458 / SPACE NETWORK GROUND SEGMENT SUSTAINMENT

SGSS Statement of Work (SOW)

Baseline

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Goddard Space Flight Center
Greenbelt, Maryland

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SGSS Statement of Work (SOW)

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Preface

This document is under the configuration management of the Space Network Ground Segment Sustainment (SGSS) Project (Code 458) Configuration Control Board (CCB). Configuration Change Requests (CCRs) to this document shall be submitted to the SGSS Project CCB, along with supportive material justifying the proposed change. Changes to this document shall be made by Documentation Change Notice (DCN) or by complete revision.

Direct all comments, questions, or suggestions regarding this document to:

Space Network Ground Segment Sustainment (SGSS) Project
Code 458
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Change Information Page

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Section 1 Introduction

1.1 Purpose

This Statement of Work (SOW) defines the Contractor's efforts required to implement the Space Network Ground Segment Sustainment (SGSS) Project. The Space Network (SN) consists of a space segment comprised of the Tracking and Data Relay Satellites (TDRSs), and a ground segment (SNGS). The SN provides the capability for global space-to-ground telecommunications and tracking coverage for Low Earth Orbit (LEO) and near-earth spaceflight missions, including both robotic and human space flight. The SNGS includes facilities and systems located at the White Sands Complex (WSC) at Las Cruces, NM; the Guam Remote Ground Terminal (GRGT) at Guam; and Space Network Expansion (SNE) East at Blossom Point, MD. Primary external interfaces for the SN include the NASA Integrated Services Network (NISN), the Flight Dynamics Facility (FDF), SN Users, the Near Earth Network (NEN), the Deep Space Network (DSN), the Goddard Space Flight Center (GSFC) Network Integration Center (NIC), and TDRS Vendors. Primary interfaces within the SN, but external to the SGSS portion of the SNGS include the Australian TDRS Facility (ATF), the Bilateration Ranging and Transponder System (BRTS), existing SN Ground Antennas, the SNE- East (SNE-E) and the TDRS spacecraft.

The purpose of the SGSS project is to implement a modern ground segment that will enable the SN to continue to deliver high quality services to the SN community, meet stakeholder requirements, and significantly reduce required operations and maintenance resources. This effort will:

- Replace existing obsolete systems;
- Create a more flexible and expandable architecture;
- Facilitate integration of the NASA Space Communications and Navigation (SCaN) networks;
- Address evolving customer requirements and advances in technology;
- Implement new methods and capabilities for using the TDRS to support SN User spacecraft, including modernization of the Radio Frequency (RF) service chain;
- Expand and improve the methods by which the SN User control centers interface with the SNGS for data and service planning and control;
- Maintain long-term operational performance, reliability and maintainability.

1.2 Scope

This SOW defines those tasks to specify, design, analyze, validate, develop, fabricate, assemble, integrate, checkout, test, evaluate, verify, deliver, transition, document, and support operations and maintenance of the SN Ground Segment Sustainment System and its interfaces.

1.3 SGSS General Requirements

[SOW 100] The Contractor shall provide all of the management and engineering services, personnel, services, materials, equipment, and facilities required for the successful and on-time implementation of the design, analyses, engineering, development, integration, test, engineering data analyses, verification, validation, qualification, delivery, installation, transition, training, maintenance through the Final Acceptance Review (FAR), and sustaining engineering of the SGSS and its interfaces in accordance with the Level Three Requirements, Contract Data Requirements List (CDRL), and all applicable documents.

[SOW 647] The contractor shall provide all data and documentation deliverables in accordance with the SGSS CDRL.

[SOW 101] The Contractor shall provide all hardware, software, development tools and support equipment required to complete the contract, including any equipment necessary to complete operational testing that is not available at SN ground facilities and systems.

[SOW 103] Any changes made by the Contractor to SN ground facilities and systems shall not adversely impact the ongoing operations of the SN.

1.4 SN Ground Segment Sustainment System Deliverable

[SOW 550] The SGSS System shall meet all Level Three Requirements.

[SOW 834] The SGSS System shall be designed to minimize operations and maintenance costs.

[SOW 551] The Contractor shall deliver a Configuration Item Identification List (CIIL) (CDRL CM-04).

[SOW 552] The Contractor shall deliver fully operational SGSS systems that meet the contract requirements to the WSC and to the GRGT.

[SOW 554] The Contractor shall deliver an SGSS interface to SNE East at Blossom Point, MD.

[SOW 924] The Contractor shall upgrade all antennas at STGT, WSGT and GRGT (as listed in Tables 3.5-2 and 3.5-3 of the SRD) to be compatible with SGSS.

[SOW 946] The Contractor shall replace the Antenna Control Units for all antennas at STGT, WSGT, and GRGT (as listed in Tables 3.5-2 and 3.5-3 of the SRD).

[SOW 553] The Contractor shall deliver a fully operational Maintenance and Training Facility (MTF) to the WSC.

[SOW 917] The Contractor shall develop and deliver a Technology Refresh and Sparing Plan as part of the Logistics Plan (CDRL MO-04).

[SOW 555] The Contractor shall deliver all developed source code (including modified COTS) and all executable code (CDRL MO-14).

[SOW 943] For all COTS, the Contractor shall provide media, licenses and associated documentation.

[SOW 927] The Contractor shall provide source code escrow for all delivered COTS software.

[SOW 928] Reserved.

[SOW 940] The Contractor shall provide all necessary products and training to allow the Government to maintain the system after acceptance.

[SOW 941] The Contractor shall provide all products necessary to completely rebuild the software system at WSC including source code, compilers, code conversion tools, and any other tools and procedures needed to rebuild the software system.

[SOW 942] The Contractor shall retain copies of all software and software product documentation until the end of the minimum system life. This documentation will be used for maintenance of the system and shall be accessible to the government.

Section 2 Definitions, Terms, and References

2.1 Definitions and Terms

The following definitions apply to this document:

Shall - Compliance by the Contractor is mandatory. Any deviation from these contractually imposed mandatory requirements requires the approval of the contracting officer.

May - At the discretion of the Contractor or Government.

Will - Designates the intent of the Government. Unless required by other contract provisions, noncompliance with the will requirements does not require approval of the Contracting Officer and does not require documented technical substantiation.

The term "(CDRL -)" refer to items in the Contract Data Requirements List (CDRL).

Throughout this document, the term "Government personnel" includes anyone designated by the SGSS Project Manager to act on behalf of the Government.

Throughout this document, the term "days" refers to business days unless specified as a calendar period (e.g., "1 month"), calendar days after contract award (DACA), or explicitly identified as calendar days.

For the purposes of this SOW, the term "Guam Remote Ground Terminal (GRGT)" includes NASA Space Network facilities and equipment located on Guam.

For the purposes of this SOW, the term "mission critical" is defined to mean any function required to support TDRS health and safety operations, human space flight missions, certain User launch operations, and services for missions of significant national priority.

For the purposes of this SOW, the term "software" refers to any software, firmware, scripts, databases, configuration files, data files, or other software code within the SGSS system.

The term "(TBS)"means, "To Be Supplied", identifies missing or incomplete information, values, or data needed to fulfill a requirement. The Government will furnish values for items identified by a TBS. The Government will provide a date or milestone for each TBS requirement.

2.2 Requirements and Order of Precedence

All documents cited or referenced in this SOW that do not have a specific version number or release date refer to the most current version available as of the SOW release date.

2.2.1 Level Three Requirements

The term "Level Three Requirements" (or "L3 Requirements") refers to the Government-controlled requirements for this contract. The following documents comprise the Level Three requirements:

1. 458-SOW-0001, SGSS Statement of Work (SOW)
2. 458-REQ-0002, SGSS System Requirements Document (SRD)
3. 458-MAR-0001, SGSS Mission Assurance Requirements (MAR)
4. 458-CDRL-0001, SGSS Contract Data Requirement List (CDRL)
5. 458-IRD-0001, NASA Integrated Services Network (NISN)

6. 458-IRD-0002, NASCOM Operations Management Center (NOMC)
7. 458-IRD-0003, Flight Dynamics Facility (FDF)
8. 458-IRD-0004, User Mission Operations Center (MOC)
9. 458-IRD-0005, User Local Equipment (ULE)
10. 458-IRD-0006, Near Earth Network (NEN)
11. 458-IRD-0009, Space Network Expansion East (SNE-E)
12. 458-IDD-0001, Antenna Mechanical Systems (AMS)
13. 458-IDD-0003, Bilateration Ranging Transponder System (BRTS)
14. 458-IDD-0002 SGSS-Australia TDRS Facility (ATF) IDD
15. 458-IDD-0004, Deep Space Network (DSN)
16. STDN 220.29, Radio Frequency (RF) Interface Control Document (ICD) for TDRS F1-F6
17. 405-F7-ICD-001, ICD for the TDRS Spacecraft / Ground Segment (10/93)
18. DS80409-H00-003, TDRS F8 - F10 RF ICD (Rev D)
19. 454-KP-SYS-ICD-001, TDRS K Program Spacecraft / Ground Segment RF ICD

2.2.2 Applicable Documentation

The following documents are included in this Statement of Work as requirements. All documents referenced by applicable documents are also applicable.

a. 450-SNUG, Space Network User's Guide (SNUG) Revision 9 dated August 2007
b. GPR 1060.2C, Management Review and Reporting for Programs and Projects
c. GPR 1410.2D, Configuration Management
d. GPR 1600.1, Security Requirements
e. GPR 5100.4D, Supplier Quality Audits
f. GPR 7120.4A, Risk Management
g. GPR 8700.4F, Integrated Independent Reviews
h. GPR 8700.6B, Engineering Peer Reviews
i. GPR 5340.3F, Preparation and Handling of Alerts, Safe Alerts and Advisories
j. GSFC form 4-37, Problem Impact Statement: Parts, Material, and Safety, August 2008.
k. GSFC EEE-INST-002 Instructions for EEE Parts Selection, Screening, and Qualification (NASA/TP-2003-212242)
l. NPD 8010.2E, Use of the SI (Metric) System of Measurement in NASA Programs
m. NPD 8720.1, NASA Reliability and Maintainability (R&M) Program Policy
n. NPD 8730.2C, NASA Parts Policy
o. NPR 1040.1, NASA Continuity of Operations (COOP) Planning Procedural Requirements w/Change 1 (03/29/04)
p. NPR 1600.1, NASA Security Program Procedural Requirements w/Change 2 (4/01/2009)

q. NPR 2190.1, NASA Export Control Program (revalidated w/ changes Feb 1, 2007)

r. NPR 2810.1A, Security of Information Technology

s. NPR 2830.1, NASA Enterprise Architecture Procedures

t. NPR 6000.1G, Requirements for Packaging, Handling, and Transportation for Aeronautical, and Space Systems, Equipment, and Associated Components

u. NPR 7123.1A, Systems Engineering Processes and Requirements

v. NPR 7150.2, NASA Software Engineering Requirements

w. NPR 7120.5D, NASA Space Flight Program and Project Management Requirements

x. NPR 8000.4A, Risk Management Procedural Requirements

y. NPR 8621.1B, NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping

z. NPR 8705.5, PRA Procedures for NASA Programs and Projects

aa. NPR 8705.6A, Safety and Mission Assurance Audits, Reviews, and Assessments

bb. NPR 8715.3C, NASA General Safety Program Requirements

cc. NPR 8820.2F, Facility Project Requirements

dd. NASA-STD-8719.9 Standard for Lifting Devices and Equipment

ee. NASA-STD-8719.13B, Software Safety Standard

ff. NASA-STD 8729.1 Planning, Developing and Managing an Effective Reliability and Maintainability (R&M) Program

gg. NASA-STD-8739.8, NASA Standard for Software Assurance

hh. NISN 700-DOC-029, NASA Integrated Services Network (NISN) Internet Protocol Operational Network (IONet) Security Policy

ii. ANSI/EIA-748-B, Earned Value Management Systems, June 2007

jj. ANSI/ISO/ASQ Q9001:2008, Quality Management Systems Requirements Standard

kk. ANSI/ESD S20.20-2007, Electrostatic Discharge Control Program Standard

ll. ANSI / ISO / IEC 17025-2005 General Requirements for the Competence of Testing and Calibration Laboratories (Revised 2005)

mm. ANSI/NCSL Z540.3-2006, Requirements for the Calibration of Measuring and Test Equipment

nn. GEIA-STD-0005-1, Performance Standard for Aerospace and High Performance Electronics Systems Containing Lead-free Solder

oo. GEIA-STD-0005-2, Standard for Mitigating the Effects of Tin Whiskers in Aerospace and High Performance Electronic Systems

pp. GIDEP Operations Manual (SO300- BT-PRO-010)

qq. GIDEP Requirements Guide (SO300-BU-GYD-010)

rr. IEEE-Std-1633, IEEE Recommended Practice on Software Reliability

ss. IPC-J-STD-001D, Requirements for Soldered Electrical and Electronic Assemblies (Class 3 requirements)

tt. SAE ARP5580, Recommended Failure Modes and Effects Analysis (FMEA) Practices for NON-Automobile Applications

uu. UL-60950-1, Information Technology Equipment,- Safety Part 1 - General Requirements

vv. National Fire and Protection Association (NFPA)-70: National Electrical Code (NEC) Standard

ww. IEEE Standard 1100: IEEE Recommended Practice for Powering and Grounding Electronic Equipment

xx. Electronic Industries Alliance (EIA) RS-310: Racks, Panels, & Associated Equipment

yy. NFPA-780: Standard for the Installation of Lightning Protection Systems

2.2.3 Order of Precedence

[SOW 912] Any inconsistency in requirements for this work shall be resolved by giving precedence in the following order: (1) Level Three Requirements in the order listed,
(2) Applicable Documents in the order listed.

[SOW 651] Any inconsistency in this solicitation or contract shall be resolved in accordance with Contract Clause 52.215-8 Order of Precedence.

