

**BY ORDER OF THE COMMANDER  
AIR FORCE SPACE COMMAND**

**AIR FORCE SPACE COMMAND  
INSTRUCTION 13-611**



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***Nuclear, Space, Missile, Command and  
Control***

***SATELLITE RELIABILITY  
ENGINEERING ASSESSMENT (REA)***

**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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This instruction implements AFPD13-6, *Space Policy*. It outlines tasks and responsibilities pertaining to satellite constellation Reliability Engineering Assessment (REA) and reliability parameter lists. It applies to Headquarters, Air Force Space Command (HQ AFSPC), Space and Missile Systems Center (SMC) and supporting agencies. This instruction does not apply to Air Force Reserve Command (AFRC) and Air National Guard (ANG). This instruction does not apply to efforts that are strictly research and development oriented, such as demonstrations or prototypes, or programs conducted for experimental or scientific research purposes, unless designated by the HQ AFSPC/A2/3/6. Send comments and suggested improvements on an AF Form 847, *Recommendation for Change of Publication*, through appropriate command channels to HQ AFSPC/A2/3/6SR, 150 Vandenberg Street, Suite 1105, Peterson AFB, CO 80914-4200. Organizations requesting document changes should ensure all units that could be affected by the change are included as informational addressees. Subordinate organizations are encouraged to supplement this instruction. The authorities to waive wing/unit level requirements in this publication are identified with a Tier ("T-0, T-1, T-2, T-3") number following the compliance statement. See AFI 33-360, *Publications and Forms Management*, **Table 1.1**. for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the Publication Office of Primary Responsibility (OPR) for non-tiered compliance items. Supplements will be coordinated through appropriate command channels and approved by HQ AFSPC/A2/3/6. Supplements will not lessen the requirements nor change the basic content or intent of this instruction. Ensure that all records created as a result of processes prescribed in this

publication are maintained in accordance with (IAW) Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of IAW Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS).

## ***SUMMARY OF CHANGES***

This document has been totally rewritten and should be reviewed in its entirety. Major changes include modifications to the report format and timelines to support the Space Mission Assurance Framework and AFSPC/CC planning, programming, budgeting and execution process.

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## Chapter 1

### GENERAL

**1.1. Overview.** This guidance establishes a standardized method for assessing satellite system reliability. Reference [Attachment 1](#) for a list of abbreviations, acronyms, and definitions.

**1.2. Purpose.** Reliability Engineering Assessments (REA) serve as the engineering baseline for subsequent mission resilience analyses in contested, degraded, and operationally limited environments and to support the HQ AFSPC planning, programming, budgeting and execution (PPBE) process.

**1.3. Mission Areas.** For the purpose of this instruction, a mission area is the existing or future capability provided by one or more satellite constellations. These mission areas can be composed of existing or future satellite constellations and may include satellite assets owned by agencies outside HQ AFSPC that share responsibility for fulfilling mission area requirements. The current HQ AFSPC mission areas required to produce REAs are: Positioning Navigation and Timing (PNT), Missile Warning (strategic and theater), Protected/Polar Communications, Environmental Monitoring, and Wideband Communications. HQ AFSPC will model mission area capabilities based on design and actual reliability parameters.

## Chapter 2

### ROLES AND RESPONSIBILITIES

#### 2.1. Director of Integrated Air, Space, Cyberspace and ISR Operations (HQ AFSPC/A2/3/6)

- 2.1.1. Ensures unassigned/future mission areas are added to this instruction and appropriate notifications are made to external agencies, as required.
- 2.1.2. Approves and authorizes distribution of all REAs to HQ AFSPC/A5/8/9 and FM including the reliability parameter lists used as inputs to computing assessments.
- 2.1.3. Approves and accredits modeling, simulation and analysis (MS&A) for use in REA process.
- 2.1.4. Ensures REAs are produced annually and verified quarterly for use in the Space Mission Assurance Framework (SMAF) process.
- 2.1.5. Serves as subject matter experts to evaluate modeling tools used by HQ AFSPC.
- 2.1.6. Provides modeling tools.
- 2.1.7. Ensures models support commonality of REAs.
- 2.1.8. Reviews accreditation plans and reports and provide recommendations concerning AF owned or managed REA MS&A tools.
- 2.1.9. Oversees a verification and validation (V&V) program that will support accreditation decisions. Ensures REA MS&A applications are accredited in accordance with AFI 16-1001, Verification, Validation, and Accreditation (VV&A).

