Report No. DODIG-2020-074

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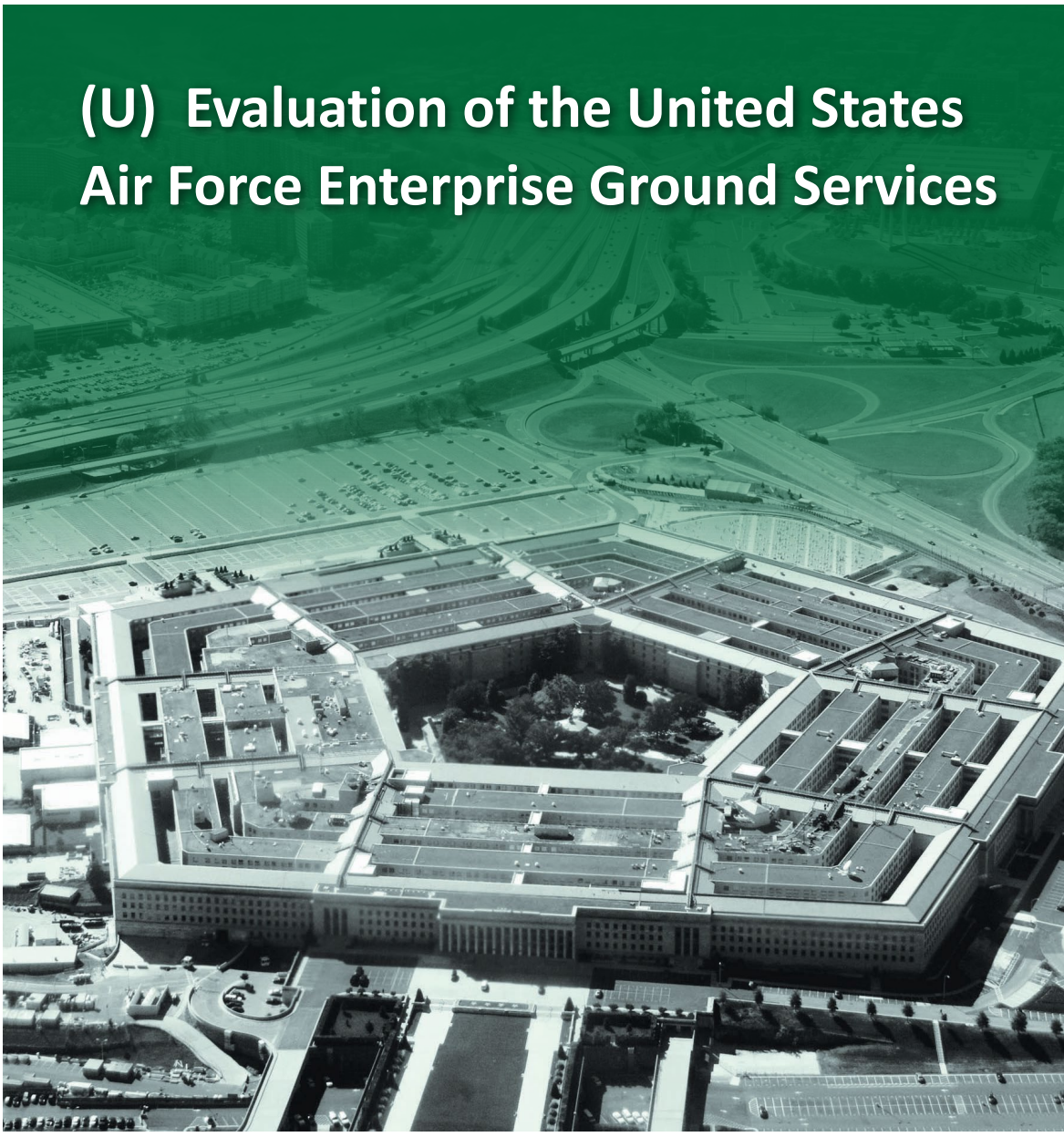
INSPECTOR GENERAL

U.S. Department of Defense

MARCH 25, 2020



(U) Evaluation of the United States Air Force Enterprise Ground Services

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Results in Brief

(U) Evaluation of the United States Air Force Enterprise Ground Services

March 25, 2020

(U) Objective

(U) The Deputy Assistant Secretary of Defense for Space Policy requested that the DoD OIG evaluate the status of Air Force efforts to develop the Enterprise Ground Services (EGS). The objective of the evaluation was to determine whether the Air Force Space Command (AFSPC) developed a plan to implement EGS. We also reviewed the status of the AFSPC's effort to implement the mandatory use of EGS by December 2028.

(U) Background

(U) The EGS concept is part of the Air Force Satellite Control Network and consists of hardware, an operational system, and software applications. The software applications are considered the common ground services that EGS intends to provide to Air Force satellite missions. A common ground service is a service that provides similar command and control functions among multiple satellite constellations.

(U) The AFSPC is developing EGS to execute satellite operations for tactical command and control. The AFSPC, in concert with the Air Force Space and Missile Systems Center (SMC), a subordinate unit of the AFSPC, will manage EGS enterprise requirements, strategy, architecture products, standards and interfaces, new system hosting, legacy systems transition, application development, and rapid development operations. On August 3, 2018, the AFSPC Commander required that all Air Force satellite programs transition to EGS by December 31, 2028.

