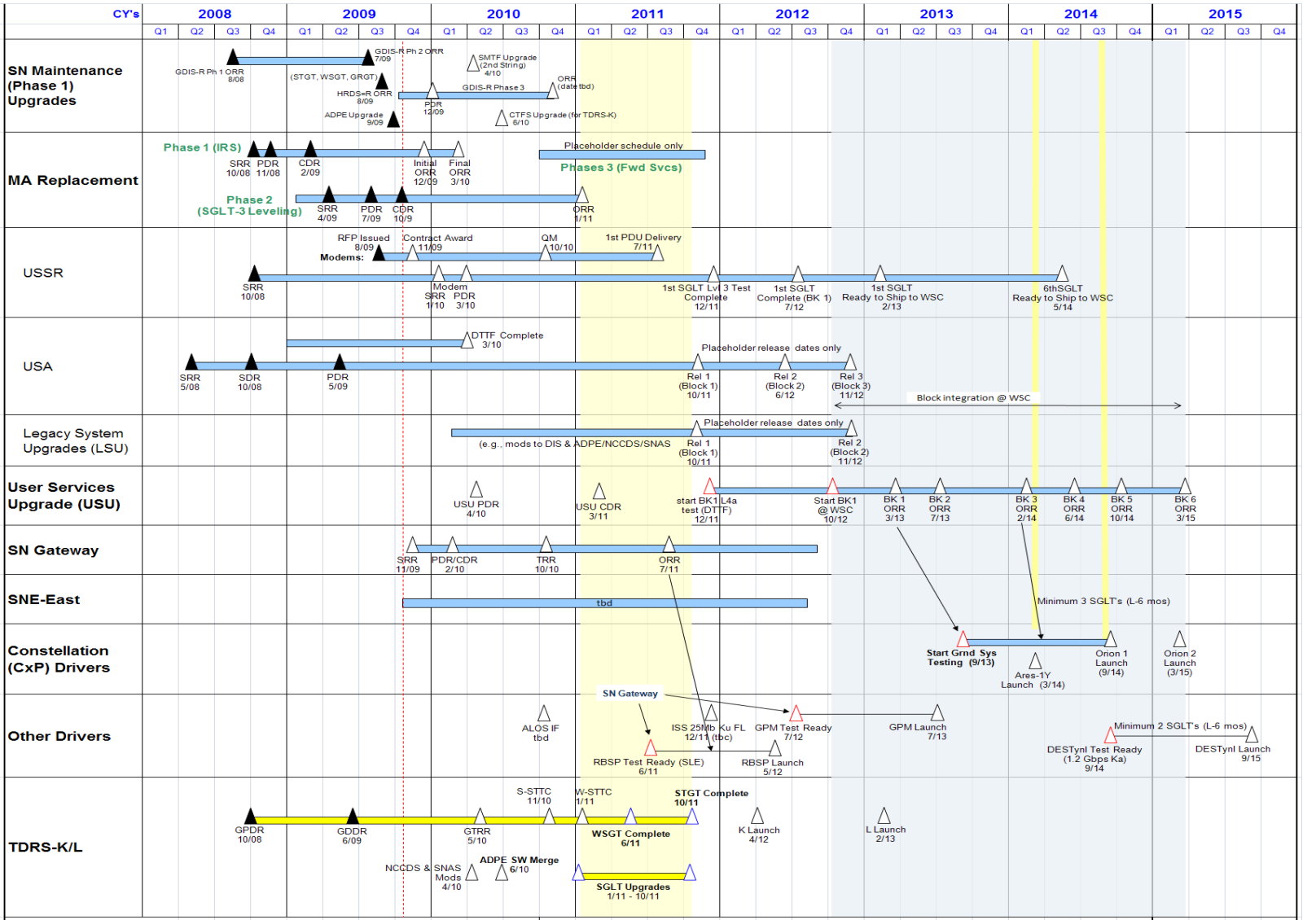


- Top box indicates current status. Drop shadow indicates forecast. The small square box indicates a numbered note.
- The color of the note box represents the previous color of the status or forecast.

- The lighter shaded diamond represents the previous overall WSC State of Health. The darker shaded diamond represents the current overall WSC State of Health.
- If there have been no significant changes during the period, then only the darker diamond is shown.

Source: October 1, 2009 NENS PMR

SN Integrated Schedule



Multiple Access (MA) Replacement Summary

- Phase 1 – Integrated Receiver Sustainment
  - To replace all the existing IRs in the MA system at all SGLTs.
  - Procurement and testing of production units continue.
  - Completion Date : End of 2009
- Phase 2 – SGLT-3 Leveling
  - To procure and install new IRs in SGLT-3
  - Procurement on U/D converters, MDP, Test Modulators initiated
  - Completion Date: End of 2010
- Phase 3 – Forward Service Upgrade
  - To replace the modulators in the MA system at all SGLTs.
  - No work initiated yet, awaiting progress on Phase 1 and 2
  - Completion Date : End of 2011

Single Access (SA) Upgrade Summary

- User Services Subsys. Replacement (USSR) – MODEM buy
  - To replace the obsolete SA comm. equip. at all SGLTs, and to add new services for future missions (Cx, RSBP, DESDynI, etc.)
  - Proposal evaluation complete
  - Completion Date: Mid 2014 with the installation into the last SGLT
- User Services Access (USA) – Scheduling, monitoring & control for USSR
  - To provide scheduling, monitoring and control for USSR
  - S/W design and equip. procurement continue
  - Completion Date: End of 2012
- User Services Upgrade (USU) I&T
  - To integrate and test USSR and USA
  - Initiated the planning
  - Completion Date: Early 2015

SGSS Summary

- SN Ground Segment Sustainment (SGSS) Project is in procurement blackout
- RFP released on October 16, 2009
- Proposals due within 45 days of RFP release
- Expect contract award in June 2010
- Anticipate 5-7 year effort to complete development and implementation
- RFP, including draft SOW and specification available at:

  http://prod.nais.nasa.gov/cgi-bin/eps/sol.cgi?acqid=135917

TDRS Naming Convention Study

- Current TDRS naming convention has caused confusion among users when scheduling or speaking to TDRS locations
  - TDRS-5 position is 167.5 but designated 171
  - TDRS-6 position is 171 but is designated TDW
- Users have requested a change to current naming convention
- Candidate Options:
  - Location (Atlantic|Pacific|Indian), Inner/Outer notation, and Potential Third identifier :
    - [A | P | I] + [I | O] + [" " | <TBD>]
  - Location, Sequential Number and TDRS ID:
    - [A | P | I] + [{number} 1 .. 9] + [{TDRS ID} A .. J]
  - Longitudinal Position Designation: 000 .. 359
  - TDRS ID (A..J) or Flight Number (F1 .. F10) or SIC (Abbreviated, 300 = TDRS A, etc.)
- The first or second option seem to be preferable – the name indicates the approximate location and/or TDRS.

TDRS Naming Convention Study (cont'd.)

- Impacts of changing the current convention
  - NCCDS and SNAS can support any 3 character alphanumeric character designation without software change
  - Impact on MOCs
    - If designator is hard coded, can be large impact, and is dependent on supporting staff and funding
    - If designator is kept in table or database, may be little or no impact
- Survey has been distributed to MOCs asking opinion on options, impact on MOC systems and time frame to implement
  - Requested return of survey by November 6 at latest
  - As of October 28, only 6 responses received from 40+ MOCs included in survey
  - Important to have replies so that impacts to all users can be considered in decision making

MOC survey responses are due on 11/06/2009

- POC William.Brown2@Honeywell.com, Phone 301-805-3265

TDRS Naming Convention Study (cont'd.)

- **Next steps:**
  - Collect and analyze replies from MOCs
  - Publish report
  - Develop process to evaluate options and reach decision
- **Alternatives that may be considered:**
  - Modify NCCDS, SNAS if a better convention is found
  - Develop a "translator" in front of NCCDS so that MOCs can continue to use the current convention

GN Overview for SCCF-17

Kevin P. McCarthy
Mission Manager, NEN NASA Stations
Ground Network Project,/Code 453
NASA/Goddard Space Flight Center

Agenda

- NEN Overview
- Key Accomplishments
- Quick Turn Around Support
- Plans

NEN Mission

NEN Mission

- Role
  - Provide best value communications & tracking services
  - To NASA missions operating in the near earth region
  - From ground based antennas
  - Now and in the future
- Objectives
  - Provide services to customers identified in the Space Communications Mission Model
  - Provide services of sufficient quantity and quality to meet customer mission requirements
  - Provide services as efficiently as possible
- NEN Inherent Characteristics
  - No flight systems
  - Short link distances
  - Large customer/provider community

SCaN Strategic Objectives

1. Provide seamless, integrated space communications and navigation services
2. Implement flexible and cost-efficient capabilities
3. Foster development of enabling technologies
4. Pursue cooperation, collaboration, and cross support with industry and other Government agencies, including international space agencies
5. Provide clear and concise guidance and policies on spectrum and standards for NASA
6. Protect NASA's space communications and navigation interest and assets nationally and internationally
7. Reduce operational costs and leverage the cost savings into build up of new capabilities