[SOW 653] In the event of conflict between terminology in this solicitation and any other dictionary, the SGSS terminology shall take precedence.

[SOW 654] In the event of any unresolved conflict, the Contractor shall request conflict resolution by the Contracting Officer.

2.2.4 Reference Documentation

The following documents are included in this Statement of Work as reference and information.

a. DoD 5220-22M, National Industrial Security Program Operating Manual (NISPOM)

b. Federal Information Processing Standards (FIPS) Publication (PUB) 199

c. Federal Information Processing Standards (FIPS) Publication (PUB) 200

d. NISN-001-001, National Aeronautics and Space Administration (NASA) Integrated Services Network (NISN) Services Document

e. Space Network Handbook (450-HDBK-SN), dated October 2007

f. AMSAA TR 652, AMSAA Reliability Growth Guide

g. CMMI Guidelines for Process Integration and Product improvement, 2nd Ed., SEI Series in Software Engineering

h. GSFC Flight Assurance Procedure, FAP P-302-720, Performing a Failure Mode and Effects Analysis

i. IEEE Standard 730-2002 Software Quality Assurance Plans

j. ISO/TR 10013:2001, Guidelines for Quality Management System Documentation

k. MIL-HDBK- 472, Military Standardization Handbook - Maintainability Prediction

l. MIL-HDBK-217F, Reliability Prediction of Electronic Equipment

m. MIL-HDBK-1250A, Corrosion Prevention and Deterioration control in electric components and circuits

n. NASA Fault Tree Handbook with Aerospace Applications (http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf)

o. NASA GB 8719.13, Software Safety Guidebook

p. PRA Procedures Guide for NASA Managers and Practitioners (http://www.hq.nasa.gov/office/codeq/doctree/praguide.pdf)

q. SAE AS9100 Quality Systems - Aerospace - Model for Quality Assurance in Design, Development, Production, Installation and Servicing

r. Telcordia SR-332 Issue 2, Reliability Prediction Procedure for Electronic Equipment

s. MIL-STD-882D, System Safety Program Requirements/Standard Practice for System Safety

t. MIL- HDBK-419A: Grounding Bonding & Shielding For Electronic Equipment

u. ASHRAE - Thermal Guidelines for Data Processing Environments, 2nd edition, ISBN 978-1-933742-46-5

v. NASA-STD-8739.1, Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies

w. NASA-STD-8739.2, Surface Mount Technology

x. NASA-STD-8739.3, Soldered Electrical Connections

y. NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses, and Wiring

z. NASA-STD-8739.5, Fiber Optic Terminations, Cable Assemblies, and Installation

aa. IPC-2221, Generic Standard on Printed Board Design

bb. IPC-2222, Sectional Design Standard for Rigid Organic Printed Boards

cc. IPC-2223, Sectional Design Standard for Flexible Printed Boards

dd. IPC-2225, Sectional Design Standard for Organic Multichip Modules (MCM-L) and MCM-L Assemblies

ee. IPC A-600, Acceptability of Printed Boards (Class 3 requirements)

ff. IPC-6011, Generic Performance Specification for Printed Boards (Class 3 requirements)

gg. IPC-6012, Qualification and Performance Specification for Rigid Printed Boards (Class 3/A requirements)

hh. IPC-6013, Qualification and Performance Specification for Flexible Printed Boards (Class 3 requirements)

ii. IPC-6015, Qualification and Performance Specification for Organic Multichip Module (MCM-L) Mounting and Interconnecting Structures

jj. IPC-6018, Microwave End Product Board Inspection and Test

Section 3 Project Management

This section describes the project management duties.

[SOW 800] The contractor organization performing this effort shall maintain and use Capability Maturity Model® Integration (CMMI-DEV 1.2) Level 3 mature processes in all areas.

3.1 Project Management Office

[SOW 106] The Contractor shall maintain a project management office to manage the technical activities and resources of the SGSS project for the duration of the contract.

[SOW 107] The Contractor's project management office shall be fully responsible for the overall technical performance, resource management, and schedule control of the contractual effort and all subcontracts.

[SOW 108] The Contractor shall appoint a dedicated Project Manager at contract award that will continue through FAR to direct and manage the SGSS project.

[SOW 109] The Contractor's Project Manager shall have responsibility for the overall technical performance, resource management, and schedule management of the contractual effort and all subcontracts.

[SOW 110] The Contractor's Project Manager shall report to a level of company management appropriate to ensure prompt resolution of all problems.

[SOW 112] The Contractor shall prepare a Project Management Plan (CDRL PM-01).

3.2 Resource and Cost Management

[SOW 113] The Contractor shall establish, implement, and maintain a comprehensive resource management system for planning, authorizing, and controlling the total resources effort for each task and for providing visibility into staffing and schedule performance.

[SOW 583] The Contractor shall establish, implement, and maintain a comprehensive cost management system for planning, authorizing, and controlling the total expenditures for each task and for providing visibility into cost performance.

[SOW 584] The Contractor shall prepare and submit supporting Cost Analysis Data Requirement (CADRe) data (CDRL PM-10) as scheduled for all Critical Milestone Reviews (see 3.13.3 Critical Milestone Reviews).

[SOW 585] The Contractor shall prepare and submit NASA 533Q Reports quarterly and NASA 533M Reports monthly in accordance with Financial Management Reports (CDRL PM-12).

[SOW 586] The Contractor shall prepare and submit Weekly Status Reports as described in (CDRL PM-07).

3.3 Schedule Management

[SOW 114] The Contractor shall establish, implement, and maintain an integrated scheduling system consistent with their corporate procedures and documented in the Project Management Plan (CDRL PM-01)

[SOW 115] The Contractor shall provide and maintain an Integrated Master Schedule (IMS) (CDRL PM-03).

[SOW 116] The Contractor shall obtain approval from the Government prior to making any non-administrative changes to the IMS baseline.

3.4 Contract Management

[SOW 117] The Contractor shall provide the necessary resources for monitoring, controlling, executing, and administering the SGSS contract and subcontracts to ensure compliance with all contractual requirements.

3.4.1 Subcontract Management

[SOW 118] The Contractor shall ensure that adequate technical, cost, and schedule oversight of subcontractors is established and maintained.

[SOW 119] The Contractor shall ensure flow down of all Level Three Requirements (with the exception of Earned Value Management (EVM) requirements as noted in [SOW 129]) to all subcontractors.

[SOW 414] The Contractor shall prepare a Subcontract Management Plan (CDRL PM-04).

[SOW 120] The Contractor shall report the status of all subcontracts at each Monthly Project Status Review (MPSR).

[SOW 121] The Contractor shall establish inspection and acceptance testing of subcontractor deliverables as required to meet all contract requirements.

[SOW 122] The Contractor shall ensure that subcontractors have established programs for parts and materials, quality assurance, and configuration management as necessary to meet all contract requirements.

[SOW 415] The Contractor shall periodically audit all subcontractors to ensure that the subcontractors are conforming to the Subcontract Management Plan (CDRL PM-04).

[SOW 416] Any issues or problems with subcontractor performance shall be tracked via the Discrepancy Report (DR) system and reported at MPSRs.

[SOW 523] The Contractor shall make available to the Government all information necessary to determine that the Contractor is in compliance with the Subcontract Management Plan (CDRL PM-04).

3.4.2 Earned Value Management

[SOW 123] The Contractor shall apply the principles and processes of EVM to provide effective and objective technical, schedule, and cost performance measurement.

[SOW 124] The Contractor shall implement an Earned Value Management System (EVMS) that complies with the Industry Guidelines for Earned Value Management Systems (ANSI/EIA-748-A).

[SOW 418] The Contractor shall prepare an EVMS Plan in accordance with (CDRL PM-05).

[SOW 125] The Contractor shall establish the initial Performance Measurement Baseline (PMB) as soon as possible after contract award, but no later than 90 calendar days thereafter.

[SOW 515] The PMB shall cover the entire technical scope of the work on the contract and shall include realistic schedules integrated with the appropriate resources required to accomplish all of the related tasks.

[SOW 126] The PMB and other Integrated Baseline Review (IBR) data will be in accordance with CDRL PM-11 and shall be presented and reviewed at the IBR.

[SOW 127] The Contractor shall obtain prior approval from the Government before adjusting contractual milestones, establishing Over Target Baseline (OTB), or implementing a Single Point Adjustment (SPA).

[SOW 128] The Contractor may adjust cost performance data (Planned Value (PV), Earned Value (EV), or Actual Costs (AC) from prior months only for (a) the correction of administrative errors, (b) routine accounting adjustments, or (c) customer-directed changes. All such prior months adjustments must be implemented in the current month and addressed in that month's Contract Performance Report (CPR) Format 5 narrative.

[SOW 129] The Contractor shall ensure flow down of all EVM requirements to all subcontract tiers with a period of performance greater than one year and greater than $25M value or that have been assigned critical tasks as determined by the Government.

[SOW 419] The Contractor shall ensure that all subcontracts with a period of performance greater than one year and greater than $25M value or that have been assigned critical tasks as determined by the Government report their monthly data for consolidation in the Contractor Performance Report (CPR) submitted to the Government.

[SOW 929] The Contractor shall be responsible for reviewing and assuring the validity of all subcontractors reporting through surveillance and other means.

[SOW 130] The Contractor shall provide monthly Contractor Performance Report CPR (CDRL PM-09).

3.5 Risk Management

[SOW 131] The Contractor shall establish and maintain a Continuous Risk Management (CRM) process.

[SOW 133] The Contractor shall document the project-specific implementation of the CRM process in a project-specific Risk Management Plan (RMP) (CDRL PM-02). Preparation of the RMP is a requirement established by NPR 7120.5D and includes the content shown in NPR 8000.4, "Risk Management Procedural Requirements."

[SOW 525] The Contractor shall establish and maintain a risk database that contains at a minimum a unique risk identifier, risk title, risk description, risk owner, probability and impacts (including technical, safety, cost and schedule), timeframe (in which action need to be taken before risk is manifested into a problem), handling strategy, mitigation plans (including burn down goals) and status.

3.6 Configuration Management

[SOW 138] The Contractor shall perform configuration management (CM) in accordance with GPR 1410.2D, Configuration Management, in support of the SGSS project.

[SOW 139] The Contractor shall develop and deliver the Configuration Management Plan (CDRL CM-01).

[SOW 628] The Contractor shall establish a Configuration Control Board (CCB).

[SOW 141] The Contractor shall maintain configuration of all SGSS deliveries/releases and all other deliverable items throughout all phases of development and test until Final Acceptance Review (FAR).

[SOW 801] The Contractor shall maintain configuration control of all developed software after unit test and all COTS software.

[SOW 802] The Contractor shall maintain configuration control of all hardware items.

[SOW 142] The Contractor shall perform and document configuration verification as sub-systems are incorporated into higher-level systems and at major Project milestones.

[SOW 592] No items under configuration control shall be changed without a CCB-approved Engineering Change Request (CDRL CM-06).

[SOW 524] The CM system shall identify each Engineering Change Request (ECR) as Class I or Class II.

A Class I ECR is a change that:

1. Affects any contract requirement.
2. Affects schedules of deliverables to the Government.
3. Impacts Installation Accountable Government Property (IAGP) and equipment in place (i.e. facilities).
4. Affects configuration to the extent that changes would be required to prior deliverables in order to maintain specified performance.
5. Creates a Single Point Failure possibility.
6. Impacts an external interface.

All other ECRs are Class II.

[SOW 143] All Class 1 ECRs shall be submitted to the Government for approval.

[SOW 144] The Contractor shall submit for Government approval a Waiver Request (CDRL CM-08) for any item that is found to be non-compliant with the contract requirements and is not reworked to be compliant, or is not replaced with a compliant item.

[SOW 145] The CCB status shall be reported at the MPSR.

[SOW 546] The Contractor shall submit CCB Minutes (CDRL CM-05) summarizing the actions of each meeting of the CCB.

3.7 Documentation and Data Management

[SOW 146] The Contractor shall develop, produce, deliver, and maintain all required documentation.

[SOW 593] The Contractor shall maintain a SGSS Document Tree (CDRL CM-02) that indexes all CDRL documents and all Level Three Requirements documents.

[SOW 147] All required documentation shall, at a minimum, be signed by the preparer, the Level 3 Work Breakdown Structure (WBS) element lead, and the project manager or a manager in the project management office who is delegated that responsibility.

[SOW 148] Contractor signatures on delivered documents shall certify review of the document for completeness, correctness, compliance with contractual requirements, proper security classification, proper export control (International Traffic in Arms Regulations (ITAR)/Export Administration Regulation (EAR)) marking, and proper proprietary marking.

[SOW 149] The signature page shall explicitly state that signatures indicate compliance with these requirements.

[SOW 150] All Contractor and subcontractor SGSS-related documentation, data, analysis, Contractor internal communications (including email related to project technical work), schedules, and other information, whether formal or informal, deliverable or not, shall be made available to the Government upon request.

[SOW 835] The Contractor shall deliver updated versions of the Space Network User Guide (450-SNUG) (CDRL MO-05) and the Space Network Handbook (450-HDBK-SN) (CDRL MO-06).

3.7.1 Electronic Access

[SOW 160] The Contractor shall provide to Government personnel remote access to a general purpose SGSS-specific electronic library.

[SOW 161] This library shall contain all completed reports, analyses, requirements documentation, internal technical memoranda, change requests and documentation, CDRLs, action items and status, DRs and all other SGSS-specific documents prepared by the Contractor.

[SOW 162] The Contractor shall maintain an index of the material (updated monthly) and a search engine (updated daily) for document access.

[SOW 945] The non-CDRL material contained in the electronic library shall be in non-proprietary format.

[SOW 164] The Contractor shall include engineering drawings in this library or provide some other storage/retrieval arrangement, at their option.

[SOW 422] All contract data deliverables containing technical information shall be available on-line to all operators and management of the operational ground system.