(U) Finding

(U) The AFSPC is in the process of developing an overall implementation plan for the EGS. To assist in developing the plan, the AFSPC sought input from all 15 system program offices (SPO) that AFSPC determined would use EGS. To focus its efforts, the AFSPC also identified a satellite system using the Scaled Agile Framework concept, which should assist AFSPC in identifying and addressing issues early in the development process. According to the SMC Chief of EGS, the AFSPC is currently on track to meet the mandatory use of EGS by December 2028.

(U) Management Comments and Our Response

(U) We did not make any recommendations; therefore, we do not require any management comments.

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
4800 MARK CENTER DRIVE
ALEXANDRIA, VIRGINIA 22350-1500

March 25, 2020

MEMORANDUM FOR SECRETARY OF THE AIR FORCE
UNDER SECRETARY OF DEFENSE FOR POLICY
COMMANDER, U.S. AIR FORCE SPACE COMMAND
DIRECTOR, JOINT STAFF

SUBJECT: (U) Evaluation of the U.S. Air Force Enterprise Ground Services
(Report No. DODIG-2020-074)

(U) This final report provides the results of the DoD Office of Inspector General's evaluation. We did not make any recommendations; therefore, we do not require any management comments. We conducted this evaluation from October 2018 through January 2020 in accordance with the "Quality Standards for Inspections and Evaluations," published in January 2012 by the Council of the Inspectors General on Integrity and Efficiency.

(U) If you have any questions, please contact [redacted] We appreciate the cooperation and assistance received during the evaluation.

Randolph R. Stone
Assistant Inspector General for Evaluations of
Space, Intelligence, Engineering, and Oversight


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(U) Contents

(U) Introduction

(U) Objective

(U) The Deputy Assistant Secretary of Defense for Space Policy requested that the DoD OIG look at the status of developing efforts for the Enterprise Ground Services (EGS). The objective of this evaluation was to determine whether the Air Force Space Command (AFSPC) developed a plan to implement the EGS. We also reviewed the status of the AFSPC's effort to implement the mandatory use of EGS by 2028.

(U) Background

(U) In 2013, the Government Accountability Office (GAO) recommended that the Secretary of Defense direct that future DoD satellite acquisition programs develop a business case for proceeding with either a dedicated or shared network for satellite control operations.[1] The GAO recommendation also called for a Department-wide long-term plan for modernizing the Air Force Satellite Control Network (AFSCN) and any future shared networks.

(U) The AFSCN is the DoD's largest shared network. It supports national security (defense and intelligence) satellites during launch and early orbit periods and is used to analyze anomalies affecting orbiting satellites. According to the GAO report, the AFSCN comprises three interrelated segments:

1. (U) operational control centers that provide satellite telemetry, tracking, and commanding support from launch preparation through on-orbit operations;[2]
2. (U) remote tracking stations that provide the space ground link between satellites on-orbit and the AFSCN; and
3. (U) interconnected network of space and ground assets with communication links that provide interfaces for external users to access network data.

(U) The National Defense Authorization Act (NDAA) for FY 2014 directed the DoD to "conduct a cost benefit analysis for all new or follow-on satellite systems using a dedicated ground control system" and "develop a DoD-wide long-term plan for satellite ground control systems, including the AFSCN."[3] In response to the NDAA, the AFSPC began developing a concept for a shared ground service in November 2013, known as Resilient Enterprise Ground Architecture. The AFSPC

[1] (U) Government Accountability Office, Report No. GAO-13-315, "Satellite Control—Long-Term Planning and Adoption of Commercial Practices Could Improve DoD's Operations," April 18, 2013.

[2] (U) On-Orbit refers to a location in space where an action, experiment, or operation is taking place.

[3] (U) National Defense Authorization Act for Fiscal Year 2014, Public Law 113-66, Section 822(a), December 26, 2013.

(U) planned the Resilient Enterprise Ground Architecture project to develop and select a new satellite control operations architecture as well as the associated concept of operations to improve future satellite control operations. In 2014, the Enterprise Ground Architecture shared ground service, which evolved from the Resilient Enterprise Ground Architecture project, received funding allocations for prototype planning and became known as EGS.

(U) EGS is a set of common services providing hardware and software applications for command and control of satellite systems for Air Force satellite missions. A common ground service is a command and control function that is similar among multiple satellite constellations. EGS consists of common applications for enterprise-wide access to data, cyber protection and defense, and the tools to receive and transmit command requests. According to the AFSPC Commander, EGS, when fully deployed in December 2028, will support all Air Force satellite missions and promote a unified command and control.

(U) Organizational Responsibilities for the Enterprise Ground Services

(U) The AFSPC, located at Peterson Air Force Base (AFB), Colorado Springs, Colorado, supports the U.S. military worldwide through the use of many types of satellites and other space operations. The AFSPC is developing EGS to execute tactical command and control of satellite operations. The Space and Missile Systems Center (SMC), a subordinate unit of AFSPC, located at Los Angeles AFB, El Segundo, California, is responsible for developing, acquiring, fielding, and sustaining military space systems. According to the EGS concept of operations and an AFSPC memorandum on EGS planning and implementation, AFSPC and SMC will work with mission partners to determine the necessary capabilities, common services, and equipment.[4] AFSPC and SMC are managing the software development element of EGS using the Scaled Agile Framework. The Scaled Agile Framework is a set of organization and workflow patterns intended to guide enterprises in scaling lean and agile software development practices.[5] These patterns are designed to allow for incremental EGS deliveries that are continuously integrated, deployed, and improved.