FY10 NEN Assets

Alaska Satellite Facility
Fairbanks, Alaska

Partner Station: NOAA CDA Station
Gilmore Creek, Alaska

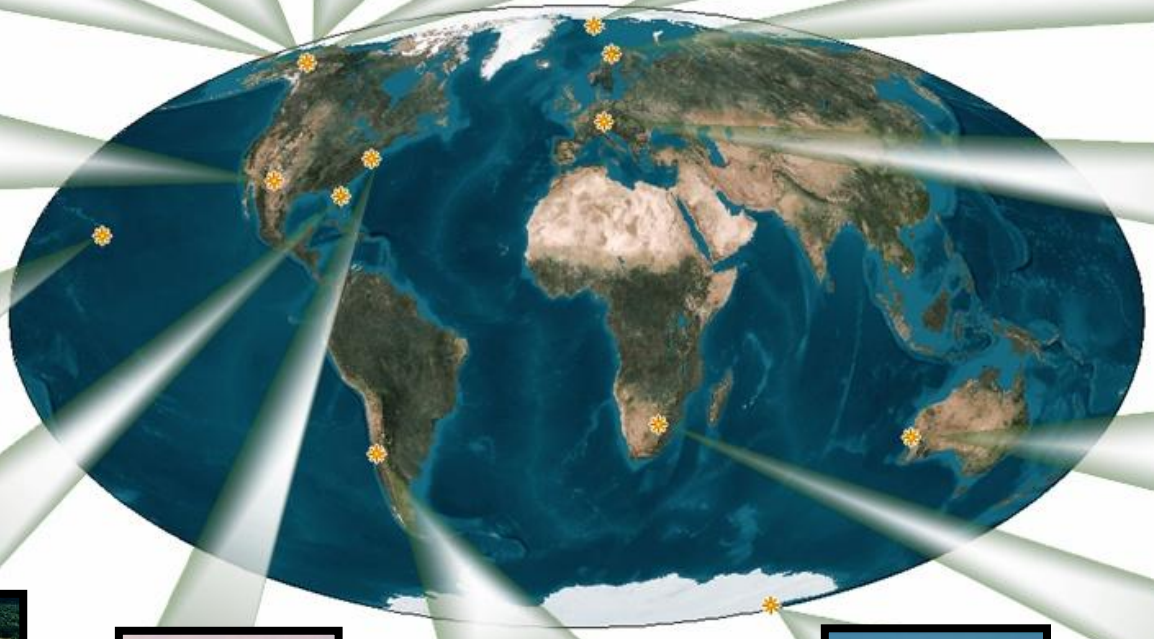
SSC/USN Alaska (1)
Poker Flat, Alaska

SSC/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

SSC/USN Hawaii
South Point, Hawaii

SSC/USN Australia
Dongara, Australia

Merritt Island Launch Annex
Merritt Island, Florida

Wallops Ground Station
Wallops, Virginia

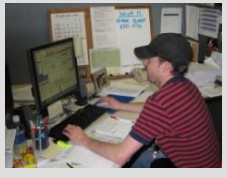
SSC Chile
Santiago, Chile

McMurdo Ground Station
McMurdo Base, Antarctica

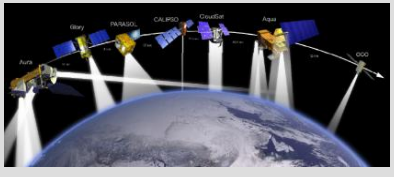
Satellite Applications Center
Hartebeesthoek, Africa

- ***NASA***
- ***Commercial***
- ***Partner***

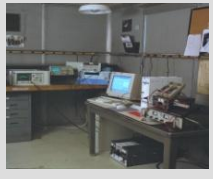
Scheduling



Pre-mission Planning & Analysis



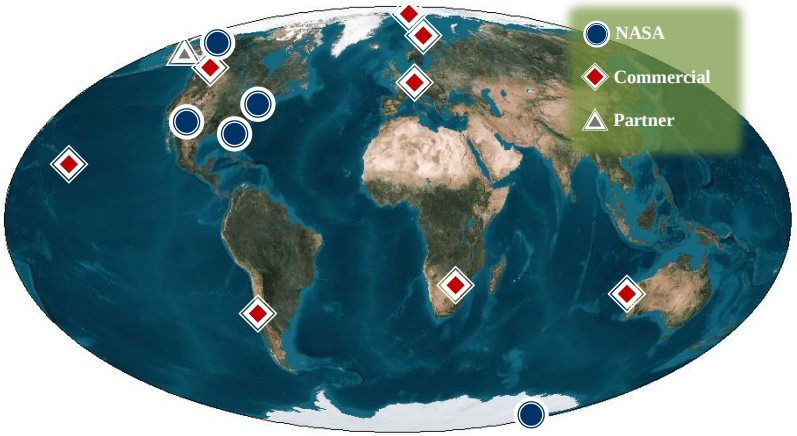
Pre-mission Testing



Network Monitoring & Coordination

Business Model Vision

NEN Configuration



Commercial Services Vision

- Procure common services from commercial providers
  - LEO/GEO S-Band and X-Band services
  - Lunar S-Band
- Use competition to:
  - Increase service quality while reducing risk and cost
  - Optimize capacity (up or down) across a relatively large customer base

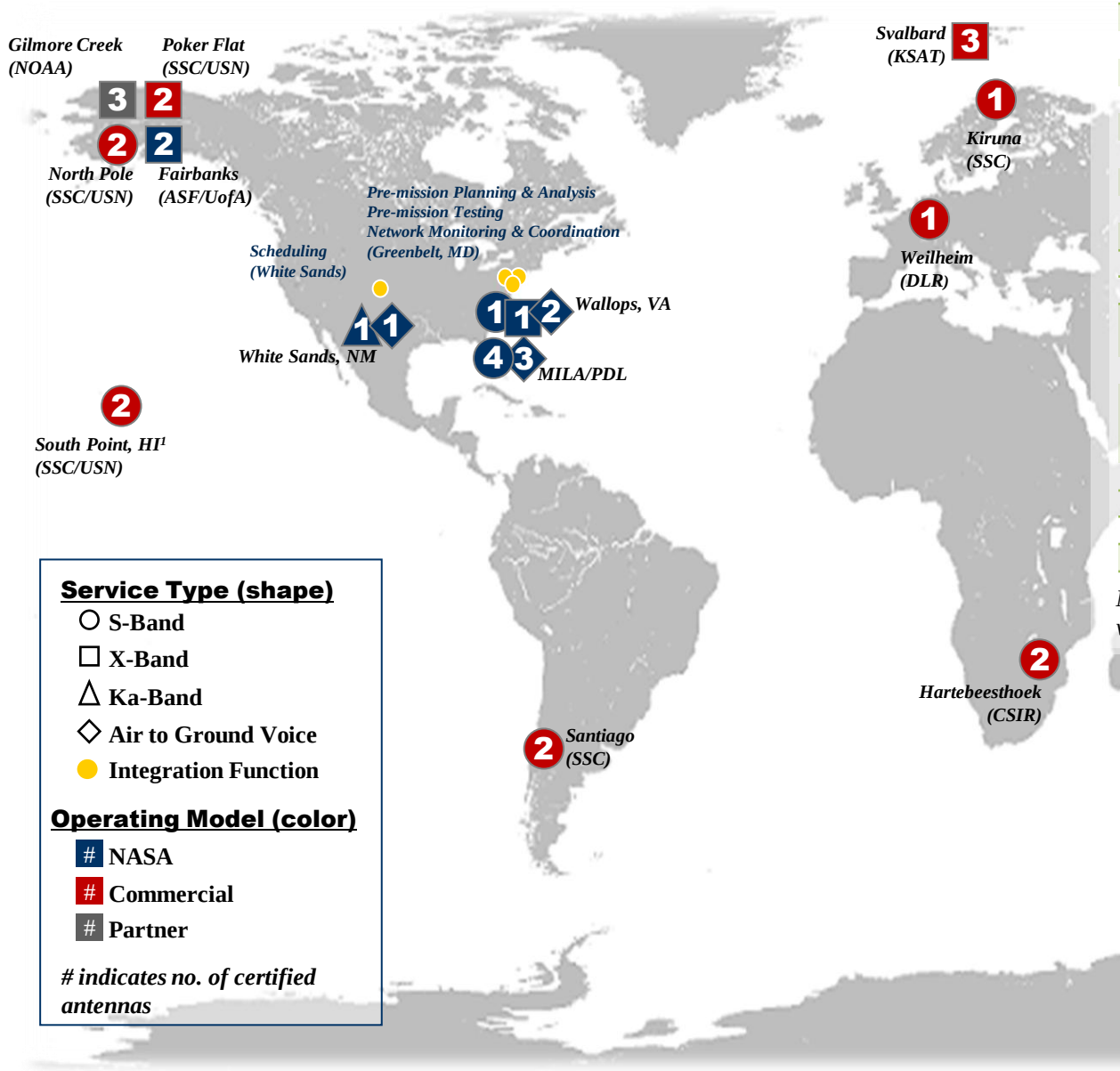
NASA Station Vision

- Provide unique services with NASA stations
  - Crewed flight launch, ascent, and landing support
  - Ka-Band lunar mission support
  - University cooperative support
- Automate operations & utilize COTS
- Minimize excess capacity for required load
- Additional benefits
  - Maintains full technical control of critical services
  - Incentive for commercial provider efficiency

Partner Station Vision

- Continue to partner with external organizations where mutually beneficial
- Additional benefit – leverages unique strengths of partners to achieve national goals

Baseline Architecture



Commercial	Common Services
Dongara	S-Band
Hartebeesthoek	S-Band
Kiruna	S-Band
North Pole	S-Band
Poker Flat	X & S-Band
Santiago	S-Band
South Point	S-Band
Svalbard	X & S-Band
Weilheim	S-Band