[SOW 704] The electronic library shall provide email notification capability that allows Government representatives to receive email notifications when documents are posted or updated.

[SOW 679] The electronic library shall provide a separate area where the Government can upload documents for Contractor use.

3.8 Action Item Tracking

Action items are minor issues, problems, and clarifications that arise as part of the ongoing development and acquisition process. They do not represent new or failed requirements, but rather additional work required as part of the ongoing development process to complete an existing task or requirement.

[SOW 155] The Contractor shall develop a closed-loop action item tracking process that includes reporting, analysis, action, and closure.

[SOW 526] Action Items shall be reported in accordance with Action Item (CDRL PM-14).

[SOW 154] The Contractor shall capture all action items assigned by the review boards, at monthly meetings, technical interchange meetings, engineering peer reviews, and working group meetings.

[SOW 157] The Contractor shall provide Government access to the Contractor's action item tracking process, including the ability to remotely view and submit action items, submit comments, submit a recommended priority, search action items, and review status.

[SOW 210] The Contractor shall respond as required to action items assigned by the Government.

[SOW 430] A meeting or event that gives rise to action items shall not be considered complete until all action items have been resolved.

[SOW 527] The status of all open action items, and all action items closed since the previous report, shall be reviewed at each Monthly Project Status Review (see 3.13.5.2 Monthly Project Status Reviews (MPSR)).

3.9 Discrepancy Report Tracking

Discrepancies are significant issues or problems that are identified during the development and acquisition process. If left unresolved a discrepancy would result in a failed requirement, budget or schedule overrun or other significant project impact. A DR (CDRL PM-13) captures the origin and details of a discrepancy and tracks the status and corrective actions to resolve the discrepancy.

[SOW 431] The Contractor shall use a closed-loop DR tracking process that includes reporting, analysis, action, and closure.

[SOW 655] The Contractor shall establish a Discrepancy Review Board (DRB).

[SOW 656] The DRB shall include representatives from the Contractor's System Engineering, Project Management, discipline engineering, and Safety and Mission Assurance.

[SOW 657] A DR shall not be closed until the resolution is reviewed and approved by the DRB.

[SOW 916] Project discrepancies shall be reported in accordance with DR (CDRL PM-13).

[SOW 637] The DR tracking process shall have the ability to filter reports based upon source, severity, status, keyword, element, and module.

[SOW 432] The Contractor shall capture all discrepancy reports that arise from internal processes as well as from the Government.

[SOW 433] The discrepancy tracking process shall include: a protocol to review past performance to determine the incidence of identical or related discrepancies, an escalation procedure (to inform higher levels of management and the Government) based on mission criticality, and a closeout process for root cause determination, anomaly mitigation, and recurrence control.

[SOW 434] The Contractor shall provide Government access to the Contractor's discrepancy tracking process, including the ability to remotely view and submit problems (discrepancy reports), submit a recommended priority for action, search DRs, and review discrepancy status.

[SOW 646] Each discrepancy report shall include a severity from I to IV as defined in table 3.9-1.

Table 3.9-1 Discrepancy Report Severity Levels

Severity Category	Definition
I	Critical: A discrepancy that prevents development progress, test progress or operational use of the SGSS system, or that has direct impact upon the milestone schedules. Discrepancies that prevent the use of a build or release; no work-around is possible or practical.
II	Urgent: A discrepancy that causes the system to fail to meet a critical requirement during operations or test, but which can be handled temporarily with a procedural workaround. Discrepancies that are serious but that do not prevent using or testing a required capability.
III	Routine: A discrepancy that does not cause a requirement failure in test or operations. This category involves minor deviations from task or project standards
IV	All other discrepancies

[SOW 435] Severity I and II discrepancy reports against systems delivered to operational sites shall not be considered resolved until the Government has reviewed and assented to the resolution (see 3.13.5.2 MPSR).

[SOW 634] The Contractor shall provide resolution of any Discrepancy Reports in systems used in operations or independent test in accordance with table 3.9-2.

Table 3.9-2 DR Resolution Timetable

Severity Category	Independent Test System	Operational System
I	Two business days	1 Hour
II	Five business days	Two business days
III	Next release	Five business days
IV	Next release	Next release
V	N/A	N/A

[SOW 932] By Final Acceptance Review (FAR), the Contractor shall transition all Discrepancy Reports from the Contractor's discrepancy tracking system to the WSC operational discrepancy tracking system.

3.10 Government Insight

[SOW 169] The Contractor shall open to Government attendance all Contractor and subcontractor reviews, audits, meetings, tests and other activities within the scope of the contract.

[SOW 171] The Contractor shall notify the Contracting Officer, the Government Resident Office and the Contracting Officer's Technical Representative (COTR) of meetings requiring Government attendance, formal reviews, dry runs for formal reviews, system-level test rehearsals or system-level test events at least 10 working days prior to the event.

[SOW 803] The Contractor shall ensure that all information required for the NASA Software Independent Verification and Validation (IV&V) effort is made available to NASA IV&V personnel.

[SOW 804] The Contractor shall allow NASA IV&V review and participation before final product delivery to the Government.

3.10.1 Government Visitor Support

[SOW 172] The Contractor shall provide facilities to support six (6) simultaneous Government representatives at each site used for element level development, integration or test, including office space, telephones, and network access to the Contractor's electronic database, from contract award through FAR.

[SOW 204] The Contractor shall allow access by the Government to all Contractor facilities used for the development, integration and test of SGSS.

[SOW 680] During major reviews, the Contractor shall provide temporary facilities (including work space, telephones, and broadband network access) to support ten (10) additional Government representatives.

[SOW 173] The Contractor shall allow the government representatives to bring government or support Contractor-owned computers, mobile phones, and personal digital assistants (PDAs) into the office space provided for Government visitor support.

[SOW 174] The Contractor shall provide within this office space high-speed (broadband) Internet access.

[SOW 175] The systems provided for visiting representatives shall include the capability to print from their notebook computers.

[SOW 821] The Contractor shall provide badges, car passes, computer passes, and any other required badging for independent entry and exit to the Contractor's facilities for Government representatives as necessary.

[SOW 176] All badging shall be valid for at least twelve (12) months before revalidation is required.

[SOW 177] If the Contractor requires training for entry into any facilities, the Contractor shall provide the necessary training to government representatives.

[SOW 178] The training requirements for government representatives shall not exceed that required of the Contractor's employees.

[SOW 179] This training shall be provided to government representatives within two (2) weeks of initial request.

[SOW 180] Government representatives shall include government employees or technical support contractors, including but not limited to project management, technical and engineering staff, and operations personnel.

3.11 Contractor Visitor Support

The Government will provide office space, furniture, facilities, networked printers, copier access, facsimile machine access, WSC Library access, phones, and broadband access to the Internet at WSC beginning one (1) month after contract award for two (2) Contractor personnel for the purpose of site survey, coordination with Operations and Maintenance (O&M) personnel, installation coordination, CCB participation, and facilitating on-site activities with the Government representatives. The Government will provide on-site space for additional Contractor personnel beginning one (1) month before the first Pre-Shipment Review.

[SOW 706] The Contractor shall provide resident management and engineering/technical support personnel at WSC starting one (1) month before the first Pre-Shipment Review and continuing through the FAR.

[SOW 707] The Contractor's WSC resident support personnel shall have at least one (1) year's experience of active participation in the development of SGSS.

[SOW 708] The Contractor's WSC resident support personnel shall be responsible for the following types of functions:

- Operational integration of SGSS with other site systems
- Assistance in planning and implementing changes or enhancements to SGSS
- Technical assistance in resolving operational problems and operator problems
- Technical assistance in resolving problems encountered during the development of software
- Assistance in the areas concerning system optimization, system utilization, and use of software development tools provided under this contract
- Installation of the latest releases of system software and software support tools provided under this contract
- Performing implementation planning, plan updates, coordination, and problem resolution activities necessary to successfully execute the I&T, Transition, and Operations Support activities
- General system expertise and technical recommendations

3.12 Project Security

Government project security requirements are conveyed through the contract and applicable documents as listed in Section 2.2.

[SOW 181] The Contractor shall be responsible for employee awareness and compliance with project security requirements.

[SOW 830] All requirements in sections "3.12.2 Personnel" and "3.12.3 Access" of this SOW shall flow down to all subcontractors and subcontractor personnel.

[SOW 197] The Contractor shall treat the SGSS as a "high-impact" resource for system security and system information purposes as defined in Federal Information Processing Standards (FIPS) Publication (PUB) 199 and FIPS PUB 200.

[SOW 626] The Contractor shall provide a Project Security Plan (CDRL PS-07) that details how they plan to address the Operational Security (OPSEC), Physical, Information/Information Technology (IT) as it relates to the protection of NASA Sensitive But Unclassified information (SBU), Personnel, Communications Security (COMSEC) and Industrial Security of the SGSS System and their development facilities.

[SOW 182] The Contractor shall comply with government requirements for industrial, physical, project, personnel, counterintelligence/counterterrorism, and information/information technology security and asset protection (as identified in the Project Security Plan (CDRL PS-07)) during all project phases and at all locations where project work will be performed, including the Contractor's and subcontractor's facilities, during transportation and while at the installation site.

[SOW 195] Any deviations or waivers to the contract security requirements shall be approved by NASA prior to submission to the cognizant agency.

[SOW 193] Security violations shall be reported to the GSFC Chief, Protective Services Division within 48 hours.

[SOW 194] Defense Security Service (DSS) or other government agency findings or direction applicable to Project activities shall be reported to NASA monthly.

3.12.1 Security Plans and Accreditation

[SOW 196] The Contractor shall prepare, submit, and implement an IT System Security Plan (CDRL PS-01).

[SOW 198] The Contractor shall accomplish, document, and submit an IT System Security Assessment (CDRL PS-02).

[SOW 618] The Contractor shall accomplish, document, and submit an IT Security Risk Assessment (CDRL PS-03).

[SOW 199] The Contractor shall prepare, submit, and implement an IT Contingency Plan (CDRL PS-04).

[SOW 200] The Contractor shall support SGSS Certification and Accreditation (C&A) activities and prepare documentation (CDRL PS-05) in accordance with NASA Procedural Requirements (NPR) 2810.1A, Security of Information Technology, Section 14.

[SOW 201] The Contractor shall support the Government's security assessment team during C&A testing.

[SOW 825] The Contractor shall support SGSS Interconnection Security Agreement activities and prepare documentation (CDRL PS-06) in accordance with NPR 2810.1A, Security of Information Technology, Section 9.2.

3.12.2 Personnel

[SOW 183] The Contractor shall maintain a list of personnel (active and inactive) performing work on the SGSS Project and their status with respect to government and contract security screening requirements.

[SOW 184] This list shall be auditable by the government.

[SOW 188] All personnel with access to project technical data, hardware, software, operational areas, or operations products, shall require a positively adjudicated Department of Defense (DoD) collateral Secret clearance.

3.12.3 Access

[SOW 520] All personnel with access to WSC, GRGT and SNE-E shall have US citizenship. Personnel with access to SN sites may not hold dual citizenship.

[SOW 185] All access by Foreign Nationals to controlled areas or systems where SGSS Project work is being performed shall be approved by NASA in advance.

[SOW 186] Project technical data, software, Integration and Test (I&T) facilities, operations areas, and operations products shall be protected per NASA and government requirements as defined in the applicable documents as listed in 2.2.2Requirements and Order of Precedence Section 2.2.

[SOW 187] Access to these articles/areas shall be limited to personnel working the project and cleared per project requirements.

[SOW 189] Access to project information and work areas shall be positively controlled and auditable.

[SOW 203] The Contractor shall obtain all required access authorizations and submit any paperwork required for the Contractor to access Government controlled facilities.

[SOW 522] All Contractor personnel with access to Space Network ground sites shall maintain a DoD Secret clearance unless NASA authorizes a specific exception.

[SOW 521] The Contractor shall obtain GSFC Chief of Security Code 240 approval for all access to foreign locations. This does not apply to the U.S. territory of Guam.

3.12.4 Classification and Marking

[SOW 190] Project Documentation shall be classified and marked in accordance with applicable Security Classification Guides and Export Control Requirements.

[SOW 191] The following project information and data shall be marked and handled as NASA SBU:

1. Ground Software code and images and design documents/information.
2. Operational Procedures and design information, to include databases.
3. System Design and Operational Description information.
4. System/Element/Unit Level performance analyses.
5. Security Plans and Implementation documents, including project access lists
6. Any system vulnerabilities not classified at higher levels.
7. Any information related to the COMSEC design or implementation not classified at higher levels.

[SOW 192] The Contractor shall maintain a list of classified documents generated or held by the project.

[SOW 153] Classified documentation shall be appropriately marked at the time of generation.

[SOW 151] Proprietary markings shall be applied only to pages of documents and/or data which contain actual proprietary information, whether formal or informal, deliverable or not.

[SOW 152] All pages of project data which contain export control (ITAR/EAR) data shall be marked properly at the time of generation of informal data or first release of formal data.

3.12.5 COMSEC

The Government intends to provide as Installation Accountable Government Property (IAGP) all existing TDRS ground COMSEC equipment. The Government also intends to provide as IAGP the COMSEC equipment associated with TDRS K/L. Note that the existing COMSEC equipment supports TDRS operations, and any use by the Contractor of this equipment must not negatively impact ongoing operations (see [SOW 103] and [SOW 709]).

[SOW 202] The Contractor shall comply with all COMSEC requirements related to the development, integration, and testing of SGSS capabilities as specified in NASA Procedural Requirements (NPR) 1600.1, NASA Security Program Procedural Requirements, Section 5.15.

[SOW 840] The Contractor shall provide any additional COMSEC equipment required for the development, integration, test, installation and transition to operations of the SGSS system.

[SOW 528] The Contractor shall implement National Security Agency (NSA)-approved Type 1 encryption and authentication in equipment/physical form.