[4] (U) Headquarters Air Force Space Command Memorandum, "Enterprise Ground Services Planning and Implementation Guidance," April 18, 2017.

[5] (U) SMC adopted the Scaled Agile Framework concept in the Space and Missile Systems Center Strategic Plan 2018. The goal was to make space systems more affordable. According to the strategic plan, the objective was to "develop an 'agile acquisition' mindset that challenges bureaucratic inertia, streamlines processes, implements continuous improvement, and reduces risk through prototyping and new engineering development models."

(U) According to the Air Force EGS program element monitor, the Secretary of the Air Force maintains an oversight role of all Air Force programs, including the EGS prototype. The Secretary of the Air Force assigns program element monitors to Air Force satellite programs. The Air Force Service Acquisition Executive then executes the planning, programming, budget, and execution process for all Air Force programs. Through this process, the Secretary of the Air Force guides Air Force investments, including investments in EGS.

(U) Air Force Space Command Requirement to Use Enterprise Ground Service

(U) On August 3, 2018, the AFSPC Commander published a memorandum that required all Air Force satellite programs to transition to EGS by December 31, 2028.[6] The memorandum also required system program offices (SPOs) to provide transition plans by July 31, 2019, that document how and when the SPOs' spacecraft operations will transition to EGS based on satellite mission requirements.

(U) On May 13, 2019, the SMC EGS Chief provided a "Refined EGS Construct" to EGS project office staff. Under the refined construct, AFSPC will continuously make developmental changes and deploy EGS services to support satellite mission partners, instead of building and delivering a comprehensive EGS system all at once. The refined construct required all AFSPC SPOs to complete the transition plans by July 31, 2019; commit to using current available services in the EGS catalog, and develop procedures for assessing and integrating updates and additional enterprise ground services as they become available.[7] The SMC will assist satellite mission program use of EGS by providing EGS standards. For additional information about transition plan guidance, see Appendix B.

[6] (U) Headquarters Air Force Space Command Memorandum, "Mandatory Enterprise Ground Services Use," August 3, 2018.

[7] (U) The SMC Enterprise Ground Services Refined Construct guidance identifies the EGS catalog as a single baseline source of available EGS. SMC will update the catalog as additional services are matured to satisfy requirements. The transition plan template in Appendix B describes the services that are being developed for EGS.

(U) Finding

(U) Air Force Space Command is Developing an Overall Plan to Implement the Enterprise Ground Services by December 2028

(U) AFSPC is developing an overall implementation plan for the Enterprise Ground Services (EGS). To assist in the development of the plan, AFSPC sought input from all 15 system program offices (SPOs) that AFSPC determined would use EGS. To focus its efforts, the AFSPC also identified a satellite system using the Scaled Agile Framework concept, which assists in identifying and addressing issues early in the development process.[8] According to the SMC's Chief of EGS, the AFSPC is on track to meet the mandatory use of EGS by December 2028.

(U) Enterprise Ground Services is in the Prototype Phase and an Implementation Plan is Under Development

(U) The EGS is in the prototype phase, and an overall plan to implement the EGS is still under development. According to Air Force Guidance Memorandum 2018-63-146-01, prototyping efforts should evaluate the potential of innovative technologies, new capabilities, or improved processes to meet existing or emerging capability gaps or create future operational opportunities. The prototyping efforts must be completed within 5 years of the approved requirement. According to SMC Budget Chief and the Research, Development, Testing, and Evaluation (RDT&E) Budget Item Justification, EGS received RDT&E funding in FY 2017 to develop and evaluate current requirements and future capabilities. In accordance with Air Force Guidance Memorandum 2018-63-146-01, the AFSPC has until FY 2022 to complete the EGS prototype phase.

(U) Air Force Guidance Memorandum 2018-63-146-01 states that results of prototype efforts determine whether the requirement will result in initiating another prototype, fielding the prototype, transitioning to a traditional program, inclusion in an existing program, or termination. Prototyping is not bound by traditional acquisition processes, such as those found in the Joint Capabilities Integration Development System manual and DoD Directive 5000.01.[9] The Milestone Decision Authority determines whether to field a prototype

[8] (U) We identified the overall implementation plan (plan) as activities and methods that describe how ground services, resources, and other required activities will be used to identify the capabilities of EGS. According to AFSPC representatives, the overall plan is an agile strategic-level plan that will encompass all of the satellite program transition plans and evolving requirements.

[9] (U) DoD Directive 5000.01, "The Defense Acquisition System," August 31, 2018.