#### 2.2. Space Operations Division (HQ AFSPC/A2/3/6S)

- 2.2.1. Serves as the HQ AFSPC Office of Primary Responsibility (OPR) for satellite REAs.
- 2.2.2. Ensures current reliability parameter lists are used to generate all HQ AFSPC assessments.
- 2.2.3. Appoints a primary and alternate Mission Area Lead for mission areas defined in [Paragraph 1.2](#).

#### 2.3. Launch, Ranges and Airfields Branch (HQ AFSPC/A2/3/6SR)

- 2.3.1. Maintains a list of mission area leads and REA status for each mission area.
- 2.3.2. Provides mission area leads with launch profile for use in assessments.
- 2.3.3. Posts the National Reconnaissance Office (NRO)-produced launch vehicle (LV) reliabilities on all levels of the Launch Information Support Network (LISN) website at <https://lisn.afspc.af.mil>.

#### 2.4. Mission Area Leads

- 2.4.1. Mission Area Leads are appointed by HQ AFSPC/A2/3/6S in accordance with [Paragraph 2.2.3](#).
- 2.4.2. Acts as primary Reliability Engineering Working Group (REWG) lead.

2.4.3. Convenes REWGs, as required, to produce all REAs. REWGs will follow guidance as specified in **Paragraph 2.9**.

2.4.4. Coordinates and distributes REA IAW **Paragraph 3.4**.

2.4.5. Updates REAs following significant events, as needed, within 30 days of event. A significant event is any change that occurs which moves missions across fiscal boundaries (e.g. maneuver reducing spacecraft lifetime to the point a replacement is required on an earlier timeline crossing a FY).

2.4.6. Identifies unassigned/future mission areas to the HQ AFSPC/A2/3/6. New mission areas are normally identified at Milestone C.

## **2.5. Director of Strategic Plans, Programs, Requirements and Analysis (HQ AFSPC/A5/8/9)**

2.5.1. Ensures REAs are reviewed and integrated into the SMAF.

2.5.2. Assists with identifying mission area requirements that can be integrated into models.

2.5.3. Attends REWGs and provide subject matter expertise in reviewing reliability parameters.

## **2.6. Director of Financial Management (HQ AFSPC/FM)**

2.6.1. Ensures REAs are reviewed and integrated into the budgeting and execution process.

2.6.2. Releases REAs and associated parameters outside of HQ AFSPC consistent with HQ AFSPC/CC PPBE direction as required.

## **2.7. Space and Missile Systems Center (SMC)**

2.7.1. Provides SMC Directorate-approved reliability parameter lists to appropriate HQ AFSPC mission area lead and HQ AFSPC/A2/3/6SR annually, and when there has been a substantive change impacting constellation status (e.g. satellite anomaly impacting the vehicle life expectancy). Current parameters will be no more than 1 year old. **(T-2)**

2.7.2. Ensures REA coordination with appropriate Service/Agency Lead(s) representative when multiple satellite systems are used to satisfy a given mission area assessment. **(T-2)**

2.7.3. Provides expertise and support to REWGs, as required by REWG Lead. **(T-2)**

2.7.4. Provides sufficient lower-level reliability model details to the REWG so the REWG understands the key factors driving the overall reliability model and its sensitivity to lower-level model perturbations. **(T-2)**

## **2.8. Reliability Engineering Working Group (REWG) Lead**

2.8.1. Convenes REWGs as required for respective mission area. Each REWG will determine if a face-to-face meeting is necessary.

2.8.2. Determines REWG membership to include (as appropriate): acquisition organization representatives, payload & platform operational managers, ground system and operations experts, MS&A, and other stakeholders and user community representatives.