[SOW 841] The Contractor shall ensure that all new NSA-approved Type 1 cryptographic equipment is compatible with all generations of TDRS spacecraft and SNGS antenna sub-systems.

[SOW 529] The Contractor shall review and provide input to the SGSS Key Management Plan.

The Government will lead development of the SGSS Key Management Plan. NSA will supply the keying material for all COMSEC units. Delivery of keying material is contingent upon NSA approval of the SGSS Key Management Plan.

[SOW 530] The Contractor shall receive a COMSEC briefing prior to access to any COMSEC materials or information.

[SOW 531] The security indoctrination / COMSEC briefing shall be conducted by a NASA authorized security representative, nominally in conjunction with SRR. The indoctrination and/or briefing can occur at the Contractor's facility, WSC, GSFC, or other NASA locations (where deemed appropriate) as long as the GSFC Security Office and the GSFC COMSEC Account Manager are given proof of the indoctrination and/or briefing.

[SOW 533] The contractor shall establish and operate a COMSEC account to support development of command encryption and authentication capabilities. (Note that a COMSEC account can be established upon completion of the security indoctrination / COMSEC briefing and splinter meeting).

[SOW 534] Any deviations or waivers to the Government COMSEC requirements or the NSA's requirements shall be approved by NASA prior to submission to the cognizant agency.

[SOW 627] All handling of SGSS Project cryptographic keying materials (regardless of classification) shall require Two Person Integrity (TPI) procedures.

3.13 Reviews and Meetings

[SOW 417] The Contractor shall provide meeting minutes via email to all meeting participants in compliance with Meeting Minutes (CDRL PM-08).

[SOW 429] Within three (3) days after each required meeting, the Contractor shall place meeting minutes into the electronic library (see 3.7.1 Electronic Access).

[SOW 681] The Contractor shall provide video conferencing capabilities, telephone conferencing, and Internet conferencing at the Contractor's facilities for interaction between the Contractor and the Government.

[SOW 682] Unless otherwise directed by the Government, all reviews and meetings shall be held at the Contractor's facilities.

[SOW 683] The Contractor shall provide all administrative support for reviews and meetings held at the Contractor's facility.

3.13.1 Project Kickoff Meeting

The purpose of the Project Kickoff Meeting is to introduce the Government and Contractor teams, review the Contractor’s approach to developing, integrating and deploying SGSS, and to address any open issues. The Project Kickoff Meeting will be attended by approximately forty (40) Government personnel.

[SOW 641] The Contractor shall conduct a Project Kickoff Meeting no later than two (2) weeks after contract award.

[SOW 642] The Project Kickoff Meeting shall be hosted at the Contractor's facility.

[SOW 705] The Project Kickoff Meeting shall include a line-by-line review of the contract schedule and clauses, Level Three requirements, and CDRL.

3.13.2 Integrated Baseline Review

The IBR is a joint Contractor and Government assessment of the Project Management Plan (CDRL PM-01), and the Integrated Master Schedule (CDRL PM-03). The purpose of the IBR is to confirm that the performance measurement baseline covers the entire technical scope of work, that the work is realistically and accurately scheduled, that the proper amount and mix of resources are assigned to accomplish all contractual requirements, and that both the government and the Contractor understand and mutually agree to the nature and possible impacts of the risks associated with the project baseline.

The IBR process begins with an IBR Kick-Off meeting (usually via a telecon and internet conferencing) six (6) weeks prior to the onsite IBR. Subsequent reviews of the developed schedule baseline and EVM Performance Measurement Baseline (PMB) are conducted remotely (e.g., via telecon) unless difficulties in generating these products are encountered then onsite reviews may be conducted. The IBR process concludes with an onsite IBR.

[SOW 215] The Contractor shall conduct an onsite IBR no later than ninety (90) calendar days after contract award.

[SOW 516] The Contractor shall prepare an IBR Data Package in accordance with CDRL PM-11.

[SOW 216] The IBR contents shall include the EVMS plan (CDRL PM-05), time phased expenditure plan, project management plan, integrated master schedule, resource loading, cost accounts, and work packages.

[SOW 217] The Contractor shall structure all plans, schedules, accounts, loading, and work packages according to the work breakdown structure.

[SOW 218] The IBR shall include a review of the Contractor's earned value assessment and reporting systems to assess system compliance with ANSI/EIA-748-A and the degree to which actual EV utilization tracks with Contractor policies and practices.

[SOW 219] The Contractor shall plan for a four (4) day IBR, not including action item resolution.

[SOW 587] Three (3) weeks prior to the onsite IBR the Contractor shall deliver the Project Manager and Control Account Manager notebooks (with contents as defined in the Contractor's approved EVM system) for review.

[SOW 588] The Contractor shall provide a mechanism for the Government to identify Areas of Concern prior to the onsite IBR.

[SOW 589] At the onsite IBR, the Contractor shall present plans to close all open Areas of Concern. Areas of Concern may be reviewed and closed via telecon prior to the onsite IBR.

3.13.3 Critical Milestone Reviews

Critical Milestone Reviews will be conducted for the purpose of assessing plans and performance at key decision points in the lifecycle. The reviews will be attended by an Integrated Independent Review Team to provide input to decision authorities in making a determination for the recommendation for continuation of the project.

[SOW 559] The Contractor shall provide technical and management leadership and support to all Critical Milestone Reviews.

[SOW 549] The Critical Milestone Reviews shall include only the following sequence of reviews:

Table 3.13-1 Critical Milestone Reviews

Review	Notes

Review	Notes
Systems Requirements Review (SRR)	The SRR examines the functional and performance requirements, the mission architecture, the flow down to all functional elements of the mission and the SGSS Project Plan to ensure that the overall concept is complete, feasible, and consistent with available resources. Systems Requirements Review (SRR) Data Package (CDRL RE-01)
Preliminary Design Review (PDR)	The PDR demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described. Preliminary Design Review (PDR) Data Package (CDRL RE-03)
Critical Design Review (CDR)	The CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test. CDR determines that the technical effort is on track to complete the flight and ground system development and mission operations, meeting mission performance requirements within the identified cost and schedule constraints. Critical Design Review (CDR) Data Package (CDRL RE-06)
Mission Operations Review (MOR)	The MOR establishes the adequacy of plans and schedules for ground systems operations preparation in order to justify readiness to proceed to implement the remaining required activities. The MOR is held to examine mission operations status. It is typically held subsequent to completion of detail design (CDR) but prior to initiation of major integration activities of ground system elements. Missions Operations Review Data Package (CDRL RE-07)
Pre-Shipment System Review(s)	Each Pre-Shipment System Review verifies the completeness of the specific end products in relation to their expected maturity level and assesses compliance to stakeholder expectations. The Pre-Shipment System Review examines the system, its end products and documentation, and test data and analyses that support verification. It also ensures that the system has sufficient technical maturity to authorize its shipment to the designated operational facility or launch site. Pre-Shipment System Review (Preship) Data Package (CDRL RE-10)
Operational Readiness Reviews (ORR)	Each ORR examines the actual system characteristics and the procedures used in the system or end product's operation and ensures that all system and support (flight and ground) hardware, software, personnel, procedures, and user documentation accurately reflect the deployed state of the system. Operational Readiness Review (ORR) Data Package (CDRL RE-12)
Final Acceptance Review (FAR)	The FAR ensures that the deliverable contract end items are in accordance with contract requirements prior to government acceptance. Final Acceptance Review (FAR) Data Package (CDRL RE-13)

[SOW 560] Critical Milestone Reviews shall meet the entrance criteria and success criteria as defined in NPR 7123.1A Systems Engineering Processes and Requirements.

[SOW 842] The Mission Operations Review shall meet the following criteria:

Table 3.13-2 MOR Entrance And Success Criteria

Entrance Criteria	Success Criteria
Mission requirements are fully understood and supported by the operations concept, the ground system architecture, and the organizational and staffing approach. Linkage of mission requirements to the ground system support requirements and subsequent flow-down to performing personnel and elements within the ground system is complete, traceable, and verifiable. Planning is compatible with applicable policies and procedures associated with asset protection considerations. Considerations regarding mission operations personnel are complete with respect to organization, roles and responsibilities, staffing and training. Implementation activity associated with the design and development of mission unique elements as well as the adaptation of institutional elements will meet mission requirements in a timely fashion. Plans for comprehensive verification and validation of ground system elements are complete and include independent execution of mission readiness testing and interactive testing with the flight system. The scope and approach for maintaining appropriate mission system elements (such as flight and ground software) throughout their operational lifetime are well understood.	SNGS requirements are fully linked to SN mission requirements and functionally allocated, traceable and verifiable. Major constraints associated with flight and ground systems have been fully accommodated within the operations concept. Operations Concept Document is complete and baselined. Operations Documentation is complete in preliminary form, including: Operations Handbook (MO-7) Operations and maintenance manual (MO-08) Mission Operations Procedures (MO-09) SN Users Guide (MO-05) SN Users Handbook (MO-06) Requirements Verification Traceability Matrix (SE-07) has been prepared to level 4 Integration and Test Plan – Level 4 (IT-01) has been prepared Personnel and physical security considerations have been defined and are compatible with all applicable requirements. Operations Planning Mission Ops Plans are complete for all routine ops scenarios; areas from which contingency ops requirements will arise are identified. The approach to mission planning and scheduling is fully defined. Preliminary plans for mission routine health and safety monitoring, user services, and contingency, safe-mode, and decommissioning scenarios are complete. Adequate planning has been completed for the successful definition, development, verification, validation and configuration management of all operations procedures. The planned ground software maintenance approach is defined. The development approach for receipt of interim databases and operating procedures from users is defined. The approach for off-line parameter trending is defined. The data archival, retrieval, and reporting approach are defined. Anomaly reporting is integrated into these plans. Operations Team Operations Team roles, responsibilities, staffing levels (including timing of and numbers during initial phase-in as well as for each mission phase), certification requirements, and training approach, are defined.

Entrance Criteria	Success Criteria
	Plans for preparing the MOT for operations through the use of classroom training, mission simulations, flight rehearsals, and network exercises are fully defined. Plans are defined for integrating TDRS experts in a manner that creates a unified mission operations team. Validation activities with the flight system, adequate in both scope and number, are planned prior to shipment to site. Simulations and rehearsals, using the end-to-end flight and ground system and involving the entire mission operations team, are included in these activities. Such tests shall include stress induced operational situations based upon anticipated and unanticipated contingencies and anomalies.

[SOW 826] The Final Acceptance Review shall meet the following criteria:

Table 3.13-3 FAR Entrance and Success Criteria

Entrance Criteria	Success Criteria
1. All validation testing has been completed. 2. Test failures and anomalies from validation testing and operations (if applicable) have been resolved and the results incorporated into all supporting and enabling operational products. 3. All operational supporting and enabling products that are necessary for the normal and contingency operations have been tested and delivered/installed at the sites necessary to support operations. 4. Operations handbook has been approved. 5. Training has been provided to users and operators on the correct operational procedures for the system. 6. Operational contingency planning has been accomplished and all personnel have been trained.	1. The system including any enabling products is determined to be ready to be fully transitioned to the Operations and Maintenance Contractor. 2. All requirements have been met and validated. 3. All applicable lessons learned for organizational improvement and systems operators have been captured. 4. All waivers, action items, and discrepancy reports have been resolved. 5. Systems hardware, software, personnel and procedures are successfully supporting full operations.

[SOW 684] The Contractor shall conduct a dry run of each Critical Milestone Review, with Government representatives in attendance, approximately two (2) weeks prior to the review.

[SOW 685] The Contractor shall plan dry runs to be the same duration as the formal review.

[SOW 686] If the Government determines that delta reviews are required, the Contractor shall conduct such reviews at a time mutually agreed upon by the Government and the Contractor.

[SOW 918] Critical Milestone Reviews shall not be complete until the Government has provided written approval that the review has met its success criteria.

3.13.4 Project Reviews

This section describes other required project reviews.

3.13.4.1 Element-Level Reviews

[SOW 562] The Contractor shall conduct Software Requirements Reviews (SWRR), Preliminary Design Reviews (PDRs) and Critical Design Reviews (CDRs) for all project elements.

[SOW 563] With Government approval, the Contractor shall tailor entrance and success criteria for element-level reviews from the entrance and success criteria defined in NPR 7123.1A Systems Engineering Processes and Requirements.

[SOW 658] The contractor shall submit element SWRR Data Packages (CDRL RE-02), element PDR Data Packages (CDRL RE-04) and Element CDR Data Packages (CDRL RE-05).

3.13.4.2 Development Reviews

[SOW 843] The Contractor shall conduct a System Integration Review (SIR) (Systems Integration Review Data Package, CDRL RE-08) prior to integration of the Elements into the initial instantiation of the System.

[SOW 914] The Contractor shall conduct a Production Readiness Review (CDRL RE-09) before beginning production of any operational custom hardware element where development of multiple or similar systems in a quantity greater than three (3) is required.

[SOW 567] With Government approval, the Contractor shall tailor entrance and success criteria for development reviews from the entrance and success criteria defined in NPR 7123.1A, Systems Engineering Processes and Requirements.

3.13.5 Other Meetings

[SOW 235] In addition to the meetings required in this SOW, the Contractor shall support routine informational meetings and telecons with the government as necessary.

3.13.5.1 Scheduled Weekly Telecons

[SOW 236] The Contractor shall participate in a scheduled weekly telecon with the SGSS Project Office to communicate status, issues, and schedule progress and plans of the overall contract effort.

[SOW 237] The Contractor shall establish the meeting agenda and distribute documentation as required.

[SOW 238] The minimum Contractor attendance shall consist of the Project Manager and Chief Systems Engineer and element technical lead managers as necessary.

[SOW 239] The Contractor shall provide detailed status, description of issues, and schedule for each major element of the contract.