NASA	Unique Services
Fairbanks (ASF)	NASA/University Cooperative Services
McMurdo	Antarctic Services
MILA/PDL	Shuttle Pre-mission, Launch, Ascent, Landing, & Post-mission Services
Wallops	Shuttle Ascent

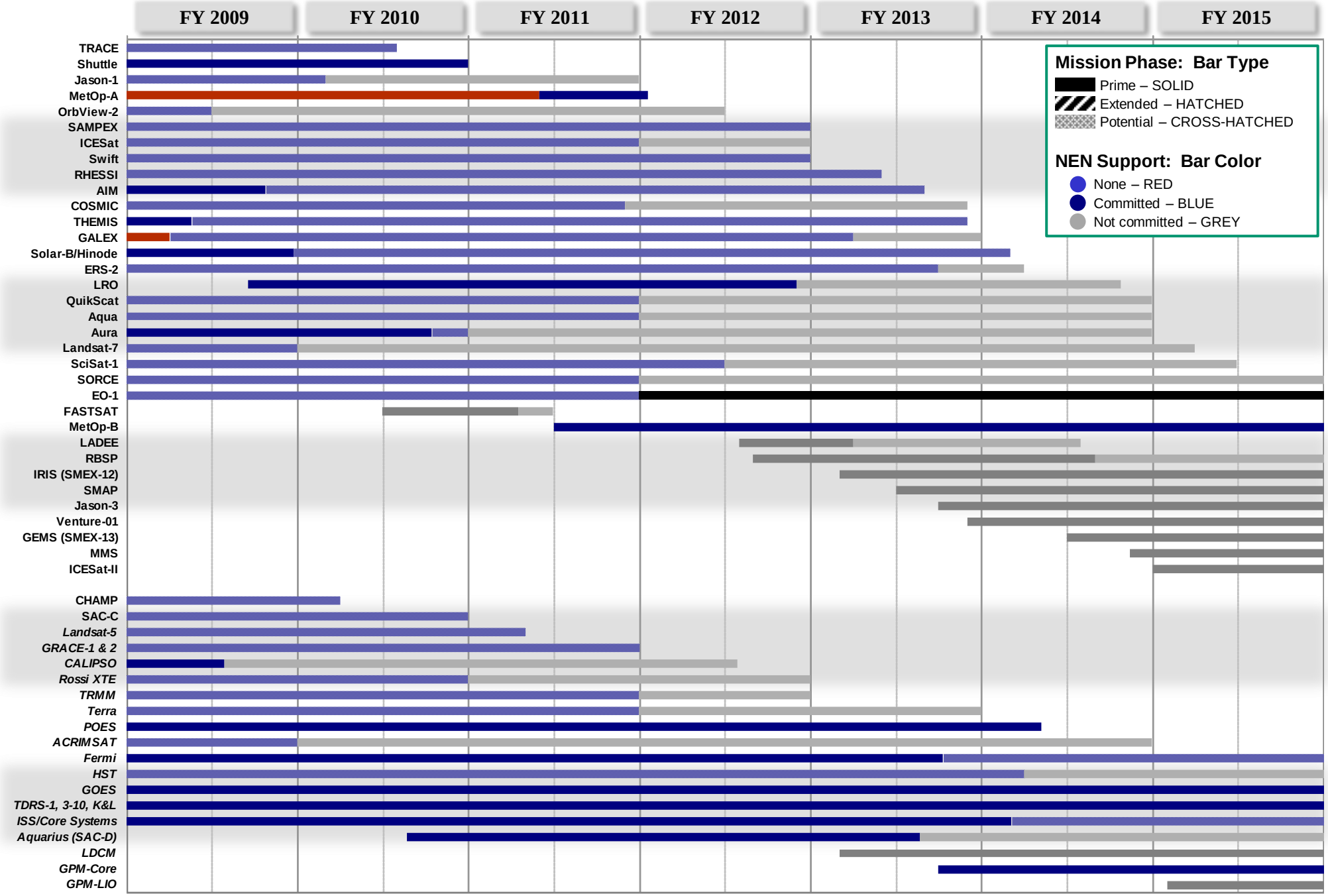
Partner	Mutual Benefit
Gilmore Creek (NOAA)	Leverage Contingency Capacity

Note: The NEN Users Guide can be accessed through the NGIN website for more information (https://code450ngin.gsfc.nasa.gov)

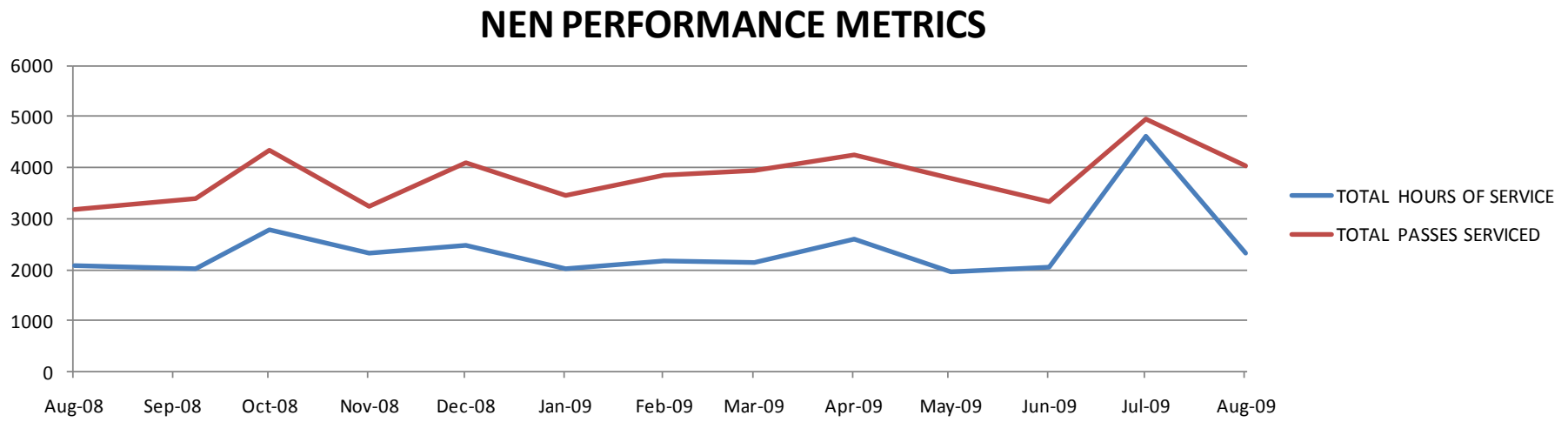
[1] Certification of a second antenna in South Point is expected in the near-term.

