The mission of the SN Ground Segment Sustainment Project is to implement a flexible and extensible ground segment that will allow the Space Network to maintain the high level of service in the future, accommodate new users and capabilities, while reducing the effort required to operate and maintain the system in the future.
Purpose

• Purpose of this meeting
  – Brief summary on SGSS system
  – Customer Mission Testing Approach and Path Forward
Significant Accomplishments since last Customer TIM (April 2018)

• Completed System Integration Review (SIR) successfully in May 2018.
• Obtained Authorization to Operate (ATO) in May 2018.
• Completed Initial External Interface Testing (with external entities) and achieved primary objectives.
• Completed installations at GSFC
• Completed build-up of MTF in Lab; currently being shipped to WSC site.
• System test in lab to verify batch of system-level requirements in progress, as planned.
SGSS Top-Level Schedule

<table>
<thead>
<tr>
<th>Major Milestones</th>
<th>GD In-Plant Activities</th>
<th>WSGT Site Activities</th>
<th>STGT Site Activities</th>
<th>TDRS Spacecraft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2018</td>
<td>2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J F M A M J J A S O N D</td>
<td>L4 I&amp;T SAT Dry Run SAT Formal</td>
<td>SR 1.1 I&amp;T SR 1.2 I&amp;T</td>
<td>SR 2 I&amp;T SR 3 I&amp;T</td>
<td>TDRS (SGSS Receive Only) Testing</td>
</tr>
<tr>
<td></td>
<td>Installations L5 Dry Run L5 Formal L6 Dry Run L6 Formal SN Post L6</td>
<td>EIT SAT Drop &amp; Reg</td>
<td>SR1 C/O &amp; Reg</td>
<td>1st TDRS Assigned to SGSS</td>
</tr>
</tbody>
</table>

Active Involvement With External Entities and Customer Missions

External Entities Testing
- Connectivity tests
- Preliminary data flows

TDRS and Customer Shadow Testing
- ULE Cutover Tests
- TDRS downlink tests
- Customer return link tests

TDRS and Customer Testing
- TDRS uplink & downlink tests
- Customer forward, return and tracking tests

SN Sponsored Tests
- Content TBP by SN
**Project Goals**

- **SGSS Project Goals**
  - Implement a flexible/extensible SN ground segment
  - Maintain a high level of service
  - Accommodate new users and capabilities
  - Reduce the effort required to maintain operations
  - Ensure uninterrupted service during transition
Architectural Design

- **SGSS Architectural Design**
  - Choose simplicity
  - Enforce design integrity
  - Distribute intelligence
  - Reduce functional entanglement
  - Separate customer data from system data
  - Embrace change
  - Provide comprehensive enterprise management
  - Maximize use of best in-class commercial off-the-shelf (COTS) technology

User Spacecraft  Space Segment  Ground Segment  User MOC
• **SGSS Architecture**
  – Enables compliance to various standards
  – Addresses NASA objectives
  – Preserves existing capabilities
  – Preserves existing interfaces
  – Enables a smooth transition from the legacy systems
• The SGSS System consists of networked:
  – Ground Terminals (GTs)
  – Space Network Operational Control (SNOC)
• The NASA Integrated Services Network (NISN) connects SGSS to:
  – User Mission Operation Centers (MOCs)
  – TDRS Vendor support facilities
  – Remote support sites, including the NEN
• **Space Network Operations Control**
  – Physically located at the Second TDRS Ground Terminal (STGT) in White Sands, New Mexico
  – Provides complete SGSS network operations of the Ground Terminals
Ground Terminals

- Ground Terminals
  - Ground terminals can be scaled, replicated, and located anywhere with NISN connectivity
  - SGSS includes ground terminals at:
    - WSGT
    - STGT
Local Control

- Ground Terminal Local Control
  - Ground terminals can operate under local control if contact with the SNOC is lost
  - Distributed intelligence
  - Local control
  - Local management
• **SGSS Extensibility**
  – A ground terminal or SNOC can be added anywhere within the NISN reach
    • Each site includes operational independence and improves scalability
  – Any ground terminal can be extended
    • Standardized network construction
  – Modular processing and pooled resources yield simple extension without disruption or application software upgrades
SGSS Sites

Sites where SGSS is to be deployed:

- Second TDRSS Ground Terminal (STGT)
- White Sands Ground Terminal (WSGT)
- Extended TDRSS Ground Terminal (ETGT)
- Maintenance & Training Facility (MTF)

White Sands Complex (WSC)
• Related functions are grouped into elements
• Elements are conceptual, *NOT* physical
• SGSS is comprised of 7 elements
  – Space-Ground Link (SGL)
  – Digital Signal Processing (DSP)
  – User Services Gateway (USG)
  – Service Management (SM)
  – Fleet & Ground Management (FGM)
  – Enterprise Infrastructure (EI)
  – Maintenance & Training (MT)
• Capabilities represent **functionality** residing in one or more system elements

<table>
<thead>
<tr>
<th>Planning and Scheduling (PS)</th>
<th>Network Management (NM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDRS Provisioning</td>
<td>Flight Dynamics (FD)</td>
</tr>
<tr>
<td>Service Execution (SE)</td>
<td>TDRS Operations Management (TOM)</td>
</tr>
<tr>
<td>User Data Services (UDS)</td>
<td>Test Services and Features (TSF)</td>
</tr>
<tr>
<td>User Tracking (UT)</td>
<td>Maintenance and Training Facility (MTF)</td>
</tr>
<tr>
<td>TDRS Tracking (TT)</td>
<td>Transition (TR)</td>
</tr>
<tr>
<td>Telemetry and Commanding Services (TCS)</td>
<td></td>
</tr>
</tbody>
</table>
The SGSS deployment of GD and Harris equipment started with a surge of MM, EETu/a and rack/workstation installations.