3.13.5.2 Monthly Project Status Reviews (MPSR)

[SOW 244] The Contractor shall participate in face-to-face monthly project status reviews alternating between the Contractor's site and a Government site.

[SOW 245] The Contractor shall assume the Government site for MPSR meetings will alternate between NASA's Goddard Space Flight Center and the White Sands Complex.

[SOW 240] The Contractor shall communicate the status of the SGSS technical effort, schedule, and resource condition to the SGSS Project on a monthly basis.

[SOW 241] The Contractor shall develop and deliver a monthly project status review package, in accordance with CDRL PM-06.

[SOW 242] The monthly project status review package shall include Integrated Master Schedules (IMS) prepared in accordance with CDRL PM-03.

[SOW 246] The Contractor shall participate in splinter meetings with the Government in conjunction with each monthly project status review.

3.13.5.3 Technical Interchange Meetings and Working Groups

Technical interchange and working groups will be necessary to resolve project issues and other topics between SGSS and external organizations. Example groups include (but are not limited to) I&T, External Interfaces, Mission Operations, IT Security, Transition to Operations, User Interface and COMSEC.

[SOW 248] The Contractor shall organize and lead technical interchange and working groups as required to resolve project and technical issues.

[SOW 249] For planning purposes, the Contractor shall assume ten (10) working groups per month, each requiring five (5) person-days support.

3.14 Administrative Duties

This section describes the project administrative duties.

3.14.1 Personnel

[SOW 256] The Contractor shall provide human resources support to maintain a trained staff sufficient to perform all the functions described in this SOW at the required levels.

3.14.2 Inventory Database

[SOW 258] The Contractor shall provide and maintain an Inventory Database (CDRL CM-07).

[SOW 687] The Contractor shall use the Inventory Database (CDRL CM-07) to identify and account for Government property in the possession of the Contractor from the time the property is acquired until it is formally delivered.

[SOW 259] The Contactor shall affix government provided tags on all equipment as directed.

3.14.3 Secretarial, Clerical, and Administrative Support

[SOW 260] The Contractor shall provide any secretarial, clerical, and administrative support required for the execution of the contract.

Section 4 System Engineering

[SOW 261] The Contractor shall perform a fully integrated systems engineering effort in accordance with the Contractor's System Engineering Management Plan (SEMP) (CDRL SE-01).

[SOW 264] The Contractor shall designate a Chief Systems Engineer to conduct and coordinate day-to-day systems engineering activities, oversee implementation of the Systems Engineering Management Plan (CDRL SE-01), and to act as the technical interface with the Government's systems engineering working group.

[SOW 820] The Contractor shall provide a Software and Systems Metrics Report (CDRL SE-17) in accordance with the Systems Engineering Management Plan (CDRL SE-01).

4.1 Requirements Analysis and Allocation

[SOW 265] The Contractor shall identify, derive, develop, and maintain requirements, including traceability and verification approach, necessary to implement a design that meets Government requirements defined in the Level Three requirements.

[SOW 266] The Contractor shall track and log all changes to requirements.

[SOW 267] The Contractor shall conduct analyses and simulations as necessary to fully establish, define, maintain, and control budget allocations for all required performance and design parameters.

[SOW 268] The Contractor shall define its Product Breakdown Structure (PBS) from the System Level (i.e., the total SGSS-delivered system) through major functional elements (e.g., Service Management, Space-Ground Link, etc.) and any applicable lower intermediate levels to the Configuration Item (CI) level.

[SOW 817] The Contractor shall describe its design concept in an Architecture Description Document (ADD) (CDRL SE-11) that addresses functional and physical representations of the system, its interfaces and inter-relationships.

[SOW 629] The Contractor shall prepare and deliver the SGSS technical documents as shown in Table 4.1-1 Technical Document Maturity Requirements.

Table 4.1-1 Technical Document Maturity Requirements

		Requirements	Interfaces	Architecture/Design	ConOps
System Level	Gov't	• System Requirements Document (SRD)	• External IRDs		
	Contractor	• Allocation of SRD requirements to Contractor's Proposed Architecture Element (CDRL SE-11) Preliminary – 90 DACA	• External ICDs (CDRL SE-08); Preliminary - 90 DACA, Final –SRR	• ADD (CDRL SE-11); Preliminary – 90 DACA Final – SRR	• ConOps Document (CDRL SE-03) Preliminary – 90 DACA Final – SRR
Element Level (e.g., Service Mgmt) plus Simulators		• Element Requirements (CDRL SE-04); Final – SRR, Updates –Element PDR • Software Requirements (CDRL SE-05); Preliminary – SRR, Final -SWRR • Element HW Rqmts (CDRL SE-06); Preliminary – SRR, Final - Element PDR	• Internal IRDs (CDRL SE-18); Preliminary – SRR, Final – PDR	• Element Architecture (CDRL SE-11); Preliminary – 90 DACA Final – SRR	• Element Scenarios Defined (CDRL SE-03); Preliminary – 90 DACA, Final – SRR
Intermediate Level(s) - as appropriate		• Sub-Element Requirements, as appropriate to the architecture (CDRLs SE-04, SE-05 and SE-06) Preliminary – SRR, Final – Element PDR		• Sub-Element Architecture to the extent appropriate (CDRL SE-11); Preliminary – SRR Final – Element PDR	
Configuration Item Level		• CI Level Specifications (CDRLs SE-05 and SE-06); Prelim. – Element PDR, Final –Element CDR	• Internal ICDs (CDRL SE-19); Preliminary – PDR, Final – CDR	• Software Design (CDRL SW-03), Database Design (CDRL SW-04), Software Data Dictionary (CDRL SW-05), and Hardware Design (CDRL HW-01); Preliminary Element PDR, Final – Element CDR • Life cycle cost model (CDRL PM-16); Preliminary PDR, Final CDR	• CI Level Scenarios (CDRL SE-03); Preliminary – PDR, Final – CDR • Mission Ops Procedures (CDRL MO-09) Preliminary - SAR, Final ORR

4.1.1 Tools

[SOW 269] The Contractor shall define and deploy, by one (1) month after contract award, a tool for requirement tracking and traceability.

[SOW 633] The requirement tracking and traceability tool shall provide export of the contents of the tool in a format that can be imported by Cradle (http://www.threesl.com).

[SOW 270] The Contractor shall provide remote electronic access to the requirements management tool and all levels of requirements data for Government-designated personnel.

4.1.2 Traceability

[SOW 271] The Contractor shall document the allocation of Government requirements as defined in the Level Three requirements to lower level specifications, showing the traceability of all requirements including performance and design drivers, and explicitly identifying any derived requirements.

[SOW 272] The Contractor shall verify that lower level requirements are fully traceable to higher level requirements.

[SOW 273] The Contractor shall maintain traceability of the requirements to the verification method and specific test event.

[SOW 385] The Contractor shall maintain and update the Requirements Verification Traceability Matrix (CDRL SE-07) to include the status (pass, fail, deferred, etc.) of each requirement throughout the testing phases and various testing activities.

4.1.3 Changes to Requirements

[SOW 274] The Contractor shall work with the COTR and other entities as necessary to resolve any problems/issues associated with the SGSS requirements.

[SOW 276] All changes to the Level Three Requirements shall require Government approval.

4.2 Interface Definition, Allocation, Verification and Control

[SOW 278] The Contractor shall perform all systems analyses and systems engineering to define internal and external interface requirements and develop interface control documents.

[SOW 279] The Contractor shall prepare and deliver updates to the SN External Interface Control Document (CDRL SE-08), SGSS Internal Interface Requirements Document (CDRL SE-18), and the SGSS Internal Interface Control Document (CDRL SE-19).

[SOW 280] The Contractor shall verify and maintain the interfaces defined in CDRL SE-08, CDRL SE-18, and CDRL SE-19 for the duration of the contract.

4.3 Design, Analysis, and Trades

[SOW 282] The Contractor shall perform all Studies and Trades necessary to develop the lower-level requirements and optimize the design of the SGSS.

[SOW 622] All requirement and design studies shall include:

1. Assessments of risks.
2. Assessment of life cycle costs.
3. Potential cost savings achievable by reducing functional and performance requirements.
4. Potential cost savings achievable by increased automation.

[SOW 283] The Contractor shall perform Make vs. Buy trade studies to reduce risk and/or to identify areas where minor to moderate functional and performance requirements changes could result in significant cost savings.

[SOW 284] At a minimum, Make vs. Buy studies shall:

1. Compare lifecycle costs of proposed solutions.
2. Compare functionality and performance of proposed solutions.
3. Assess the risks of both approaches.
4. Identify potential requirements tradeoffs that could be made for the purpose of decreasing total lifecycle costs.

[SOW 818] The Contractor shall document the results of all Technical Studies, Trade Studies and Analyses (CDRL SE-12) performed.

[SOW 819] The Contractor shall prepare and submit a Make vs. Buy Plan (CDRL SE-21) that documents the overall selection and rationale for Make vs. Buy to the Configuration Item Level.

4.3.1 Modeling and Simulation

[SOW 285] The Contractor shall prepare and submit a Modeling and Simulation Plan (CDRL SE-13) describing the planned model capabilities and their use for prototyping, emulation, and/or simulations that will be used to support design, concept validation, verification, integration and test, training, and operations support.

[SOW 659] The Modeling and Simulation Plan (CDRL SE-13) shall include the identification and execution of simulation requirements to support design, development, integration, test, transition and operational requirements

[SOW 286] The Modeling and Simulation Plan (CDRL SE-13) shall describe Contractor plans to integrate, test, validate and utilize the simulators.

[SOW 287] The Contractor shall prepare and submit Modeling and Simulation Analysis reports (CDRL SE-14) documenting the results of the modeling and simulation activities.

4.3.2 Performance Analysis and Budgets

[SOW 295] The Contractor shall develop performance budgets (including data throughput, data latency, and memory utilization), and maintain these through system acceptance.

[SOW 296] The Contractor shall present performance budgets, current margins and trending data at all system and element reviews.

4.3.3 Technical Studies

During the course of this contract, the Government intends to direct the Contractor to undertake various technical studies. Each study will be initiated by written direction from the Government Contracting Officer (CO). The Government will coordinate with the Contractor to define each study in detail, and establish manpower ceilings, performance schedules, and deliverables.

[SOW 836] The Contractor shall conduct the following initial technical studies:

1. SCaN Integrated Service Management (ISM) Study: Provide technical analysis and concept of operations for using the SGSS system to support the SCaN ISM by accommodating the scheduling, allocation, monitor and control of DSN and NEN assets.

The SCaN service-based architecture includes an SGSS user interface incorporating common service and network management to maximize access to all of the SCaN Integrated Network's capabilities via an on-line, electronically accessible interface by which all the service management functions are accessible by the user missions. The SGSS will potentially provide mission users with a set of standard service management functions and will offer these management functions using secure service management interfaces. It has been envisioned that the SGSS perform service management for all of the services provided by the NEN, SN, DSN, Lunar Network, and potentially the Mars Network.

2. Multiple Access (MA) Beacon Study: The contractor shall perform a technical analysis and cost assessment on implementing a continually broadcast MA Forward Beacon with 24x7 availability from each of the three TDRS global locations. The beacon beamwidth shall cover the entire earth plus 1300 km and be identifiable from each TDRS location via a unique Pseudo Noise (PN) code for reception by multiple simultaneous users. The beacon consists of a low rate data message and a PN code for modulation onto a MA Forward signal. The beacon shall include information to aid Global Positioning System (GPS) and TDRSS users in time correlation, navigation, correlated data measurement and analysis, and system health assessment. Beacon message data can come from sources both external and internal to White Sands.

   The contractor shall perform trades to examine alternatives for implementing the broadcast beacon that provide 24x7 global availability of the beacon signal while minimizing or eliminating impacts to other multiple access users. The study shall address maintenance and reliability of the new service and notification to users prior to updates or loss of service.

3. Fast Forward Study: The contractor shall perform a technical analysis and cost assessment on implementing the ability to quickly allocate unused MA Forward beams to a SN user to complement the Demand Access MA Return service. The contractor shall identify the approach to implementing this service including any system implications. The contractor shall assess the need and ability to buffer the forward signal until the MA asset is available, or the user is available. This study shall also include an examination of the applicability of Disruption Tolerant Networking (DTN) to the SN, including the potential application of the associated Consultative Committee for Space Data Systems (CCSDS) Green Book. The contractor shall provide an operations concepts covering this service in the SGSS system.

[SOW 165] The Contractor shall conduct other technical studies and perform selected non-recurring studies related to SGSS as directed by the Government in accordance with the Special Studies procedures stated in this contract.

[SOW 167] The Contractor shall prepare and submit results of Technical Studies (CDRL SE-12).

4.4 System Engineering Reviews and Audits

[SOW 298] The Contractor's system engineering process shall include the reviews listed in Section 3. 13.3: Critical Milestone Reviews, Section 3.13.4: Project Reviews, and this section. Additional reviews that the Contractor deems necessary to successfully execute the project, which do not negatively impact cost and schedule, may be conducted at the Contractor's discretion.

[SOW 301] For all reviews the Contractor's Systems Engineering organization shall ensure that:

1. Content requirements of the review are satisfied.
2. Entry and exit criteria are satisfied.
3. Appropriate notes and action items are recorded.
4. Action items are appropriately closed and the results are captured in the final meeting minutes.

4.4.1 Audits

[SOW 303] The Contractor shall provide access and support for both formal and informal Government audits of the Contractor's activities, processes, products, documentation and data in order to provide assurance to the Government that the project is being implemented according to all requirements and specifications.

4.4.2 Engineering Peer Reviews

[SOW 304] The Contractor shall define and implement a set of Engineering Peer Reviews (EPRs) throughout the development life cycle to identify and address risks, problems, and issues as they arise commensurate with the scope, complexity and acceptable risk of the product.

[SOW 305] The Contractor shall submit an Engineering Peer Review Plan (CDRL SE-09).