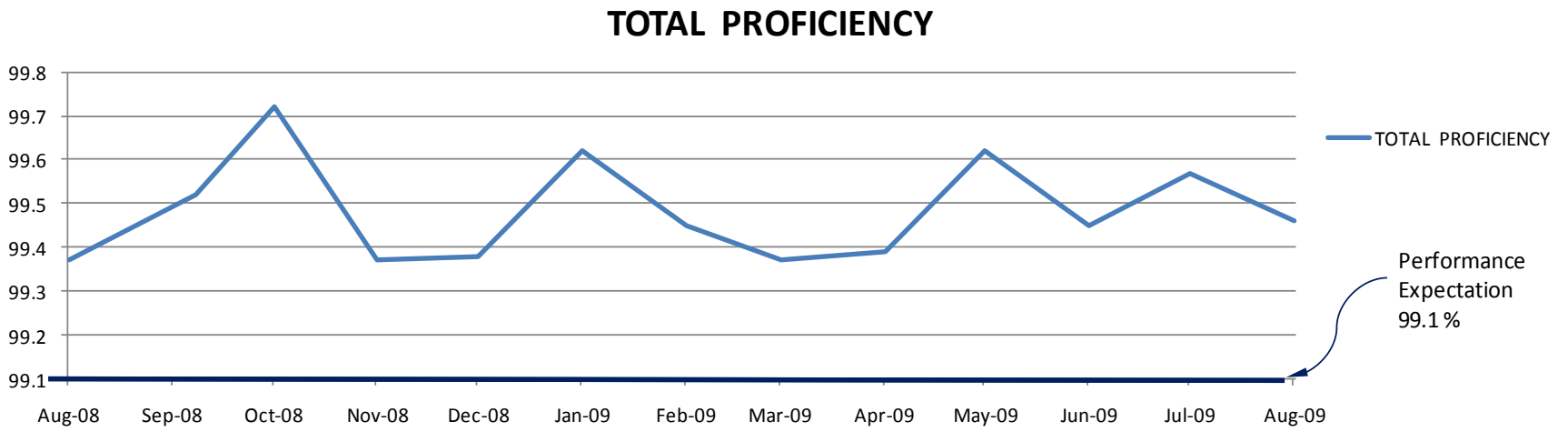
NEN Mission Set

Based on SCMM as of 8/5/09

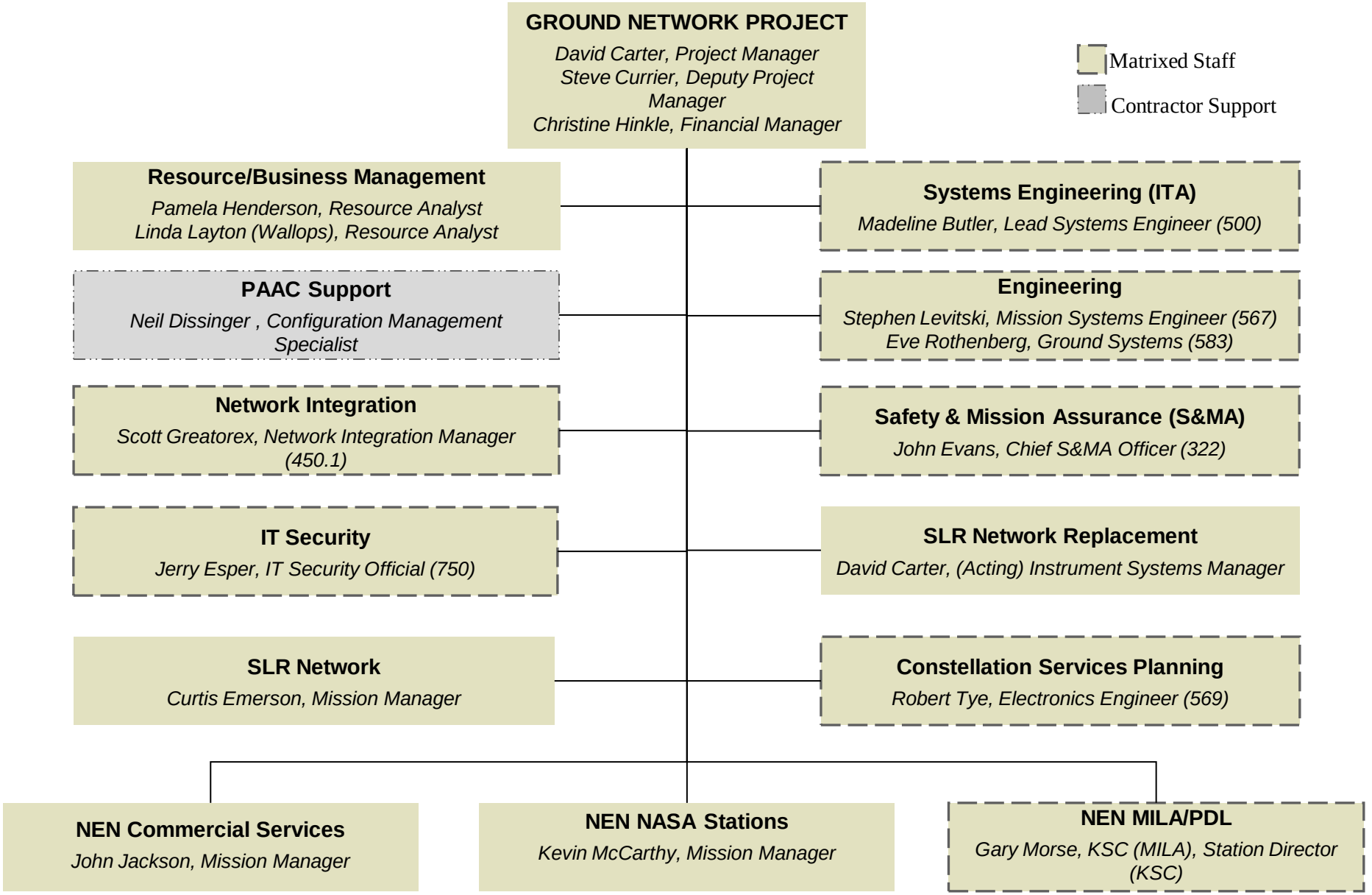


NEN Historical Metrics





Ground Network (GN) Organization



Agenda

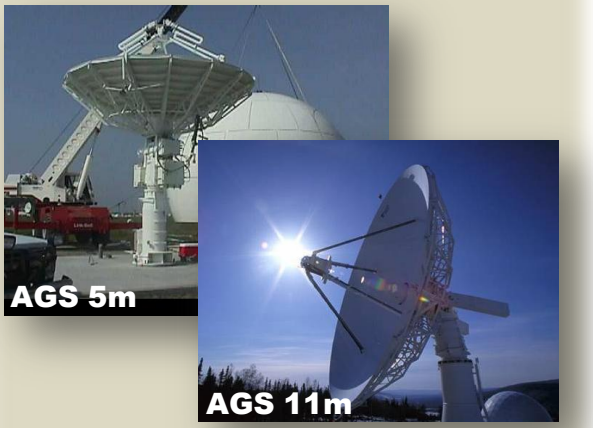
- NEN Overview
- Key Accomplishments
- Quick Turn Around Support
- Plans

Key Accomplishments

CSP Changes

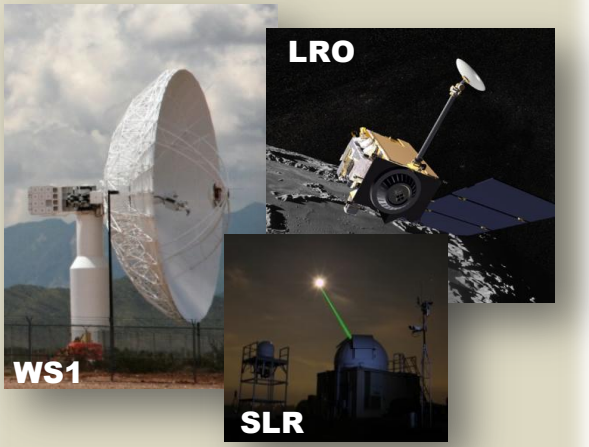
- USN acquired DataLynx systems, consisting primarily of TT&C antennae in Poker Flat (Feb 2008)
- SSC acquired the University of Chile Santiago Satellite Station (July 2008)
- SSC acquired USN (May 2009)

Antenna Decommissioning



- The NEN removed two GFE'd Poker Flat assets from service to reduce legacy sustainment requirements
- Transferred AGS 5m LEO-T to NOAA (May 2009)
- Transferred AGS 11m to the WFF Range (Sept 2009)

Lunar Services



- Initiated LRO S- & Ka-Band services from WS1 following 18 June 2009 launch
- Purchased S-Band lunar services from Kiruna, Weilheim, Dongara, and South Point
- Utilizing GN's SLR capability to meet LRO's precision orbit determination requirement to the sub-meter level

Agenda

- NEN Overview
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Quick Turn Around Support

Soyuz

- Due to a prior reentry anomaly, the Russian Space Agency requested redundant tracking support from NASA on the following Soyuz mission
- In less than a month, the NEN team developed, tested and deployed a VHF system to Athens, Greece providing the only source of Soyuz telemetry during the critical de-orbit burn period
- NASA support of a second Soyuz reentry in April 2009 was impacted due to an RFI issue when support was moved from Greece to Tel Aviv

Kepler

- Following a HQ review 7 days prior to launch, the Kepler project requested launch support from the NEN's USN South Point station in Hawaii to supplement DSN support to fill in a known gap in coverage
- Although the Kepler project was satisfied with their support, the USN South Point station had a late acquisition of signal due to an operator error as well as an unexpected spacecraft orientation

Agenda

- NEN Overview
- Key Accomplishments
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‘Full Benefit’ Commercial Services

The NEN intends to hold an open procurement for commercial services in the SCNS era in order to achieve full benefit commercial services

GOALS

- Achieve consistent contracts (e.g., pure price/pass) with all providers to enhance competition
- Expand the number of independent providers utilized by the NEN
- Eliminate tiering of contracts (e.g., DLR and Kiruna through SSC)
- Reduce contractual minimums to increase scheduling flexibility in order to achieve cost- and performance-optimized schedules