2.8.3. Ensures REA production annually and following significant events.

**2.9. Reliability Engineering Working Group (REWG)**

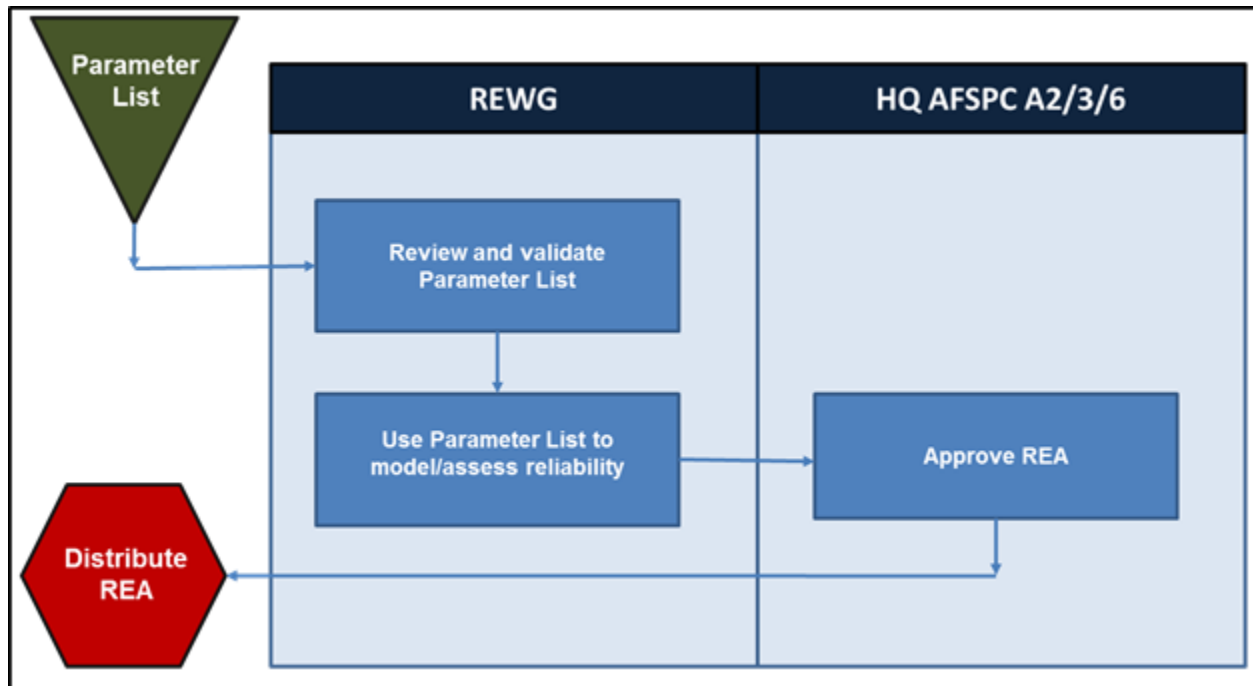
- 2.9.1. Reviews and validates SMC Directorate-approved reliability parameter lists within 30 days of receipt.
- 2.9.2. Ensures MS&A tools used for REA production are accredited.
- 2.9.3. Ensures all MS&A tools/reliability parameters used in REA development are listed and clearly identify all additional inputs and assumptions.
- 2.9.4. Obtains mission area requirements from HQ AFSPC/A5/8/9.
- 2.9.5. Ensures REAs utilize the latest NRO-produced launch vehicle success probabilities posted on the LISN website.
- 2.9.6. Adds classified supplements, as needed.

## Chapter 3

### SATELLITE RELIABILITY ENGINEERING PROCESS

**3.1. Satellite Reliability Engineering Assessment Process.** Figure 3.1 illustrates the satellite REA process.

**Figure 3.1. Satellite Reliability Engineering Assessment (REA) Process.**



### 3.2. Reliability Parameter Lists (Input)

3.2.1. SMC Directorates will generate reliability parameter lists annually and following significant events and internally approve reliability parameters prior to forwarding them to HQ AFSPC mission area lead and HQ AFSPC/A2/3/6SR. Current parameter lists will be no more than 1 year old. (T-2)

3.2.2. Upon receipt of SMC Directorate-approved reliability parameter lists the respective mission area lead will forward them to the REWG members. Each REWG will meet, as required, to review, understand and validate their reliability parameter lists within 30 days.