[SOW 306] The Contractor shall chair and host EPRs at the Contractor's facilities.

[SOW 613] The Government shall be notified ten (10) days in advance of all Engineering Peer Reviews.

[SOW 623] The Contractor shall provide support for the Government to participate in person or remotely in all EPRs.

[SOW 666] The Contractor shall ensure that peer review teams include technical experts with experience relevant to the technology and requirements.

[SOW 307] The Contractor shall document EPRs in accordance with Engineering Peer Review Data Packages (CDRL SE-16).

[SOW 308] The Contractor shall systematically and comprehensively peer review the product at the individual element level and lower levels, as appropriate. Element and software design reviews are considered to be EPRs and subject to this procedure.

[SOW 309] The Contractor shall conduct peer reviews, as appropriate, over the lifecycle of each element and component, with content consistent with the evolving design and development.

[SOW 310] Applicable peer reviews shall be completed prior to and summarized at the corresponding SGSS milestone review (e.g. CDR). Successful completion of these reviews and resolution of associated technical issues and action items is considered to be an important aspect of entry criteria in the formal review process.

[SOW 311] The Contractor shall also use EPRs for the focused evaluation of concepts, designs, plans and processes associated with combinations of elements and system functions that cross traditional element or discipline boundaries.

[SOW 312] The Contractor shall conduct additional EPRs as directed by the Government.

[SOW 315] For any reuse of heritage software or hardware proposed for use on SGSS, the Contractor shall conduct an EPR to assess its performance and the validity of its use in SGSS.

4.5 Verification & Validation

Validation is the process that shows that the correct requirements and architecture have been defined and meet the mission objectives. Verification show how the requirements are met by the system. In addition to the Contractors Verification and Validation (V&V) efforts, the Government will also conduct independent V&V efforts.

[SOW 844] The Contractor shall verify all requirements.

[SOW 922] The Contractor shall validate each requirement.

[SOW 845] The Contractor shall validate the set of requirements at each level.

[SOW 394] The Contractor shall incorporate Government-provided test data (e.g., recorded TDRS downlink data) in their verification activities.

[SOW 395] The Contractor shall provide test data for Contractor test and verification efforts when such data is not provided by the Government.

[SOW 342] The Contractor shall ensure that all documentation of Contractor V&V efforts are made available to the Government via the electronic library. This includes but is not limited to all reviews and reports, developer plans and procedures, software code, design documentation, and problem reporting data.

4.5.1 Verification & Validation Plan

[SOW 290] The Contractor shall develop a V&V Plan (CDRL SE-02).

[SOW 846] The Contractor shall describe in the V&V Plan (CDRL SE-02) the overall approach for verifying and validating the SGSS requirements including the management and technical approach.

[SOW 847] The Contractor shall describe in the V&V Plan (CDRL SE-02) the verification methods, verification activities, verification reporting, discrepancy reporting, verification roles and responsibilities.

[SOW 848] The Contractor shall provide in the V&V Plan (CDRL SE-02) references to applicable plans, specifications, procedures, and reports that define the technical aspects of the verification program.

[SOW 849] The Contractor shall address in the V&V Plan (CDRL SE-02) any limitations in the ability to verify any performance requirement along with a risk assessment of the limitations in verifying those requirements.

[SOW 850] The Contractor shall include in the V&V Plan (CDRL SE-02) the definition of tests and analyses that collectively demonstrate that the hardware and software/firmware complies with the Level Three requirements.

[SOW 851] The Contractor shall include or reference the Requirements Verification Traceability Matrix (RVTM) (CDRL SE-07), the attributes associated with the RVTM(CDRL SE-07), and describe the process for tracking, controlling, updating the RVTM (CDRL SE-07) in the V&V Plan (CDRL SE-02).

[SOW 852] The Contractor shall include in the V&V Plan (CDRL SE-02) a detailed plan for validating the models and simulations with analysis, measurement, test data or test results.

[SOW 853] The Contractor shall describe in the V&V Plan (CDRL SE-02) the process for updating the analysis with the test results used to verify the requirements.

[SOW 854] The Contractor shall describe in the V&V Plan (CDRL SE-02) how each system at each operational site (WSC, GRGT) will be verified and how the total system (SNGS) will be verified.

[SOW 855] The Contractor shall describe in the V&V Plan (CDRL SE-02) the interaction of test and analysis activities.

[SOW 856] For each analysis activity, the Contractor shall include in the V&V Plan (CDRL SE-02) objectives, a description of the mathematical model, assumptions on which the model is based, required output, criteria for assessing the acceptability of the results, the interaction with related test activity and requirements for reports.

[SOW 857] The Contractor shall describe in the V&V Plan (CDRL SE-02) the process for validating the SGSS for each level in the test program.

4.5.2 Methods of Verification

[SOW 858] The Contractor shall use only the following methods of verification:

Table 4.5-1 Methods of Verification

Test	Measurement of performance to show compliance with specified requirement.
Analysis	Predicted performance using calculations to show compliance with specified performance.
Inspection	Visual proof of existence of specified characteristics or properties.
Demonstration	Observed compliance of functional operation or behavior with that specified.

4.5.3 Software Verification and Validation

[SOW 373] The Contractor shall assure that software fault tolerance and redundancy requirements have been specified, implemented correctly, and verified by testing.

[SOW 375] The Contractor shall establish a repository for software and system metrics to document, monitor, analyze and track software and system metrics during each stage of development and across development and operational phases.

[SOW 376] The Contractor shall include in the software metrics the collection and classification of software defects including design and unit test defects.

[SOW 377] The Contractor shall perform trend analysis on the software defects and make the analysis results available for lessons learned and root cause analysis.

Section 5 Mission Assurance

[SOW 534] The Contractor shall implement a Safety and Mission Assurance program in compliance with the SGSS Mission Assurance Requirements document (see Section 2.2.2).

Section 6 Technology Development

[SOW 640] The Contractor shall develop a Technology Readiness Assessment Report (TRAR) (CDRL SE-20) which provides an evaluation and justification of all the technologies proposed for use in SGSS.

[SOW 368] The Contractor shall develop a Technology Development Plan (CDRL SE-10) for any proposed technology below Technology Readiness Level (TRL) 8 (as defined by NPR 7123.1A - NASA Systems Engineering Processes and Requirements Table G-19 - Technology Readiness Levels) or lower.

[SOW 369] The Contractor shall manage the development of any technologies below TRL 8 to at least TRL 8 and include the development program in their risk management and project reporting activities.

Section 7 Ground System Design and Implementation

7.1 Facilities

The Government will implement any construction modifications to NASA facilities required to implement this contract, based upon the requirements defined by the Contractor and the government in the appropriate engineering change documentation. The Government will also implement any significant configuration changes to NASA facilities, including all work under raised floors, in cable runs, or that impacts existing systems or infrastructure.

[SOW 420] The Contractor shall specify in the Transition Plan (CDRL MO-01) the requirements (power, space, cooling) for modifications or configuration changes to existing NASA facilities (e.g., WSC) or new facilities as necessary to meet the requirements of this contract.

[SOW 930] The Contractor shall prepare the appropriate engineering change documentation to implement the modifications at the NASA facilities.

[SOW 421] The Contractor shall ensure that the facility modification requirements comply with NPR 8820.2E (Facility Project Implementation Guide) and NPR 8820.2F (Facility Project Requirements) for development, design, construction, and activation of SN domestic and non-domestic facilities.

[SOW 925] The Contractor shall deliver, install and configure all new SGSS System equipment.

[SOW 926] The Contractor shall provide all communication cables required for the installation and operation of the SGSS System.

[SOW 831] The Contractor shall support the Government during modifications to existing NASA facilities to accommodate the SGSS System.

[SOW 832] The Contractor shall gain concurrence of the Government for any modification or impact to existing NASA facilities.

7.2 Hardware Design and Construction

[SOW 661] The Contractor shall use Government approved quality control procedures as cited in the SGSS Mission Assurance Requirements (MAR) document.

[SOW 662] The Contractor shall provide all items necessary to ensure proper operation of all hardware provided.

[SOW 688] The Contractor shall create a SGSS Hardware Design Description (CDRL HW-01).

[SOW 689] The Contractor shall create a SGSS Element Hardware Requirements Specifications (CDRL SE-06) and a Hardware Element Design Description (CDRL HW-02) for every element.

[SOW 915] The Contractor shall deliver engineering drawings as necessary (CDRL SE-15).

[SOW 594] The Contractor shall deliver an engineering drawing tree indexing all engineering drawings (CDRL CM-03).

[SOW 660] The Contractor shall use COTS hardware unless the Contractor can demonstrate the lifecycle cost, risk, and technical factors supporting a non-COTS solution are in the best interest of the Government.

[SOW 691] The Contractor shall produce hardware designs with supporting rationale (e.g. documentation, information, analysis, prototype testing, demonstrations, etc) that identify how requirements will be satisfied.

[SOW 692] The Contractor shall identify, conduct and document hardware design trades (CDRL TS-01).

[SOW 693] The Contractor shall characterize design interfaces with their function and performance.

7.2.1 Hardware Test Plan

[SOW 698] To ensure a comprehensive hardware test approach, the Contractor shall prepare a Hardware Test Plan (CDRL HW-03) that describes the total hardware testing program.

7.3 Software Design and Implementation

[SOW 371] The Contractor shall document in the Software Development and Management Plan (SDMP) (CDRL SW-01) the software management approaches and processes for software analysis, design, development, documentation, version control, test, validation, risk management, metric collection, and assurance of all software products.

[SOW 372] The Contractor shall adhere to the SDMP.

[SOW 837] The Contractor shall use Government approved quality control procedures as cited in the SGSS MAR document.

[SOW 694] The Contractor shall create a SGSS Software Design Description (CDRL SW-09) for each software delivery.

[SOW 695] The Contractor shall create a SGSS Element Software Requirements Specifications (CDRL SE-05) and a Software Element Design Description (CDRL SW-03) for every element.

[SOW 663] The Contractor shall employ a source code version control tool to maintain revision control on all software requirements, design, source code, data, and documentation.

[SOW 696] The Contractor shall implement a consistent set of software development tools to support software development for all elements.

[SOW 822] The Contractor shall use Commercial Off-the-Shelf (COTS) software unless the Contractor can demonstrate the lifecycle cost, risk, and technical factors supporting a non-COTS solution are in the best interest of the Government.

[SOW 823] The Contractor shall identify, conduct and document software design trades (CDRL SE-12).

[SOW 824] The Contractor shall produce software designs with supporting rationale (e.g. documentation, information, analysis, prototype testing, demonstrations, etc) that identify how requirements will be satisfied.

[SOW 697] The Contractor shall create a SGSS Database Design Description (CDRL SW-04) for each database incorporated in SGSS.

7.3.1 Software Test

[SOW 436] To ensure a comprehensive software test approach, the Contractor shall prepare a Software Test Plan (CDRL SW-06) that describes the total software testing program.

7.3.2 Software Problem Reporting and Corrective Action

[SOW 379] The Contractor shall provide for a corrective action process that tracks every software nonconformance to its final disposition.

[SOW 378] The Contractor shall create Discrepancy Reports (DRs) (CDRL PM-13) to identify, classify, track, report and correct software non-conformances and software test failures throughout the development lifecycle.

7.4 Simulator Development and Implementation

The Government seeks to ensure that simulators used to verify or validate the SGSS system are designed and developed independent of the rest of the SGSS ground system. This section of the SOW applies to the simulators used to verify or validate the SGSS ground system.

[SOW 805] The Contractor shall treat the simulators as separate element(s) of the SGSS architecture with all the required element level CDRLs and reviews.

[SOW 806] The Contractor shall use an independent development process for the mission simulators.

[SOW 807] The mission simulator development team shall receive only requirements, functional specifications, and interface definitions from the rest of the Contractor's team.

[SOW 808] The mission simulator development team shall have no access to design, documentation, algorithms, code or data developed by the rest of the Contractor's team.

[SOW 811] The mission simulator development team shall interact independently with the Government to refine requirements, gather necessary information, etc., as needed.

[SOW 933] The Contractor shall include a separate section for the simulators in the following CDRLs: PM-01 (Project Management Plan), PM-03 (Integrated Master Schedule), CM-01 (Configuration Management Plan), SE-01 (Systems Engineering Management Plan), SE-02 (SGSS Verification and Validation Plan), SW-01 (Software Development and Management Plan), IT-01 (Integration and Test Plan), MA-01 (Mission Assurance Implementation Plan), MA-02 (Software Quality Assurance Plan), TR-01 (Training Plan), MO-02 (Maintenance and Sustainment Plan), MO-08 (Operations and Maintenance Manual), MO-11 (Computer Programming Manuals).

[SOW 934] The Contractor shall include relevant simulator information in other CDRLs as appropriate for an element of the SGSS architecture.

7.5 Technology Refresh

[SOW 668] The Contractor shall implement the Technology Refresh and Sparing Plan contained in the Logistics Plan (CDRL MO-04) for the Period of Performance of this contract.

Section 8 Systems Integration, Test and Installation

[SOW 232] The Contractor shall conduct data reviews following completion of each test event to ensure that the test data verifies required performance/functionality and to review all anomalies.

[SOW 459] The Contractor shall test IAGP (see IAGP Section 12) that has been integrated into the SGSS system in order to support verification and acceptance (e.g., operational and test antennas).

[SOW 463] The Contractor shall be responsible for implementation of a full integration, test and installation program.

[SOW 669] The Contractor shall be responsible for ensuring the performance and readiness of the SGSS for satellite operations.

[SOW 670] The Contractor shall provide all necessary hardware and software to accomplish integration and testing at the factory.

[SOW 672] The Contractor shall test any reused or heritage hardware or software to verify that it meets the requirements of the SGSS system.