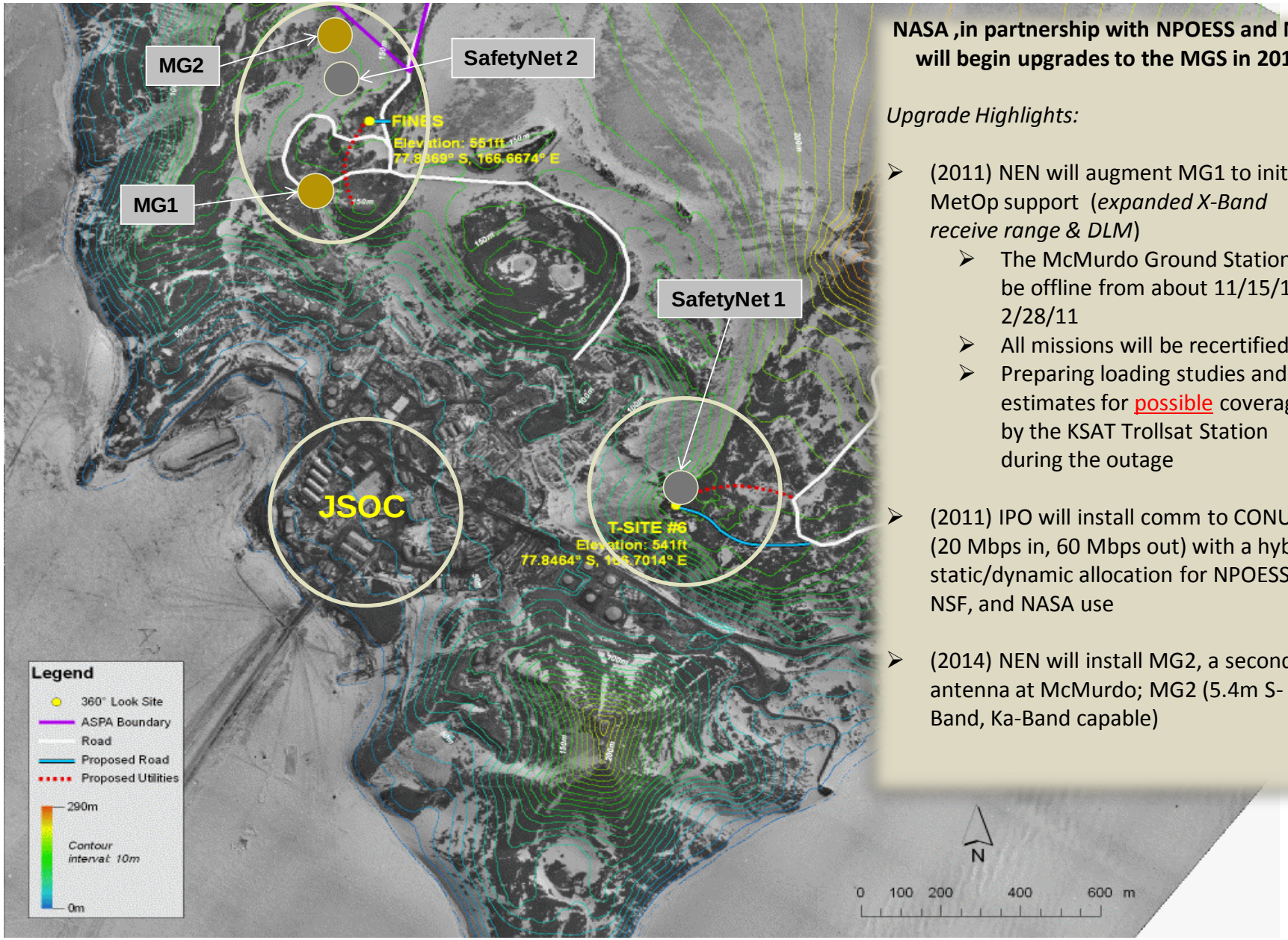
Image: Kongsberg Satellite Services (KSAT) Tracking Station in Svalbard, Norway

Planned Asset Decommissions

NEN Antenna Decommissioning

- The NEN currently plans to decommission the MILA and PDL assets following the Shuttle Program termination at the end of FY10 (STS-133 or 134 planned for 9/14/2010)
- The MILA station will be closed, but PDL will be required for Constellation launch and ascent services
- In addition, the NEN may also decommission the WGS 5m LEO-T asset following the completion of Shuttle operations

McMurdo Upgrades



NASA ,in partnership with NPOESS and NSF, will begin upgrades to the MGS in 2011

Upgrade Highlights:

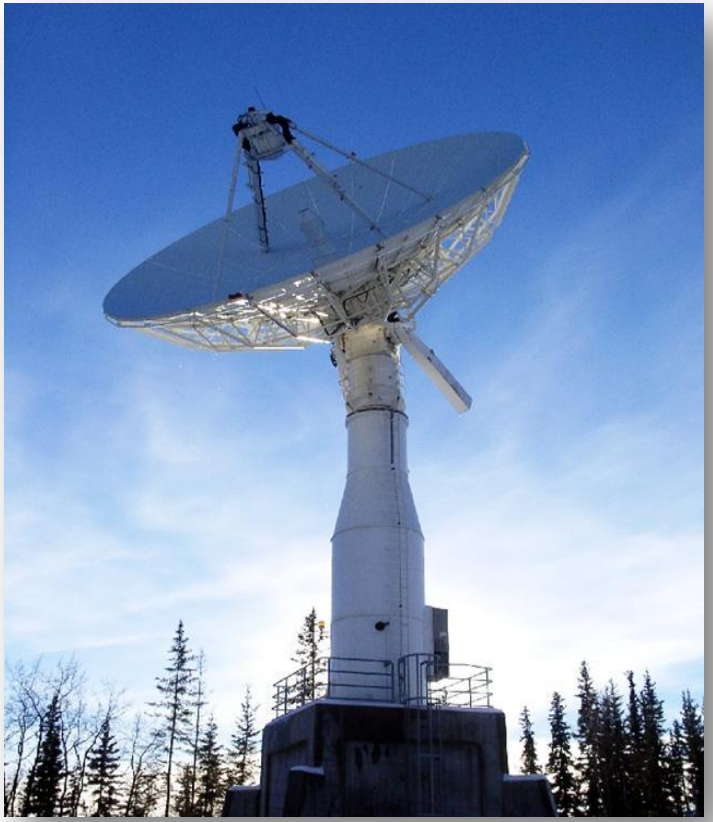
- (2011) NEN will augment MG1 to initiate MetOp support (*expanded X-Band receive range & DLM*)
  - The McMurdo Ground Station will be offline from about 11/15/10 to 2/28/11
  - All missions will be recertified
  - Preparing loading studies and cost estimates for possible coverage by the KSAT Trollsat Station during the outage
- (2011) IPO will install comm to CONUS (20 Mbps in, 60 Mbps out) with a hybrid static/dynamic allocation for NPOESS, NSF, and NASA use
- (2014) NEN will install MG2, a second antenna at McMurdo; MG2 (5.4m S-Band, Ka-Band capable)

ASF 11m Upgrades

The NEN will perform a refresh of the ASF 11m system in FY12 in order to address known problems and obsolescence issues

- Improve system reliability and future sustainability
- Increase flexibility for future missions
- Reduce unplanned maintenance and the probability of an extended downtime
- Planned upgrades will allow for an expanded mission set capability

Additional upgrades of the ASF 11m asset are being considered which would enable EOS support



Planned Upgrades

- Depot Level Maintenance
- Replace the ViaSat SCC
- Replace the ACU
- Provide a spare XP PTP
- Install an antenna system UPS
- Install replacement HPA
- Install Cortex XXL X-Band Upgrade
- Upgrade the S-Band Receiver
- Upgrade the X-Band freq converters

Constellation Launch & Ascent Support

- Official requirements have been established for NEN Constellation Launch and Ascent support (Orion DV, ARES DFI)
  - DFI is for first five flights only
  - Additional requirements in the Launch Area currently allocated to the USAF could potentially be reallocated to the NEN (ARES MEL)
- Current studies indicate the NEN will need to operate a minimum of 4 stations to meet requirements
  - Launch area main and wing site
  - Mid-Atlantic / Wallops area asset
  - New England area asset (e.g., New Boston, NH)
- On-going trade Studies will determine appropriate implementation options for supporting Cx req's
  - Launch Area Location Analysis
  - Downrange Location Analysis
  - MEL Implementation Options
  - Wallops Implementation Options
- Expected NEN Constellation Support Schedule
  - SRR: October 1, 2009
  - PDR: Spring 2010
  - CDR: Fall 2010
  - O&M: Commence in 2014 (with testing in 2013), per the current Constellation Support schedule

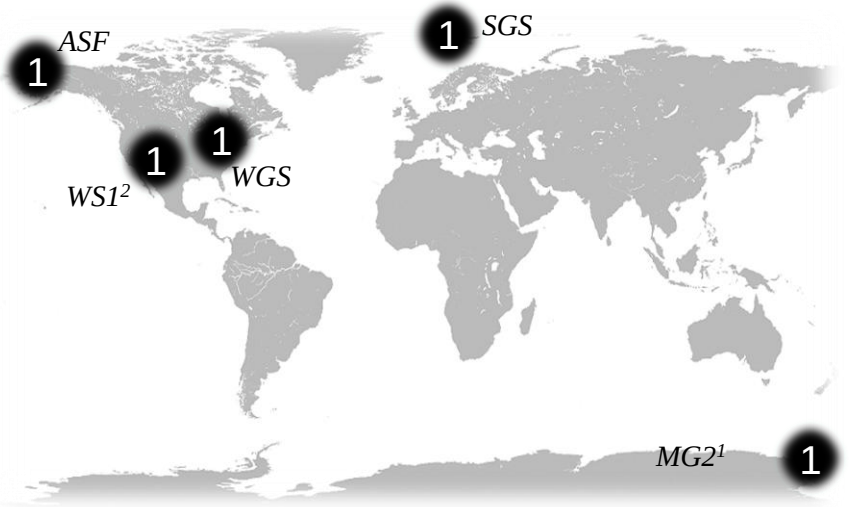
NEN Support to Constellation Link Summary: Expected Responsibility by Link and Mission Phase

		Launch	Ascent	On-Orbit
Orion	**DV:** S-Band, ~10 kbps	NEN	NEN	Ø
ARES	**DFI:** S-Band, ~20 Mbps Downlink only *(5 Flights Only)*	NEN	NEN	Ø
ARES	**MEL:** S-Band, ~15 Mbps Downlink only	Air Force *(partial NEN possible)*	SN	Ø

Ka-Band NEN Enhancements (Pre-Phase A)

- Motivation: future missions will need significantly higher downlink data rates (1 Gbps+) than S- or X-Band spectrum allocations can accommodate
- Key finding: No significant technical obstacles to achieving 1 Gbps+ Ka-Band LEO communication within 5 years
- Recommended baseline solution* includes:
  - New Ka-Band capabilities, with 12-13m antenna, at 3 sites:
    - Wallops (WGS)
    - Alaska (ASF)
    - Svalbard (SGS)
  - Upgraded existing WS1 (18m asset) Ka-Band capability, from 100 Mbps to 1 Gbps+
  - Upgrade the MG2 antenna system with Ka-band equipment and bring MRTS-2 back up
  - Expansibility for future needs