(U) or continue with further prototyping depending on the prototype level of effort. Prototyping efforts enable smart risk taking and appropriate planning, thereby avoiding the premature creation of a program of record.[10]

(U) Air Force Space Command Is Gathering Information to Develop a Plan to Implement EGS

(U) AFSPC is in the process of developing an overall EGS implementation plan. To assist in the development of the plan, AFSPC sought input from all 15 SPOs that AFSPC determined would use EGS. To focus its efforts, the AFSPC identified a satellite system using the Scaled Agile Framework concept, which assists in identifying and addressing issues early in the development process. The AFSPC Commander issued a mandatory use memorandum on August 3, 2018, that required SPOs to provide transition plans that include mission capabilities and ground operations by July 31, 2019, to assist in the transition to EGS by December 31, 2028. AFSPC sent a transition plan template to the 15 SPOs between November 2018 and January 2019. The 15 SPOs included 7 legacy missions, 5 missions that have not been fielded, and 3 research and development missions. AFSPC senior officials stated that the mission requirements of the transition plans submitted by the 15 SPOs will be used to develop an overall plan.

(U) According to the SMC's Chief of Enterprise Ground Services, the AFSPC is developing an overall plan to implement EGS using the Scaled Agile Framework concept, which focuses on developing a plan that will continuously evolve based on developing requirements. The AFSPC is using the Scaled Agile Framework planning concept in response to EGS's fluid software development. According to AFSPC officials, the implementation plan will be a living document, including updates to the transition plans. The transition plans will be updated through joint working groups and product increment planning as part of the Scaled Agile Framework process. According to an AFSPC memorandum, dated December 20, 2019, the EGS Program Manager briefed the AFSPC Commander on the draft EGS implementation plan on November 25, 2019. The Commander directed the Program Manager to provide regular status updates.

[10] (U) The Defense Acquisition University glossary defines, a "program of record" as a program recorded in the current Future Years Defense Program (FYDP) or updated from the last FYDP by approved program documentation (e.g. Acquisition Program Baseline, Acquisition Strategy, or Selected Acquisition Report).

Air Force Guidance Memorandum 2018-63-146-01.

(U) Satellite Program Offices Used Transition Plan Templates to Provide Information for an Overall Plan to Implement EGS

(U) The AFSPC sent transition plan templates to all 15 SPOs that AFSPC determined would use EGS. AFSPC instructed the SPOs to complete the templates with information about the mission capabilities, intended use of EGS core applications, and EGS onboard dates. As of July 31, 2019, 11 transition plans that included 15 SPO missions were submitted.

(U) The EGS transition plan template contains instructions for the following seven topic areas that SPO personnel must complete.

1. (U) Mission Summary: Summarize the satellite's mission and capabilities.
2. (U) EGS Services: Detail the 16 services that EGS will provide to SPOs, including telemetry, tracking mission management, data analytics, and cyber service.
3. (U) Core EGS Applications: Detail which core EGS applications the program will use, and prioritize the importance of the services.
4. (U) Mission Unique Applications: Identify which mission-unique (non-EGS core) service applications are required and submit justifications for not transitioning mission-unique applications to EGS.
5. (U) Schedule: Discuss program milestones (such as launches, tests, and upgrades), ground milestones, and the EGS onboard date.
6. (U) Funding: Detail funding requirements similar to Program Objective Memorandum inputs and use the information for the unfunded requirement process or the FY 2022 Program Objective Memorandum cycle to justify EGS onboarding needs. The funding requirements section must include a detailed roadmap.
7. (U) Risks and Challenges: Describe the risks, challenges, and mitigation efforts associated with EGS transition.

(U) The transition plan template also includes a list of 16 core applications that EGS will provide to satellite programs. SPOs were required to identify which core applications the mission will use and describe the function that the service provides for the mission. SPO officials were required to prioritize the importance of these applications. The identification of the intended use of a core application did not indicate immediate adoption of this service, only the intent to use it by 2028. According to the template, the AFSPC will provide the following services to the SPOs once EGS is initialized.

- (U) Platform as a Service
- (U) Commanding Service
- (U) Cyber Service

- (U) Data Analytics Service
- (U) Data Storage Service
- (U) External Interface Service
- (U) Flight Dynamics Service
- (U) Front End Processing Service
- (U) Ground Resource Management Service
- (U) Ground Resource Scheduling Service
- (U) Messaging Service
- (U) Mission Management Service
- (U) Simulation Service
- (U) Telemetry Service
- (U) Tracking Service
- (U) User Experience Service

(U) We reviewed 11 transition plans that included 15 SPO missions. We found that the SPOs completed the transition plan template and provided the required information by July 31, 2019. Specifically, we determined that all 11 transition plans addressed the 7 topic areas and prioritized the 16 core applications in accordance with the EGS transition plan guidance. The SPOs detailed the core applications, identified the services the mission will use, and described the function that the service provides for the mission. According to the SMC's Chief of Enterprise Ground Services, the mission management team continues to work with the SPOs to update transition plan information as EGS matures.

(U) AFSPC is Gathering Information by Analyzing Test Results of EGS Integration for Priority Satellite Mission

~~(U//FOUO)~~ [redacted]

(U//FOUO) [redacted]

(U//FOUO) [redacted]

(U) Risk Reduction Events and Developmental Test and Evaluations Results Demonstrated Progress in EGS Development

(U//FOUO) [redacted]

(U//FOUO) [redacted]

(U//FOUO) [redacted]

[11] (U) Risk reduction events are individual tests made prior to DT&E. Each event results in a test report, which is used to document deficiencies prior to DT&E.