[SOW 859] The Contractor shall incrementally verify functionality and performance beginning at the unit level and continuing through the buildup of the SGSS system, transition into operations and culminates in the FAR.

[SOW 860] The Contractor shall allow the Government to witness any test.

[SOW 861] While at the operational sites or operational facilities, the Contractor shall abide by the policies and procedures applicable to conducting business in the operational environment of SNGS.

8.1 I&T Management

[SOW 383] The Contractor shall ensure that test personnel attend and participate as necessary in all reviews throughout the period of performance, including requirements, architecture, and design reviews.

[SOW 387] The Contractor shall create DRs (CDRL PM-13) to identify, track and resolve any integration or test problems, starting at PDR and continuing through integration and test and operations and sustainment.

[SOW 388] The Contractor shall perform the necessary changes to resolve integration and test problems.

[SOW 671] The contractor shall ensure that the I&T Plan (CDRL IT-01), V&V Plan (CDRL SE-02) and Transition Plan (CDRL MO-01) are consistent and provide a complete set of activities necessary to deploy, install, and ensure readiness of the SGSS to support operations.

[SOW 709] The Contractor shall conduct all installation and testing activities without negative impact to ongoing operations, unless previously coordinated with, scheduled with and approved by the Government.

8.2 Integration and Test Plan

[SOW 392] The Contractor shall prepare, submit, and implement an I&T Plan (CDRL IT-01) addressing all integration and test activities.

[SOW 398] The Contractor shall coordinate post-test analysis to develop requirements verification status, discrepancy resolution, and consolidated test results.

[SOW 862] The I&T Plan (CDRL IT-01) shall define the overall strategy for testing the SGSS system.

[SOW 863] The I&T Plan (CDRL IT-01) shall include the test approach, types of tests, pass/fail criteria, decision process, and control milestones for proceeding to the next test.

[SOW 864] The I&T Plan (CDRL IT-01) shall summarize all tests and analyses that will be performed at each level.

[SOW 865] The I&T Plan (CDRL IT-01) shall describe how the I&T program will be managed and staffed.

[SOW 866] The I&T Plan (CDRL IT-01) shall include a schedule for test execution including the location and types of tests for the SGSS.

8.3 Test Levels

This section defines the required Contractor test levels and associated products. There are six (6) levels of test as defined in table 8.3-1.

Table 8.3-1 Test Levels

Test Level	
1	Unit
2	Sub-element
3	Element
4	System
5	On-Site System
6	Transition

[SOW 867] The Contractor shall plan, manage, and execute all levels of testing to ensure that the SGSS System meets the requirements in the operational environment.

[SOW 868] The Contractor shall develop Test Plans (CDRL IT-02), Test Procedures (CDRL IT-03), and Test Reports (CDRL IT-04) for all tests at all levels of testing and make these available for Government audit. For Levels 1-3, Test Procedures and Test Reports are not deliverable documents but shall be available upon request.

[SOW 869] Before beginning Level 4, Level 5 or Level 6 test, the Contractor shall conduct a Test Readiness Review (CDRL RE-11).

[SOW 870] Before beginning Levels 1-3 test, the Contractor shall conduct an informal review to ensure that the test level entrance criteria have been met and document the results for Government review.

[SOW 871] The Government shall be invited to participate in the Level 1-3 test entrance criteria review.

[SOW 872] No commands shall be sent to TDRS without approval by the Government.

[SOW 873] A Certified Operator shall execute all commanding to TDRS. Certified Operators will be provided by NASA.

[SOW 874] For each test conducted at the operational site, an informal review of the test plans, test procedures and test reports shall be conducted.

8.3.1 Level 1: Unit Tests

[SOW 878] The Contractor shall conduct unit level tests to verify all unit-level requirements. For COTS products, review of the supporting vendor test documentation is sufficient if the vendor test documentation is submitted as part of the unit Test Plan (CDRL IT-02).

[SOW 879] The Contractor shall perform verification of Level Three requirements at the unit level only where verification at a higher level is not feasible.

8.3.2 Level 2: Sub-Element Tests

Sub-element level testing occurs after the integration of all individual hardware and software units into the sub-elements. External simulators and stimuli may be used to simulate external interfaces.

[SOW 880] The Contractor shall conduct sub-element level tests to verify all sub-element level requirements.

[SOW 881] The Contractor shall perform verification of Level Three requirements at the sub-element level only where verification at a higher level is not feasible.

8.3.3 Level 3: Element Tests

Element level testing occurs after the integration of all individual hardware and software sub-elements into the element. External simulators and stimuli may be used to simulate external interfaces.

[SOW 882] The Contractor shall conduct element level tests to verify all element-level requirements.

8.3.4 Level 4: System Test at Contractor Site

[SOW 441] The Contractor shall test software to be delivered on an environment that is, with respect to function, configuration, and complexity, representative of the operational environment, to support determination of readiness for site installation.

[SOW 883] Level 4 test shall verify all system level requirements to the extent feasible using simulators or real data for external interfaces.

[SOW 884] The Contractor shall verify all element to element interface requirements in Level 4 test.

[SOW 885] Level 4 test shall be conducted using operational hardware.

[SOW 886] The Contractor shall show system level functionality and performance in Level 4 test.

[SOW 887] The Contractor shall integrate elements into a complete system for the purpose of performing SGSS system level tests.

[SOW 889] Following completion of the Level 4 tests, the Contractor shall disassemble, pack, and ship the equipment to the site(s) where it will be installed.

8.3.5 Level 5: On-site Integration & Test

[SOW 890] The Contractor shall be responsible for preparation, management, and execution of all Level 5 system tests.

[SOW 891] After reassembly of the equipment at the operational site, the Contractor shall conduct post-ship tests to re-verify system functionality and integrity.

[SOW 892] The Contractor shall ensure that all necessary spares, test equipment, simulators, and maintenance equipment are available at the operational site for use during testing.

[SOW 893] During level 5 tests, the Contractor shall verify all system level requirements and external interface requirements (e.g., SGSS System to User functional, performance and interface requirements, SGSS System to FDF functions and performance, scheduling services, etc.).

[SOW 894] When the legacy antenna(s) is available, the Contractor shall modify the legacy antenna(s), verify that the antenna is ready for operations, and conduct an ORR before using that antenna in operations.

[SOW 895] During Level 5 tests, the Contractor shall incrementally demonstrate SGSS System capability (functional, performance, interface) by first using the test antennas, user simulator antennas, ground antennas and the collimation tower.

[SOW 896] In parallel with on-going legacy operations, the Contractor shall demonstrate the SGSS System capability to shadow user return services, including TDRS command and control.

8.3.6 Level 6: Transition

[SOW 456] The Contractor shall prepare and submit ORR Data Package(s) (CDRL RE-12).

[SOW 457] The Contractor shall conduct an ORR after the completion of Level 6 testing and prior to transitioning any part of the SGSS system to operations.

[SOW 897] The Contractor shall be responsible for preparation, management, and execution of all Level 6 tests.

[SOW 898] The Contractor shall develop a sequential plan for transitioning each ground antenna into operations for all ground terminals.

[SOW 899] During Level 6 test, the Contractor shall use full, two-way interfaces with operational systems for verification and validation.

[SOW 900] In Level 6 testing, the Contractor shall demonstrate the SGSS System End-to-End capability to control and monitor a TDRS using a ground antenna and a TDRS.

[SOW 901] In Level 6 testing, the Contractor shall demonstrate the SGSS System End-to-End capability to control and monitor a TDRS using a ground antenna, a TDRS and a user simulator antenna(s).

[SOW 902] In Level 6 testing, the Contractor shall demonstrate the SGSS System End-to-End capability to control and monitor a TDRS using a ground antenna, a TDRS and a real user.

[SOW 903] Following ORR, the Contractor shall coordinate with the COTR to schedule and execute any remaining verification and validation activities that require using the transitioned system.

[SOW 904] For thirty (30) calendar days following successful completion of ORR, the Contractor shall provide continuous (24x7) operations support to the O&M Contractor for the transitioned system.

[SOW 905] Upon completion of all Level 6 testing at all operational sites, all of the following shall have been tested: control and monitor of all TDRS generations, all ground antennas, all local interfaces, all NISN and external interfaces, all user services, all control centers, all equipment and site redundancy, all failover scenarios, all external resources (e.g., ATF, DSN, NEN), all performance testing including loading & throughput.

8.4 External Interface Testing

[SOW 437] The Contractor shall support interface testing and test data requests from external interface organizations as approved by the Government.

[SOW 438] The Contractor shall perform testing in conjunction with external organizations to verify external interface functions and performance.

[SOW 673] The Contractor shall work with the SGSS Project to identify and execute early interface compatibility testing.

8.5 Site Preparation

[SOW 443] The Contractor shall create a Transition Plan (CDRL MO-01).

[SOW 444] The Contractor shall identify, document, and justify in the Transition Plan (CDRL MO-01) all facility requirements (including a schedule and any required deadlines) to implement the SGSS System design including, but not limited to:

1. Floor space
2. Heating, Ventilation, and Air Conditioning (HVAC)
3. Power
4. Safety
5. Security
6. Existing hardware/software.

[SOW 445] The Contractor shall recommend solutions in the Transition Plan (CDRL MO-01) for any shortfalls in required versus available facility and infrastructure resources.

[SOW 827] The Contractor shall perform surveys of operational sites as necessary.

8.6 Site Installation

[SOW 447] The Contractor shall coordinate all site installation and checkout activities, schedules and procedures with the COTR.

[SOW 448] The Contractor shall install the SGSS system at each operational site, after ensuring, prior to each installation, that the site is ready.

[SOW 450] The Contractor shall perform all installation work in accordance with industry codes and ordinances.

[SOW 699] The Contractor shall obtain Government approval for activities at any Government site in advance of the need date.

[SOW 700] To support installation the Contractor shall:

1. Prepare, submit, and implement an Installation Plan (CDRL MO-13).
2. Prepare and submit Release Package (CDRL MO-14).

Section 9 Independent Test

The Government intends to conduct independent tests of the SGSS system. The timing and extent of the independent test effort will be determined based upon the Contractor's proposed solution and transition plan.

[SOW 702] The Contractor shall coordinate usage schedules for the MTF and all installed components with the Government to ensure that there is sufficient availability for independent test activities.

[SOW 813] A Contractor point of contact (POC) shall be assigned and available to independent test personnel, as required, for questions, clarification, and status meetings. For planning purposes, assume a level of effort equal to four hours per week by a senior systems engineer.

Section 10 Mission Operations and Maintenance

10.1 Concept of Operations

[SOW 472] The Contractor shall perform all work necessary to develop the SGSS Project concept of operations for all phases and modes, derive requirements for operational products, and to develop, verify and deliver all required operational products.

[SOW 473] The Contractor shall prepare and submit (CDRL SE-03) a SGSS Concept of Operations (ConOps).

[SOW 474] The Contractor shall develop all normal, maintenance, and contingency operations procedures and products required for NASA to operate the SGSS system following acceptance.

[SOW 514] The Contractor shall prepare and submit Mission Operations Procedures (CDRL MO-09) including operational, maintenance, and contingency procedures.

[SOW 517] The Contractor shall develop a Operations Handbook (CDRL MO-07) and an Operations and Maintenance Manual (CDRL MO-08).

[SOW 625] The Contractor shall cooperate and coordinate with the WSC O&M Contractor staff on the development of all operational products.

10.2 Transition to Operations

While SGSS installation, integration, and testing are part of achieving operational readiness, the Transition to Operations classification includes the remaining efforts: the non-I&T activities that lead to full operational readiness and all sustainment activities following the transition to operations. Transition to Operations encompasses operator training and certification, , mission simulations and rehearsals, shadow operations and flight and ground operations. The SGSS System FAR is the culmination of all SGSS Transition activities that lead up to the transfer of the SGSS System and associated infrastructure and support components, to the Operation and Maintenance contractor for full SN operations. Upon completion of a successful FAR, all overall responsibility is transferred to NASA (Space Network). The Contractor support to these Government activities includes the following:

[SOW 468] The Contractor shall implement the transition to operations according to the Transition Plan (CDRL MO-01).

[SOW 471] The Contractor shall assist in transitioning sustainment skills to Government designated staff.

[SOW 573] The Contractor shall transition the SGSS system into operations without any negative impact to planned, scheduled or ongoing operations, unless coordinated with, scheduled with, and approved by the Government.

[SOW 575] The contractor shall not transition any equipment at GRGT until the successful completion of at least one ORR at WSC.

[SOW 576] The Contractor shall ensure the capability to operate indefinitely at any step in the transition.

[SOW 577] The Contractor shall ensure that no SNGS legacy operational capabilities are lost or degraded as a result of transitioning SGSS System capabilities to operations.

[SOW 578] The Contractor shall cooperate and coordinate with the WSC O&M Contractor staff on the development of all operational basic Graphic User Interface (GUI) designs.

[SOW 579] At least two weeks prior to PDR, the Contractor will present draft operational basic GUI mockups to the WSC O&M Contractor for comment and feedback.

[SOW 580] At least two weeks prior to CDR, the Contractor will present final operational basic GUI mockups to the WSC O&M Contractor for comment and feedback.

[SOW 632] The Contractor shall prepare and submit a plan for software maintenance which identifies the hardware, software and other resources needed for life cycle support of the deliverable software as part of the Maintenance and Sustainment Plan (CDRL MO-02).

[SOW 644] As part of the Operations Handbook (CDRL MO-07), the Contractor shall provide a mapping of all existing SNGS operational procedures to SGSS System procedures.

[SOW 645] The Contractor shall convert all existing SNGS spacecraft operational data to the SGSS system.

[SOW 675] The Contractor shall convert existing SNGS ground system operational data related to reused or heritage components to the SGSS system.

[SOW 676] The Contractor shall verify that all converted operational data provides accurate trending and analysis results.

[SOW 678] The Contractor shall ensure the capability to revert to the last stable operations environment at any time during transition.