Recommended Baseline NEN Solution



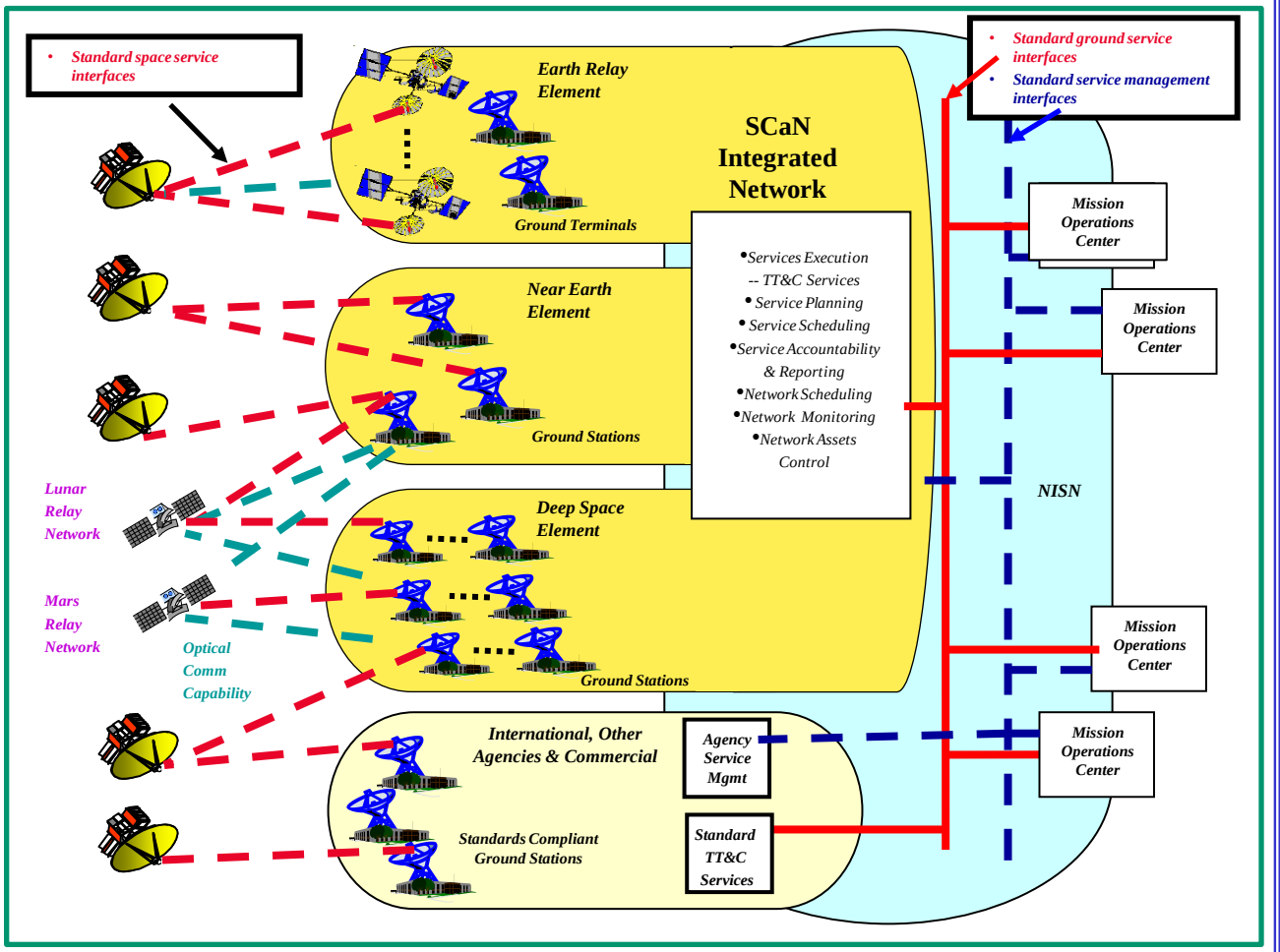
[1] *Existing 5.4m asset will need to be upgraded to support 1+ Gbps*
[2] *Existing 18m asset will need to be upgraded to support 1+ Gbps*

- Details to refine through further study:
  - Cost
  - Schedule
  - Implementation
- Estimated availability (subject to funding):
  no earlier than 2015*

* Preliminary

SCaN Vision

- SCaN is incrementally advancing to a 'network of networks' architecture
  - Promote interoperability
  - Achieve greater integration of services
  - Improve reliability
  - Enhance support to future space missions
  - Reduce costs
- The GN will continue to support SCaN efforts to achieve efficiency and simultaneously enhance service



SCaN future (~2018) architecture concept

Flight Dynamics Facility

S. Hoge
FDF Operations Director

FDF Today

- Located in Building 28, North Wing, Second floor
- FDF Highlights for FY09
  - In addition to routine missions, FDF supported
    - Supported 5 STS missions
      - HTV and multiple Soyuz missions
    - Supported NOAA N Prime, OCO, LRO, GOES-O, FGST, KEPLER, IBEX
    - Supported 12 ELV launches
    - Began Phase 1 of FDF Modernization

New Flight Dynamics Support Services Contract

- FDSS contract awarded to AI Solutions
  - Five year contract
  - CPAF; task order
- Phase-In began October 16
  - Forty-five day phase in
- Contract begins November 30, 2009
- No major change in operations task structure
- Funding for contract done as pool
  - Funds transferred to pool for distribution to tasks
  - Coordinate with customers on transfer of funds

FDF Modernization

FDF Modernization

- The current FDF architecture is based on a 30+ year evolution and can be characterized as follows:
  - Robust, time-proven and meets all current requirements for flight dynamics support
  - Application software architecture:
    - mostly custom in-house with some COTS S/W used for some mission support and product generation. (Approx. 100 S/W components).
    - runs on combination of (40) HP UNIX and (22) Windows PC based systems.
    - Oracle DBMS used to store tracking data and for acquisition data generation.
  - Communications Architecture
    - Interfaces with various networks (IONET – open, closed, restricted) and CNE
    - Allows for exchange of data and delivery of products with external entities.

- While proven, a change is necessary in the FDF architecture based on the following:
  - Indirect costs (approximately equal to 100% of "direct" costs) need to be reduced to remain cost competitive
  - New applications (GOTS and COTS) are often costly to introduce into the FDF
  - No integrated architectural component to handle all external communications.
  - System configuration issues – limited mechanisms for automated failover and load balancing.

FDF Modernization
Architecture Study Team

- Architecture Study Team established
  - Issued Architecture Study Report dated September 2007.
- Significant findings of study team
  - GSFC Mission Service Evolution Center (GMSEC) architecture should be employed; this architecture leverages past work and enables easier integration of applications software.
  - A reasonable implementation is possible in 5 years (dependent on funding)
    - Implementation done in four phases
  - Resource requirements are manageable and can make use of some resources already available
- The end result of the proposed FDF modernization program will be a facility that can better adapt to new mission requirements and provide cost effective flight dynamics services for the foreseeable future with a "reasonable" investment of resources.

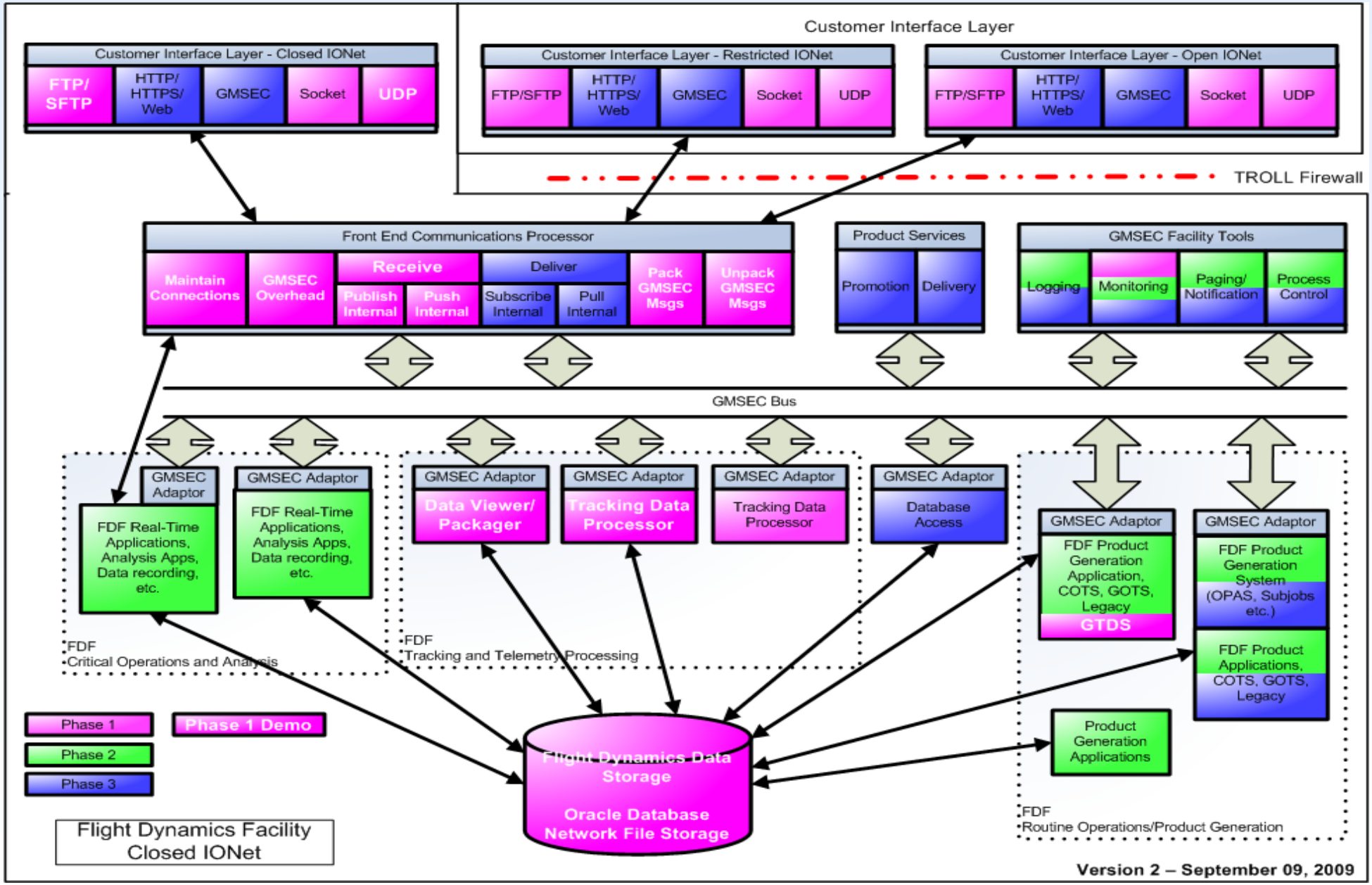
FDF Modernization
High Level Architecture Requirements