[12] (U//FOUO) [redacted]

~~(U//FOUO)~~ [redacted]

~~(U//FOUO)~~ [redacted]

~~(U//FOUO)~~ [redacted]

~~(U//FOUO)~~ [redacted]

- ~~(U//FOUO)~~ [redacted]

[13] (U) Agile software development is a commercial practice that the AFSPC followed to execute the Space and Missile Systems Center Strategic Plan 2018; Goal 3. Make space systems more affordable–"develop an 'agile acquisition' mindset that challenges bureaucratic inertia, streamlines processes, implements continuous improvement, and reduces risk through prototyping and new engineering development models."

- (U//FOUO)
- (U//FOUO)

(U//FOUO)

[14] (U//FOUO)

[15] (U//FOUO)

[16] (U//FOUO)

(U) Summary

(U) The AFSPC demonstrated progress in developing an overall implementation plan. EGS is in the prototype phase and the Air Force is not required to have an overall implementation plan until the completion of its EGS prototype efforts. To assist in the development of its implementation plan, the AFSPC sought input from 15 SPOs. To focus its efforts, the AFSPC also identified a satellite system using the Scaled Agile Framework concept, which assists in identifying and addressing issues early in the development process. According to AFSPC senior officials, a shared command and control of national security space elements will improve uniformity of AFSPC satellite operations. Specifically, operators will be able to focus on satellite missions, rather than focusing on different satellite software applications and equipment.

(U) Appendix A

(U) Scope and Methodology

(U) We conducted this evaluation from October 2018 through January 2020 in accordance with the "Quality Standards for Inspection and Evaluation," published in January 2012 by the Council of the Inspectors General on Integrity and Efficiency. The standards require that we plan and perform the evaluation to obtain sufficient and appropriate evidence to provide a reasonable basis for our findings, conclusions, and recommendations based on our evaluation objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions, based on our evaluation objective.

~~(U//FOUO)~~ [redacted]

(U) We interviewed stakeholders from the following offices to understand and identify their roles and responsibilities as it relates to the EGS process.

- (U) Deputy Assistant Secretary of Defense for Space Policy
- (U) AFSPC
- (U) SMC
- (U) Defense Digital Service
- (U) MITRE Federal Funded Research and Development Center
- (U) Space Based Infra-Red System Payload High Elliptical Orbit Program Office
- (U) Long Range Pro-Pulsed Program Office
- (U) Enhanced Polar System Risk Reduction Program Office
- (U) Advanced Extremely High Frequency; Wideband Global Satellite Communication; Evolved Strategic Satellite Communication; Military Strategic and Tactical Relay; Defense Satellite Communications System Programs Office
- (U) Protected Tactical System Program Office
- (U) Quasi Zenith Satellite System Program Office

- (U) Wide Field of View Program Office
- (U) Navigation Technical Satellite-3 Program Office
- (U) Weather System Follow-on Microwave Program Office

(U) We reviewed the following documents related to EGS and the requirements to implement the mandatory use of EGS by 2028:

- (U) GAO Report No. 13-315, "Satellite Control: Long-Term Planning and Adoption of Commercial Practices Could Improve DoD's Operations," April 18, 2013
- (U) National Defense Authorization Act for FY 2014, "Assessment of Dedicated Ground Control Systems before Milestone B Approval of Major Defense Acquisition Program Constituting a Space Program," December 26, 2013
- (U) Air Force Space Command Research and Development Test and Evaluation Budget Item Justification Project Budget, dated February 2016, May 2017, February 2018, and February 2019
- (U) Joint Publication 3-14, "Space Operations," August 10, 2018
- (U) Deputy Secretary of Defense Memorandum, "Space Organization and Management Tasks," September 10, 2018
- (U) AFGM 2018-63-146-01, "Air Force Guidance Memorandum for Rapid Acquisition Activities," June 13, 2018
- (U) AFSPC Prioritized Space Superiority Activities, "Priority #3, BMC2 SATOPS," May 21, 2018
- (U) EGS, "Mission Integration Handbook," October 10, 2018
- (U) EGS, "System Concept," December 15, 2017
- (U) EGS, "Mission Plan," Version 1.1 (Transmission Plan Template)
- (U) Memorandum for Record, "Commander's Decision Brief (COB) Summary (re: Enterprise Ground Services [EGS])," January 29, 2019
- (U) Memorandum for Space Missile Command/Range Network, "AFSPC Enterprise Ground Services (EGS) Priority Guidance," February 5, 2019
- (U) AFSPC Memorandum for Distribution, "Mandatory Enterprise Ground Services (EGS) Use," August 3, 2018
- (U) AFSPC Memorandum for HQ AFSPC A5/9 Divisions, "Enterprise Ground Services (EGS) Requirements Guidance," August 16, 2018
- (U) AFSPC Memorandum for Distribution, "Enterprise Ground Services (EGS) Planning and Implementation Guidance," April 18, 2017

(U) Use of Computer-Processed Data

(U) We did not use computer-processed data to perform this evaluation.

(U) Prior Coverage

(U) No prior coverage has been conducted on the Enterprise Ground Services during the last 5 years.

(U) Appendix B

(U) AFSPC Guidance to Satellite Missions for EGS Transition Plan

(U) Enterprise Ground Services Mission Plan Template

(U) This appendix provides the transition plan template that AFSPC sent to the SPOs between November 2018 and January 2019. The transition plans were used to help AFSPC develop an implementation plan for EGS, and the transition plans provide details about how the SPOs plan to transition to EGS by December 2028. Additional descriptions of the common ground services are shown in the table that follows the mission plan template.