[SOW 710] The Contractor shall plan to install and test one SGL antenna system at a time, unless otherwise approved by the Government.

[SOW 828] The Contractor shall convert any SNGS ground system discrepancy reports related to reused or heritage components to the SGSS system.

[SOW 906] The Contractor shall preserve two operational legacy SGLTs until after the launch of TDRS-K, currently scheduled for 2012.

[SOW 907] The Contractor shall convert all existing SNGS spacecraft command procedures to the SGSS system.

[SOW 908] The Contractor shall verify and validate all converted spacecraft command procedures, ensuring that the output of the new spacecraft command procedures are identical to the existing spacecraft command procedures, including identity of commands, sequence of commands, timing of commands, etc.

[SOW 913] Reserved.

[SOW 944] The Contractor shall ensure that a spare operational antenna is available at WSC at all times during transition.

10.3 Acceptance

[SOW 614] Final acceptance of the SGSS system shall occur upon the successful completion of the Final Acceptance Review (FAR).

10.4 Maintenance

[SOW 475] The Contractor shall perform all maintenance for all delivered, operational items through FAR.

[SOW 476] The Contractor shall resolve discrepancies identified and assigned to the Contractor, based on Government designated priority, through the Period of Performance.

[SOW 477] The Contractor shall perform maintenance and upgrades with Government coordination on a non-interference basis with operations.

[SOW 478] The Contractor shall support maintenance of operational interfaces.

[SOW 479] The Contractor shall contract for technical support as needed from third party vendors.

[SOW 480] The Contractor shall maintain and provide to the Government a complete list of all third party maintenance or technical support contracts and agreements associated with the delivered SGSS system.

[SOW 481] The Contractor shall prepare, submit, and implement a Maintenance and Sustainment Plan (CDRL MO-02).

[SOW 482] The Contractor shall prepare and submit Maintenance Records (CDRL MO-03).

[SOW 483] The Contractor shall prepare and submit Software Maintenance Manuals (CDRL SW-07).

[SOW 829] The Contractor shall prepare and submit Hardware Maintenance Manuals (CDRL HW-04).

10.4.1 Hardware Maintenance

[SOW 485] The Contractor shall perform hardware maintenance, including repair, on all equipment procured by this contract through FAR.

[SOW 487] At each operational site, the Contractor shall provide all general purpose electronic diagnostic test equipment, special purpose test equipment (unique to SGSS System), tools, instructions, documentation, non-expendable resources, and all other items (such as specialized connectors, fixtures, power supplies, etc.) that are not included as part of the operational systems, but are required to perform maintenance of the SGSS System at that site.

10.4.2 Software/Firmware Maintenance

[SOW 489] The Contractor shall perform software/firmware maintenance required to meet the operational availability requirements of the system.

[SOW 490] The Contractor shall provide in the Maintenance Training Facility (MTF) all source software code, compilers, compiler procedures and COTS software required to recreate the baseline software configuration.

[SOW 491] The Contractor shall retain full responsibility for software/firmware maintenance of all modules through FAR.

10.5 Sustaining Engineering

[SOW 484] The Contractor shall provide resources to conduct an orderly transition of sustaining engineering knowledge, processes, and tools to the Government or to a successor Contractor, beginning twelve (12) months prior to the end of the Period of Performance.

[SOW 492] The Contractor shall perform tasks relating to the continued operational support of the SGSS System, as authorized by the Government and in accordance with Contract Clause C.3, Task Ordering Procedure.

[SOW 615] For the period beginning with the FAR until the end of the Period of Performance, the Contractor shall provide sustaining engineering support to the SGSS system in accordance with the Maintenance and Sustainment Plan (CDRL MO-02).

[SOW 909] The Contractor shall maintain at Contractor facilities all the capabilities, tools and equipment required to support the sustaining engineering effort.

The Government will direct the Contractor to perform sustaining engineering tasks. Each task will be initiated by written direction from the Government Contracting Officer. The Government will coordinate with the Contractor to define each task in detail, and establish manpower ceilings, performance schedules, and deliverables.

For informational purposes, these Government-initiated tasks are expected to include the following types of tasks:

1. Support operations of the SGSS System. This support could include but is not limited to supplying technical expertise to perform analyses, to review data, or to review changes to documentation.

2. Investigate anomalies of the SGSS System and provide recommendations for resolution.

3. Provide updates to SGSS software to provide new or improved capabilities requested by the Government, including technical documentation, familiarization, installation procedures, validation procedures and back-out procedures.

[SOW 923] For critical anomalies (ones which impact mission success), the Contractor shall acknowledge notification of the anomaly and provide an initial action plan within twenty-four (24) hours of notification by the Government.

[SOW 931] The SN ground system shall provide on demand or scheduled return and forward services with a proficiency of at least 99.9%. Proficiency for a given time period is defined as: the amount of time scheduled for User events (sched_t) minus the amount of User event time lost for the system (lost_t) then divided by the amount of time scheduled for User events (proficiency = (sched_t-lost_t)/sched_t).

10.6 Logistics Support

[SOW 493] The Contractor shall conduct and submit a Logistics Analysis and Support Plan (CDRL MO-04) of the system's logistic requirements to meet operational availability and other performance requirements.

[SOW 494] The Contractor shall base the Logistics Analysis on detailed failure tracking, reliability assessments, performance, and projection of future risk of failures.

[SOW 496] The Logistics Analysis and Support Plan (CDRL MO-04) shall consider the utilization of the existing site logistics services.

[SOW 497] The Contractor shall procure spare equipment as identified in the Logistics Analysis and Support Plan (CDRL MO-04).

[SOW 498] The Contractor shall implement any needed procedures or measures as identified in the Logistics Analysis and Support Plan (CDRL MO-04).

Section 11 Training and Documentation

[SOW 501] The Contractor shall provide training for applicable personnel, who perform spacecraft mission operations and maintenance, scheduling, engineering, ground hardware/software maintenance, and help desk services, and training of operations and maintenance personnel in accordance with the SGSS Training Plan (CDRL TR-01).

[SOW 503] During the development phase, the Contractor shall conduct preliminary training courses to prepare Government and Contractor personnel for integration and test activities involving the system.

[SOW 504] The Contractor shall provide training and Training Documentation (CDRL TR-02) that covers all aspects of the system including, at a minimum:

- Newly deployed hardware/software
- Modifications to existing hardware/software, and rationale for changes
- New and modified interfaces
- Operations procedures
- Contingency/anomaly response procedures

[SOW 505] The Contractor shall provide a mixture of classroom presentation, computer based training, and hands-on training activities.

[SOW 703] Training shall take place at the Contractor facility, GRGT, and WSC.

[SOW 508] The Contractor shall provide audio and video recordings of all training classes as part of the Training Documentation (CDRL TR-02).

[SOW 509] The Contractor shall prepare and submit a System Wall Chart (CDRL TR-03).

[SOW 510] The Contractor shall prepare and submit Manuals including:

1. Software User Manuals (CDRL SW-08)
2. Hardware User Manuals (CDRL HW-05)
3. Computer Operations Manuals (CDRL MO-10)
4. Computer Programming Manuals (CDRL MO-11)
5. Firmware Support Manuals (CDRL MO-12)

Section 12 Installation-Accountable Government Property

The Government property described in the List of Installation-Accountable Government Property (IAGP) will be made available to the Contractor on a no-charge basis for use in performance of this contract.

[SOW 582] IAGP shall be utilized only within the physical confines of the NASA installation that provided the property.

[SOW 583] The Contractor shall establish and adhere to a system of written procedures for holding employees liable, when appropriate, for loss, damage, or destruction of Government property.

[SOW 910] The Contractor shall coordinate usage of IAGP with the Government.

Section 13 Options

13.1 Contract Option 1 - Remote Backup SNOC

Option 1 of this contract concerns the design and implementation of Remote Backup Space Network Operations Center (RBSNOC) systems. The RBSNOC will use the existing operational S & Ku Band SGL antennas and COMSEC equipment. No test services will be provided. The government will provide a facility at the Goddard Space Flight Center for the installation of the RBSNOC systems.

[SOW 595] The Contractor shall be responsible for the design and implementation of the RBSNOC systems.

[SOW 620] The Contractor shall prepare an Option Management and Implementation Plan (CDRL PM-15).

[SOW 600] The Contractor shall deliver to the Government all operational RBSNOC hardware and software.

[SOW 601] The Contractor shall deliver to the Government operations procedures for the RBSNOC.

[SOW 602] The Contractor shall deliver to the Government documentation and user's manuals for the RBSNOC.

[SOW 605] The Contractor shall provide initial training on the operation of the RBSNOC system to a maximum of twenty (20) Government representatives.

[SOW 606] The Contractor shall support the Government during the installation and initial checkout of the RBSNOC.

[SOW 935] The RBSNOC shall allow remote control of any available SN resource.

[SOW 936] The RBSNOC shall provide functions to maintain TDRS health and safety.

[SOW 937] The SGSS System shall support transfer of primary SN operations to the RBSNOC within 5 minutes of initiation of transfer.

[SOW 938] The RBSNOC shall provide functions to manage and schedule User Services, where SN resources are operational to provide User Services, at SNE-E, GRGT and WSC.

[SOW 939] The RBSNOC operator workspace shall be functionally equivalent to the primary SNOC operator workspace.

13.2 Contract Option 2 - SNE East Upgrade

Option 2 of this contract concerns the design, implementation and installation of an SGSS system to provide the full SNGS User Service capability at SNE East Blossom Point, Maryland. This option, if executed, will replace the SGSS Interface [SOW 554].

[SOW 607] The Contractor shall be responsible for the design, implementation and installation of an SGSS system that meets all of the level three requirements at SNE East Blossom Point.

[SOW 608] The SNE East SGSS system shall be fully integrated into the overall SGSS architecture.

[SOW 621] The Contractor shall prepare an Option Management and Implementation Plan (CDRL PM-15).

[SOW 610] The Contractor shall provide initial training on the operation of the SNE East SGSS system to a maximum of twenty (20) Government representatives.

Appendix A Acronyms

Acronym	Description
AC	Actual Costs
ADD	Architecture Description Document
ATF	Australian TDRS Facility
BRTS	Bilateration Ranging Transponder System
C&A	Certification and Accreditation
CADRe	Cost Analysis Data Requirement
CCB	Configuration Control Board
CCSDS	Consultative Committee for Space Data Systems
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CI	Configuration Item
CIIL	Configuration Item Identification List
CM	Crew Module
CO	Contracting Officer
COMSEC	Communications Security
CONOPs	Concept of Operations
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off The Shelf
CPR	Contract Performance Report
CRM	Continuous Risk Management
CSOPs	COMSEC Standard Operating Procedures
DACA	Days after contract award
DR	Discrepancy Report
DRB	Discrepancy Review Board
DSN	Deep Space Network
DSS	Defense Security Service
DTN	Disruption Tolerant Networking
DoD	Department of Defense

Acronym	Description
EAR	Export Administration Regulation
ECR	Engineering Change Request
EPR	Engineering Peer Review
EV	Earned Value
EVM	Earned Value Management
EVMS	Earned Value Management System
FAR	Final Acceptance Review
FDF	Flight Dynamics Facility
GFP	Government Furnished Property
GPR	Goddard Procedural Requirements
GRGT	Guam Remote Ground Terminal
GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
I&T	Integration and Test
IAGP	Installation Accountable Government Property
IBR	Integrated Baseline Review
ICD	Interface Control Document
IDD	Interface Definition Document
IMS	Integrated Master Schedule
IONet	Internet Protocol Operational Network
IRD	Interface Requirements Document
ISM	Integrated Service Management
ITAR	International Traffic in Arms Regulations
IV&V	Independent Verification and Validation
LEO	Low Earth Orbit
MA	Mission Assurance
MAR	Mission Assurance Requirements
MOR	Mission Operations Review
MPSR	Monthly Project Status Review
MSE	Mission Systems Engineer
MTF	Maintenance Training Facility
NEN	Near Earth Network

Acronym	Description
NIC	Network Integration Center
NISN	NASA Integrated Services Network
NISPOM	National Industrial Security Program Operating Manual
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement
NSA	National Security Agency
O&M	Operations & Maintenance
OPSEC	Operational Security
ORR	Operational Readiness Review
OTB	Over Target Baseline
PBS	Product Breakdown Structure
PDA	Personal Digital Assistants
PDR	Preliminary Design Review
PMB	Performance Measurement Baseline
PN	Pseudo-Noise
POC	Point of Contact
PRESHIP	Pre-Shipment System Review
PUB	Publication
PV	Planned Value
RBSNOC	Remote Backup Space Network Operations Center
RF	Radio Frequency
RFP	Request for Proposal
RMP	Risk Management Plan
RVTM	Requirements Verification Traceability Matrix
SBU	Sensitive But Unclassified
SCaN	Space Communication and Navigation
SDMP	Software Development and Management Plan
SEMP	Systems Engineering Management Plan
SGL	Space-Ground Link
SGSS	Space Network (SN) Ground Segment Sustainment
SIR	System Integration Review
SLA	Service Level Agreement

Acronym	Description
SN	Space Network
SNE	Space Network Expansion
SNE-E	Space Network Expansion - East
SNGS	Space Network Ground Segment
SNUG	Space Network Users Guide
SOW	Statement of Work
SPA	Single Point Adjustment
SRD	Systems Requirements Document
SRR	Systems Requirements Review
STGT	Second TDRSS Ground Terminal
SWRR	Software Requirements Review
TBD	To Be Determined
TBR	To Be Resolved
TBS	To Be Supplied
TDRS	Tracking and Data Relay Satellite
TPI	Two Person Integrity
TRAR	Technology Readiness Assessment Report
TRL	Technology Readiness Level
TRR	Test Readiness Review
V&V	Verification and Validation
WBS	Work Breakdown Structure
WSC	White Sands Complex
WSGT	White Sands Ground Terminal