- Overarching requirements
  - Must be able to support mission model (and beyond)
  - Reduce sustaining engineering and facilities operations costs
  - Facilitate routine task automation
- Requirements addressing facility architecture (the infrastructure)
  - Establish and maintain an "enterprise architecture"
  - Facilitate system changes / upgrades
  - Deploy new communications interfaces – with required security measures
  - Install database data synchronization and automated failover
- Requirements addressing application software
  - Reduce the number of legacy software systems
  - Eliminate redundancy
  - Optimize database functionality: redesign schema; develop analysis tools
- Requirements addressing operations concepts
  - The new architecture must support / provide
    - System-wide monitoring – fault detection, prevention, notification, automated recovery
    - Receive / transmit data over multiple networks
    - Publish / subscribe compliant applications that support interactive or automated modes
    - Automatic product generation and delivery for routine operations
    - Automation – lights out for routine ops; automated load distribution
    - Security – support for HSPD-12 and NASA security standards

FDF Modernization Approach

- Implementation to be performed by Code 590/FDF and Code 580 personnel
  - Current software and sustaining engineering staff providing most of resources needed
  - Additional funds provided by Center in FY09 and SCAN in FY10
- Four phases over 5 year period
  - Pre-Phase – Design and Architecture
  - Phase 1 – Data Collection, Processing, and Database
  - Phase 2 – Process Engineering, Legacy Application Upgrade
  - Phase 3 – Data Processing, Operations, Data Distribution
- Early Phases target data capture and processing in order to better adapt to new mission requirements early in implementation
- Reviews Performed for Each Phase:
  - System Requirements and Design Review
  - Test Readiness Review
  - Operations Readiness Review
  - Pre-Next Phase Assessment

FDF Modernization Phase Components



FDF Modernization
Phase-1 Objectives

- Ingest all incoming data – tracking data, vectors, other – through the front end systems (**Customer Interface Layer - CIL, Front-end Communications Processor - FECP**)
- All internal data interfaces via GMSEC
- Correctly process the data via the **Modular Data Processors – MDP**
- Store the data in the Oracle database – database will be updated with new schema
- Retrieve data from database
  - Format data for follow-on applications (GTDS) – **Data Packager**
  - Enhanced flexible queries – **Data Viewer**
- Process retrieved data through an orbit determination process (GTDS), with comparison of results to output generated from operational side processing of the data (Capability Demonstration).
- Provide initial **Monitor** capability
  - Connections from CIL to FECP
  - Data traffic from CIL thru FECP and MDP to database
  - Rudimentary statistics on volume and data type

FDF Modernization
Progress to date

- Progress to Date:
  - Baseline version of Operations Concept doc. – July 2008
  - High-Level Requirements doc. and Review – October 2008
  - High-Level Architecture doc. and Review – March 2009
  - Schedule and staffing re-plan – May 2009
    - Initial Phase-1 capability demonstrations in March/April 2010
    - Phase 1 complete and ready for transition to ops December 2010
  - Phase-1 Detailed Design – May 2009
    - Derived requirements walk-thru – June 2009
    - Sub-component level design walk-thru – mid July 2009
    - Informal Detailed Design Review – early August 2009
    - Phase 1 coding - started late August
  - Space Act Agreement activity
    - GTDS GMSEC compliance completed July 2009

High-Level Schedule

Activity	Start Date	End Date
Pre-Phase Items	February 2008	November 2008
Phase-1	December 2008	March 2011
Capability Demos.	December 2009	March 2010
Phase-2	Oct 2010	February 2012
Phase-3	July 2011	December 2012

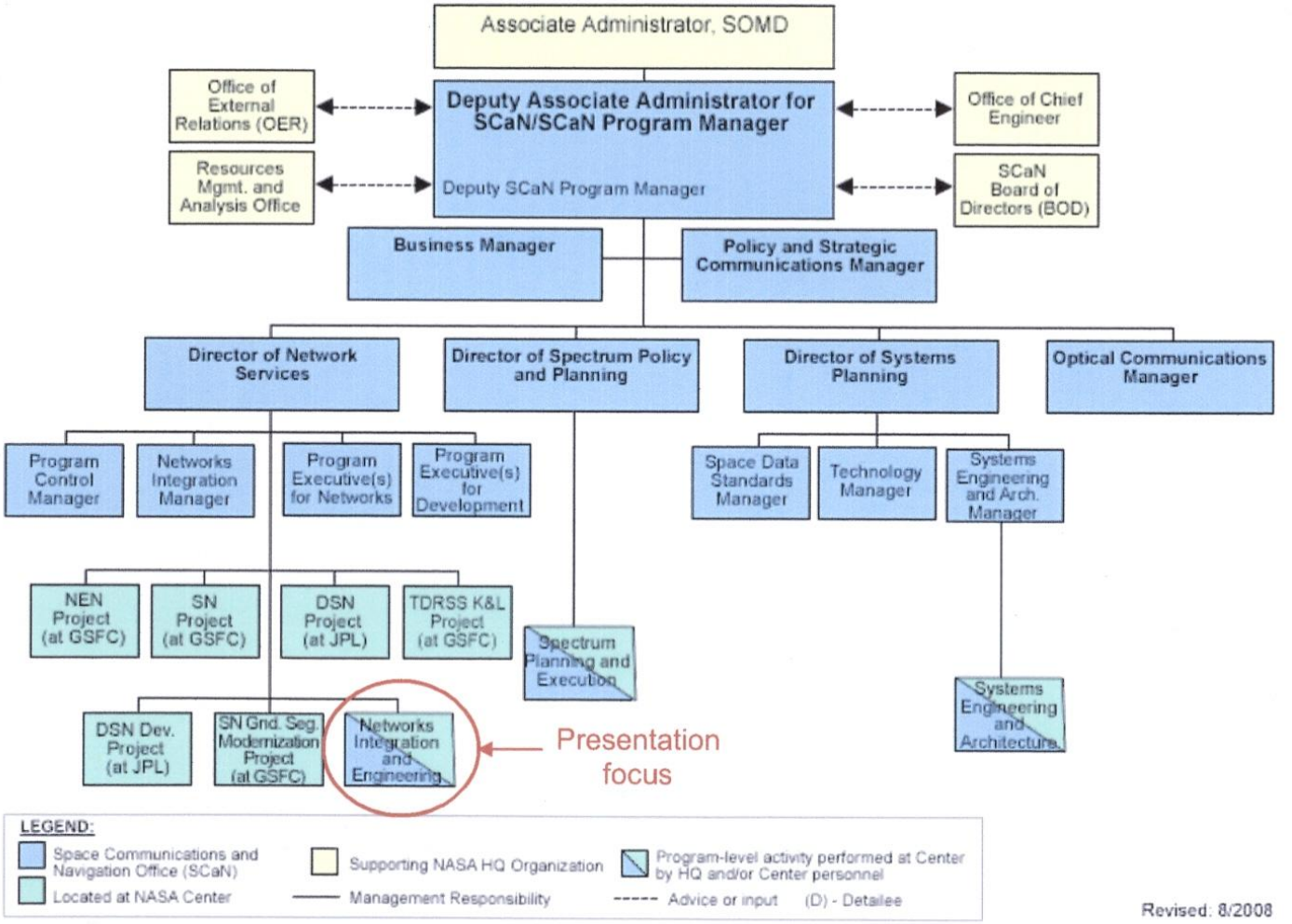
National Aeronautics and Space Administration

Keeping the universe connected.