(U) Enterprise Ground Services Mission Plan Template

PROGRAM NAME
ENTERPRISE GROUND SERVICES (EGS)
MISSION PLAN

DD MMM 2019

VERSION 1.1

1

(U) Enterprise Ground Services Mission Plan Template (cont'd)

MISSION SUMMARY

Provide a 1-2 paragraph summary of the program or mission. In the first paragraph, briefly describe the capability the program provides. Can be pulled from JCIDS documentation, if necessary.

Example pulled from Weather System Follow-on program:
WSF will be used by DoD warfighters to observe the environment and enable the exploitation of weather in operations. The WSF mission will sense atmospheric, terrestrial, oceanographic and space environmental parameters from a variety of orbits and a combination of single, multiple disaggregated low-earth orbit (LEO) & geosynchronous earth orbit (GEO) spacecraft and provide to all elements of the DoD.

In the second paragraph, describe how the program or system will be operated from the ground perspective. Include details such as approximate numbers of satellites or payloads, who primarily operates the system, and location(s) of primary and backup operations centers. If these items are still to be determined, note that and identify potential trades or considerations.

SERVICES

For reference:
Service: *A function or set of functions accessed through a prescribed interface or process independent of actor/performer*
Application: *Software tool that performs a function or functions required to support a service or services*
Core Application: *A common application implementing a service in the EGS catalog (Note: the EGS Catalog may contain multiple options for a service)*

The following services will have applications provided by EGS. Although EGS will provide many core applications, most require some mission-unique development to successfully utilize the application for each mission.

- Platform as a Service
  - **The Platform as a Service (PaaS)** enables the ability to host core-EGS and mission unique applications onto the EGS infrastructure. The applications are available for discovery and are controlled by the Ground Resource Management Service. PaaS provides hosting, computing resources, and communication to enable the hosted application to function as a service within the EGS architecture.

- Commanding Service
  - **Commanding Service** applications generate commands for transmission to the spacecraft. Commanding Service applications receive commanding requests to include the mission plan, automated response, manual command entries, etc. and translates the requests into the sets of commands that will result in the spacecraft performing the specified actions. Commanding Service applications will require some mission-unique development to translate from the requests to the mission-unique sets of commands. This function provides the capability to prepare and output commands to the space vehicle.

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(U) Enterprise Ground Services Mission Plan Template (cont'd)

- Cyber Service
  - **Cyber Service** applications protect and defend from the actions of malicious actors and detect those actions to inform an appropriate response. Functions include access management, access control, enterprise protection, enterprise defense, and defensive cyber operations. The EGS infrastructure provides the bulk of these functions, but in some cases, mission-unique development will be required to provide full capability. EGS also provides software assurance capabilities to increase software quality to reduce system vulnerabilities. EGS Authorization functions provide the processes and artifacts to enable an Authorizing Official to grant permission for system test and operation.

- Data Analytics Service
  - **Data Analytics Service** applications provide enterprise-wide, cross-program analysis tools. The intent is to enable expanded use of telemetry data for satellite state-of-health (SOH) trending and analysis by providing access to all data available in the enterprise. This enables the development of new Space Domain Awareness (SDA) tools with enterprise-wide insights into ground and space.

- Data Storage Service
  - **Data Storage Service** provides data storage for all users. It can subscribe to any message transiting the messaging service and will capture and store the messages it subscribes to. The captured information is available for offline analysis or troubleshooting. The Data Storage Service provides both short-term and long-term storage option. Mission storage requirements and throughput rates will impact EGS requirements, so this information must be included in EGS and mission service level agreements (SLA) and MOA.

- External Interface Service
  - **External Interface Service** applications handle all data exchanges with entities external to EGS. External interfaces subscribe to relevant messages on the bus and translates to the format required by the external agent. It also receives information from external entities, translates it into the relevant messages, and publishes them onto the EGS architecture. Mission-unique development will be required to enable the translation from EGS-GMSEC to external communications protocols.

- Flight Dynamics Service
  - **Flight Dynamics Service** applications can generate precise models of each vehicle's orbit. It publishes satellite location and velocity. These applications enable modeling of orbit change maneuvers and updates the orbit model based on ephemeris changes. Flight dynamics applications require mission-unique development to enable accurate model changes to a satellite's orbit.

- Front End Processing Service
  - **Front End Processing Service** converts the data stream from the antenna into a usable bit stream. It also converts formatted command data into the appropriate antenna data stream.

- Ground Resource Management (GRM) Service
  - **Ground Resource Management Service** applications provide the ability to control and status ground system hardware. For many programs, GRM applications will not have mission unique implications. However, for programs utilizing mission unique equipment (MUE) (e.g. antennas) or mission-unique applications (MUA), there will be a requirement to provide mission unique development to the GRM to allow it to control and status the MUE and MUA.

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(U) Enterprise Ground Services Mission Plan Template (cont'd)

- Ground Resource Scheduling (GRS) Service
  - **Ground Resource Scheduling Service** applications provide the ability to schedule the ground system hardware. GRS applications receive mission plans for all assets assigned to EGS and produces a plan that satisfies all mission needs, if possible. If there are resource conflicts, GRS applications use mission priority as assigned by the CCMD to ensure the highest priority missions are satisfied. For many programs, GRS applications will not have mission unique implications. However, for programs bringing MUE or MUA, there will be a requirement to provide mission unique development to the GRS to allow it to schedule the MUE and MUA.