The SGSS “First Deployment” for WSC was conducted in four phases with GD and two phases with Harris:
- First shipment was from Harris on Dec 21, 2017
- The remaining shipments started on Jan 10, 2018 and completed Feb 23, 2018

SGSS workstations have been rolled out to their prospective locations (WSGT CDCN/GCE, STGT CDCN and STGT TOCC).

All GD SGSS racks have been cabled and startup procedures were executed and are fully functional.

GSFC installation is complete.

Provisional System Acceptance Test (SAT) is ongoing as of Sep 2018 at GD.

Antenna testing and Pre-Level 5 testing is ongoing at WSC.
### SGSS Top Level Schedule

#### Major Milestones

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>L4 I&amp;T</td>
<td>SAT Dry Run</td>
</tr>
<tr>
<td></td>
<td>SAT Formal</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>SR 1.1 I&amp;T</td>
<td>SR 1.2 I&amp;T</td>
</tr>
<tr>
<td></td>
<td>SR 2 I&amp;T</td>
<td>SR 3 I&amp;T</td>
</tr>
</tbody>
</table>

#### GD In-Plant Activities

- **L4 I&T**
- **SAT Dry Run**
- **SAT Formal**

#### WSGT Site Activities

- **Installations**
- **L5 Dry Run**
- **L5 Formal**
- **L6 Dry Run**
- **L6 Formal**
- **SN Post L6**

#### STGT Site Activities

#### TDRS Spacecraft

- **TDRS (SGSS Receive Only) Testing**
- **1st TDRS Assigned to SGSS**

### Active Involvement With External Entities and Customer Missions

- **External Entities Testing**
  - Connectivity tests
  - Preliminary data flows

- **TDRS and Customer Shadow Testing**
  - ULE Cutover Tests
  - TDRS downlink tests
  - Customer return link tests

- **TDRS and Customer Testing**
  - TDRS uplink & downlink tests
  - Customer forward, return and tracking tests

- **SN Sponsored Tests**
  - Content TBP by SN

---

SGSS Customer TIM 20181003 (Abbreviated)
• SGSS supports the Serial and Packetized Baseband User Local Equipment (ULE) interfaces

• Packetized Baseband interface is available for future use

• When services are scheduled on legacy SN, the cards pass-through clock and data signals to/from the ULE and legacy switches. For services scheduled on SGSS, data flows from SGSS Baseband Network directly to the ULE

• SGSS will only conduct ULE Cutover Tests. The approach is to conduct testing through legacy path during L5 testing and through SGSS path during L6 testing. The ULEs will be re-connected to legacy configuration at end of each test.

• Final cutover and/or transition will be conducted by the SN (in collaboration with the Customer Missions)
The SGSS system at WSC site is ready to conduct ULE Cutover Testing through legacy path.

The missions have been grouped to achieve efficiencies in coordination.

The execution of the test occurs at least 3 weeks after the coordination meeting.

SGSS will be reaching out to the Customer Mission Groups for coordination meeting with developed test procedure (compliant with the ICD and Transition Appendix) and menu options (operational modes) to discuss the test details and obtain agreements on test mode(s) and test windows.

Continued cooperation from the Customer Missions is needed for us to be successful and would be highly appreciated.
• **Initial Setup**
  – Mission support scheduled for legacy WSGT antenna.
  – Cables connected from HR/LRDS Test Ports (allocated to SGSS) to USG LI FWD and/or RTN ports for that mission.

• **Test Conduct**
  – Test conductor disconnect legacy cables at Mission LI and connect cables from USG/LI to the Mission LI.
  – Mission check data receipt and quality
  – Test conductor disconnect cables from USG/LI at Mission LI and connect legacy cables to the Mission LI.
• **Initial Setup**
  - Mission support scheduled for TDRS on SGSS WSGT antenna.

• **Test Conduct**
  - Test conductor disconnect legacy cables at Mission LI and connect cables from USG/LI to the Mission LI.
  - Mission check data receipt and quality
  - Test conductor disconnect cables from USG/LI at Mission LI and connect legacy cables to the Mission LI.
• The test process starts with notifying the individual missions of the test
  – The missions will assign a POC

• SGSS Pre-Coordination
  – SGSS complete development of the procedure.
  – SGSS perform preliminary testing of USG\LI and cables.
  – SGSS reviews test results, system configuration and test procedure.
  – Develop presentation to provide mission representatives at Coordination Meeting.

• Mission and SGSS – Coordination Meeting
  – SGSS provide detailed presentation of the test to be performed.
  – Review Mission feedback on the procedure and identify changes.
  – Obtain consensus on Go/No Go for moving forward to the test.
  – Identify and finalize the modes for testing and the test windows.

• Upon the decision to move forward with the test, the SGSS Project will work with the mission to schedule the test.
Wrap-Up

- Please look out for request for coordination meetings.
- Please ensure that missions operations / test support subject matter experts are available at the coordination meetings to provide feedback and finalize the test modes and test windows.
- Your continued cooperation and collaboration is highly appreciated.
- SGSS POC for Customer Mission Testing is Vir Thanvi (vir.Thanvi@nasa.gov).