SCaN Network Services Division
SCCF #17
Network Integration and Engineering
John Hudiburg
October 29, 2009

www.nasa.gov

SCaN Organization Chart



Constellation (CxP) Phase 1 Team Overall Role and Responsibilities

- Responsibilities:
  - Lead a multi-center team to perform the following tasks:
    - Develop common system engineering processes in support of NI&E Office
    - Interface with CxP Projects, attend appropriate panels and working groups, and coordinate review of the CxP-SCaN-NISN Joint Technical Baseline Documents
    - Coordinate SCaN response to CxP requirements through:
      - Validation and verification of CxP requirements through joint and SCaN trade studies & analysis
      - Perform CxP requirements gap analysis and assess impact on current SCaN networks
      - Flowdown of CxP requirements on SCaN networks
    - Identify test and verification plan for SCaN implementation of CxP requirements and perform joint test and verification with CxP
- Personnel:
  - Task management at GSFC and JPL
  - Financial and Administrative Assistants
- Major Deliverables:
  - Participate in all major CxP reviews and decision-making forums
  - Deliver validated CxP requirements to SCaN Networks in support of SN upgrade and sustainment tasks, GN upgrade and future DSN evolution plans
  - Organize, plan, and conduct required NPD 7120 SCaN formulation reviews

Communication Links Active During Launch and Ascent

Links before Launch Area Ground Station Loss of Signal (~ 6.5 minutes)

- Orion MOL (~186.2 kbps / 384 ksps) Transmit to TDRSS
- Dissimilar Voice (~8 kbps / 10.24 ksps) Transmit to the Ground
- Ares MOD (~50 kbps) And Ares MRD (~200 Mbps) Hardlined to CEV
- Ares MEL (~14.5 Mbps / 15 Msps) Transmit to Ground
- Ares DFI (~19.4 Mbps / 20 Msps) Transmit to Ground (*1st 5 Flights Only*)
- Two C-Band Tracking Beacons
- Flight Termination System

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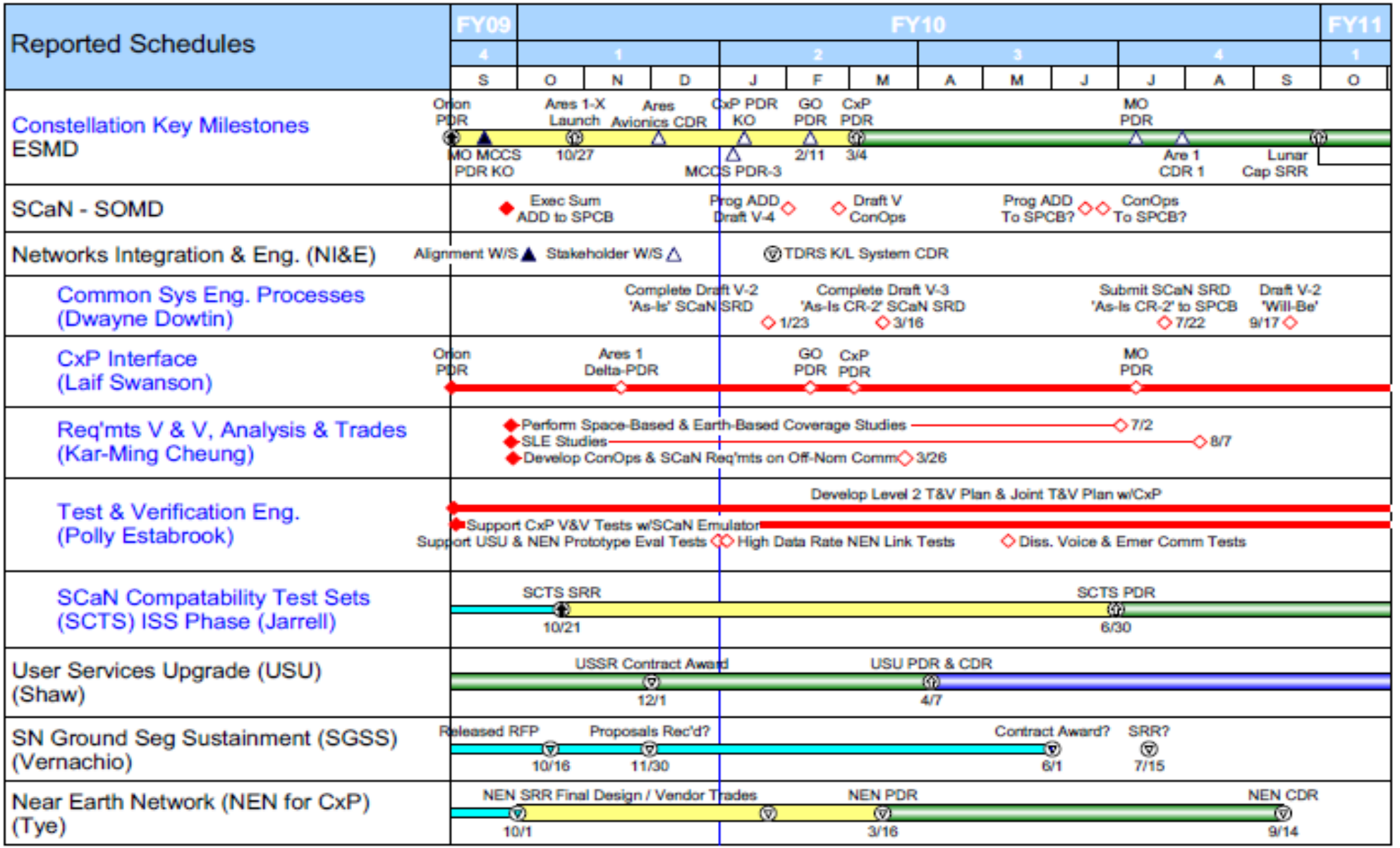
CxP-Related SCaN Major Projects

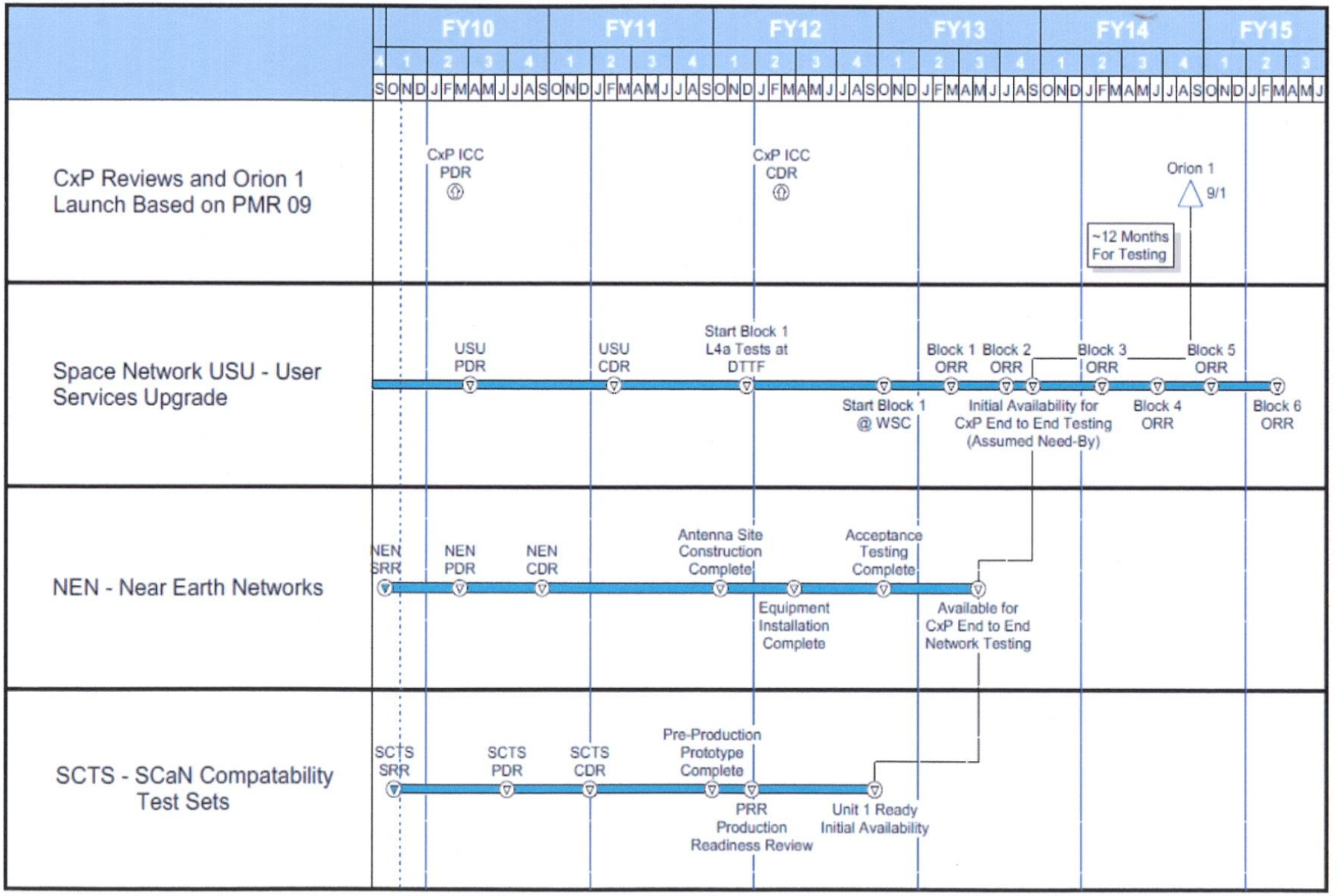
Fiscal Year 2010

10/26/09



SCaN Projects Schedule Links With CxP Orion 1 Mission

11/3/09



Open Floor

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Closing Remarks

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