- Messaging Service
  - **Messaging Service** applications manage the exchange of information between all other EGS services. It provides for encryption of data in motion and routing of data to subscribers.

- Mission Management Service
  - **Mission Management Service** applications receive tasking, generates and publishes the system and mission plans, schedules, and timelines for the applicable space assets.

- Simulation Service
  - **Simulation Service** applications use PaaS to host software models, simulations, or emulations of external systems such as satellites, antenna systems, or external tasking agents. The interface enforces message format rules that ensure all data being provided by the simulation service are identified as simulation data. To support simulation environments for training or other uses, EGS uses the exact baseline services that are used by a mission during operations, but the Messaging Service application is configured so that only data identified as simulation is delivered to the applications in the simulation environment. Enforcing simulation identification at the message layer allows applications to be agnostic to what mode they are supporting or type of data in use and enables EGS to ensure segregation of simulation data from live data. As the AFSPC and SMC approved emulation application, the Standard Space Trainer (SST) will be used to create the emulations of systems.

- Telemetry Service
  - **Telemetry Service** applications decode, process, and limit check space vehicle telemetry. It translates from a mission unique telemetry stream into EGS defined messages that enable all other services to access the data as needed.

- Tracking Service
  - **Tracking Service** applications process tracking data to generate space vehicle ephemeris.

- User Experience Service
  - The **User Experience Service** provides a unified interface for users of EGS. The standardized look and interaction unify the EGs experience and remove the need for specialized training based on different applications.

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(U) Enterprise Ground Services Mission Plan Template (cont'd)

CORE ENTERPRISE GROUND SERVICES APPLICATIONS

In this section, identify which core-provided EGS applications the mission will use. Describe the function that the service provides for the mission. Prioritize the importance of these services. Note that identifying the intended use of a core-provided EGS application does not indicate immediate adoption of this service, only that there is intent to use it by 2028. *NOTE: The SMC/RN mission management team can provide the most up-to-date details of which core-EGS applications are available or in development for each service.*

MISSION UNIQUE APPLICATIONS

In this section, identify which mission-unique (non-EGS core) service applications are required. These can be applications for services that EGS does not cover or applications that provide a similar service to EGS core applications. Identify if there is intent to transition from these applications to EGS core applications later in the process. If there is no intent to transition, provide justification. If other missions require the use of these mission unique applications, include a recommendation to incorporate the application as an EGS core application.

SCHEDULE

Include a populated roadmap that includes:

- Major program milestones, including, but not limited to:
  - Launches
  - Test and checkout periods
  - Program/acquisition reviews
  - Upgrades
- Specific ground milestones
  - Need or transition/onboard dates for specific EGS services
  - Need date for ground system being operationally ready (sometimes referred to as Operational Acceptance)
- EGS onboard date – when EGS is providing all required/requested services

HQ AFSPC and SMC will use schedules provided and program-identified priorities to create the roadmap for overall EGS service development, deployment, and availability. A roadmap template has been provided with this document for optional use.

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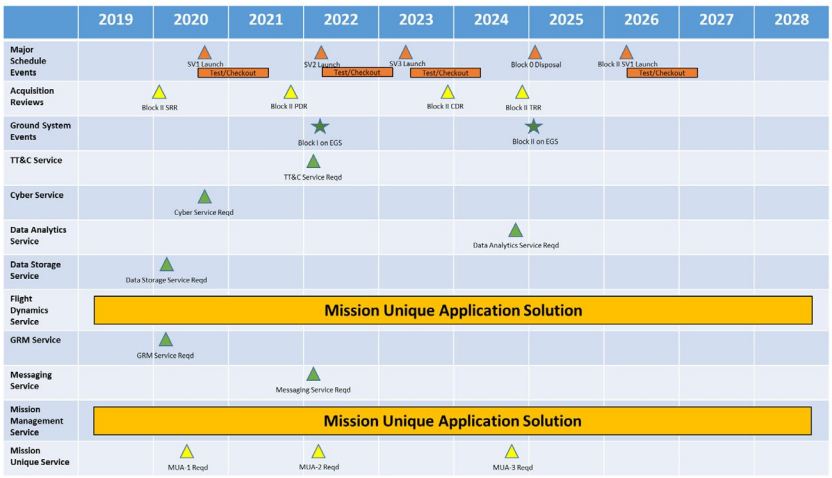
(U) Enterprise Ground Services Mission Plan Template (cont'd)



FUNDING

Include funding data, similar to POM inputs. We will be using this information during the UFR process or the FY22 POM cycle to justify and defend EGS onboarding needs. If necessary, budget data may go beyond current FYDP. The "EGS Adjustment" line is intended to capture additional funding necessary for the following things (not all-inclusive):

- Mission unique development for core EGS applications
- Virtualization or translation of mission unique applications to run on the EGS PaaS
- Testing for mission unique development, virtualization, or translation
- Testing/checkout/integration of applications onto EGS

	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26
CURRENT	200	200	200	200	200	200	200	200
EGS ADJUSTMENT	14.4	36.6	91.2	98.9	17.0	63.3	8.4	9.2

Next make sure to capture what this funding will provide each year. For example (using the roadmap above):

FY19
In FY19, $14.4M will be necessary to initiate mission unique plug-in development for GRM and Data Storage Services. In addition, we have to modify Mission Unique Application 1 to operate on the EGS Platform as a Service, and contract modification will be complete for work start in 4Q FY19.

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(U) Enterprise Ground Services Mission Plan Template (cont'd)

FY20
In FY20, $36.6M will be used to complete mission unique plug-in development for GRM and Data Storage Services. In addition, modifications to Mission Unique Application 1 will also complete. Funds will be used to complete testing and operational acceptance of those services. Funds above baseline dollars will be required to complete development of mission unique analytics for the EGS Cyber Service in order to ensure defensive cyber operations.

…

FY26
The Block II mission completed integration onto EGS in FY25. $9.2M will be used to sustain mission unique applications and mission unique plug-in for EGS core applications.

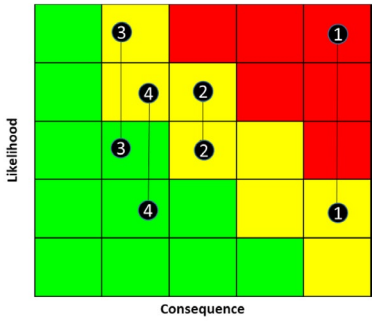
7

(U) Enterprise Ground Services Mission Plan Template (cont'd)

RISKS AND CHALLENGES

Describe risks, challenges, and mitigation efforts associated with EGS transition. It may be useful to use a standard risk chart to capture these risks (see figure below, and will help the HQ AFSPC and EGS team advocate for the solution that best meets the needs of your program.

Example:



Risk 1: *Data Analytics Service is not ready for Block II testing.*
Consequence: *Mission would not be able to recognize SOH trends and would be vulnerable.*
Mitigation: *Include contract language in Block II contract to develop Mission Unique Application (part of $17M funding delta in FY23). Advocate for higher priority for Data Analytics Service development.*

…

One additional challenge is that it is still unknown who will operate our mission and which location it will operated out of. If a non-DoD entity is selected to conduct operations, the location of their SOC may not host or be connected to the EGS infrastructure. It is unknown if their hardware will be compatible with the EGS platform and may not support EGS core applications.

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(U) Source: AFSPC Enterprise Ground Service Mission Plan 2019

(U) Table. Common Ground Service Descriptions

(U) The following table lists the definitions of the EGS core applications identified in the Transition Plan Template.

(U) Table. Common Ground Service Descriptions

(U) Common Ground Service	Description
Commanding Service	This application receives command requests, then generates commands for transmission to the spacecraft or payload.
Cyber Service	This application manages, monitors, and enforces access to components. The service protects and defends EGS from the actions of malicious actors by assuring access management and control and enterprise protection and defense.
Data Analytics Service	This application provides enterprise-wide, cross-program analysis tools. The service is traditional satellite state of health trending and analysis with a goal of providing access to all data available in the EGS enterprise to help develop new space situational awareness tools.
Data Storage Service	This application will receive and store data for long- and short-term time periods, receive data requests, and provide the requested data. Data will also be encrypted, if requested.
Messaging Service	This application manages the exchange of information between all EGS services. It also manages EGS information publisher and subscriber lists.
External Interfaces Service	This application manages all data exchanges and communications with external EGS entities.
Flight Dynamics Service	This application can generate precise models of each satellite's orbit. The service will identify the location of a space vehicle for use during a command upload. This application requires mission-unique development to enable accurate model orbit changes.
Front End Progressing Service	This application converts a data stream from the antenna into a usable bit stream. It also converts formatted command data into the appropriate antenna data stream.
Ground Resource Management Service	This application provides the ability to control the ground system hardware.
Ground Resource Scheduling Service	This application provides the ability to schedule the ground system hardware to receive mission plans, generate and maintain routing plans, and conduct schedule change requests. (U)

(U) Table. Common Ground Service Descriptions (cont'd)

(U) Common Ground Service	Description
Mission Management Service	This application receives taskings and generates and publishes the system and mission plans, schedules, and timelines for the applicable space assets.
Platform as a Service	This application provides a platform allowing customers to run, develop, and manage applications without the complexity of building and maintaining the infrastructure associated with developing and launching an application.
Simulation Service	This application uses the platform as a service to host software models, simulations, or emulations of external systems such as antenna systems or external tasking agents for simulation purposes.
Telemetry Service	This application provides automatic data measurement and transmission that enable all other EGS services to access the data as needed.
Tracking Service	This application processes satellite tracking data to generate coordinates.
User Experience Service	This application provides a unified interface for users of EGS. The standardized look and interaction unify the EGS experience and remove the need for specialized training based on different applications. (U)

Source: AFSPC.

(U) Acronyms and Abbreviations

(U) AFSCN	Air Force Satellite Control Network
(U) AFSPC	Air Force Space Command
(U) DT&E	Development Test and Evaluation
(U) EGS	Enterprise Ground Services
(U) SPO	System Program Office
(U) SBIRS HEO	Space Based Infra-Red System High Elliptical Orbit
(U) SMC	Space and Missile Systems Center


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