### 3.3. Reliability Engineering Assessment (REA)

3.3.1. AF and HQ AFSPC-approved tools will be used to perform modeling. To gain HQ AFSPC approval for other modeling tools, the REWG should present a summary of the modeling tool, its capabilities, and output examples to HQ AFSPC/A2/3/6 for approval.

3.3.2. The model alone is not the complete answer. The REWG is responsible for validating model results and accurately depicting system/ mission area assessments.

3.3.3. Baseline REAs will be produced annually by July. Additionally, REAs will be reviewed/updated quarterly and following any significant event.

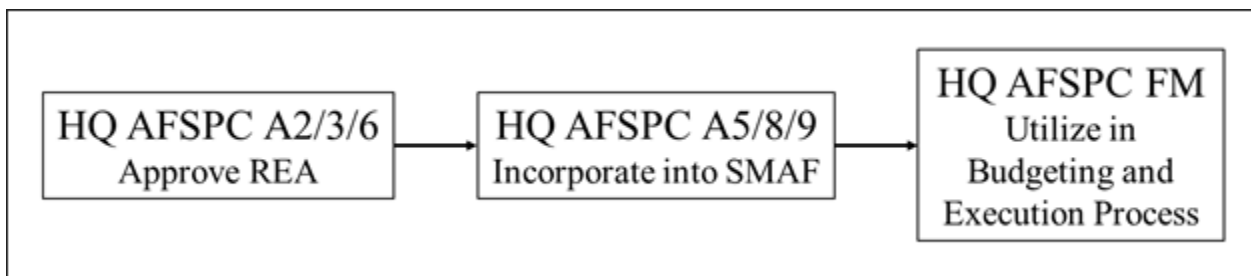
3.3.4. Analytical REAs may be produced at the request of the HQ AFSPC/A2/3/6, HQ AFSPC/A5/8/9, HQ AFSPC/FM or HQ AFSPC mission area lead. Analytical REAs must be clearly marked as such to prevent misinterpretation and confusion with baseline REAs.

3.3.5. HQ AFSPC/A2/3/6S and any other agency capable of producing modeling reports will ensure reports are properly marked with appropriate launch schedule, time origin, parameter dates, purpose for production, and indicate variations from approved launch schedules and validated parameters.

### 3.4. Distribution

3.4.1. REAs will be distributed per [Figure 3.2](#)

**Figure 3.2. REA Distribution.**



3.4.2. HQ AFSPC/A2/3/6 is final approval for REAs. Approved REAs are provided to HQ AFSPC/A5/8/9 for incorporation of threat information via the SMAF and a copy provided to HQ AFSPC FM.

3.4.3. HQ AFSPC/A5/8/9 utilizes REA information as an input to the SMAF.

3.4.4. HQ AFSPC/FM utilizes the REAs in conjunction with SMAF outputs in the AFSPC budgeting and execution process.

3.4.5. External agencies may request baseline REAs, parameters or analytical REAs. External agency requests/products will be routed to HQ AFSPC/FM for distribution as required. Distribution of REAs and supporting reliability parameters/Excel file/data outside of HQ AFSPC is at the discretion of HQ AFSPC/FM in coordination with the HQ AFSPC/CC PPBE process.

JOSEPH T. GUASTELLA, JR., Major General, USAF  
Director of Integrated Air, Space,  
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**Attachment 1****GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

DoDI 5000.61, *DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)*, 9 December 2009

AFI 16-1001, *Verification, Validation and Accreditation (VV&A)*, 22 Jun 2016

***Abbreviations and Acronyms***

**AF**—Air Force

**AFI**—Air Force Instruction

**AFMAN**—Air Force Manual

**AFRC**—Air Force Reserve Command

**AFRIMS**—Air Force Records Information Management System

**AFSPC**—Air Force Space Command

**AFSPCI**—Air Force Space Command Instruction

**ANG**—Air National Guard

**DoD**—Department of Defense

**FY**—Fiscal Year

**HQ**—Headquarters

**IAW**—In Accordance With

**ISR**—Intelligence, Surveillance and Reconnaissance

**LISN**—Launch Information Support Network

**LV**—Launch Vehicle

**MS&A**—Modeling Simulation and Analysis

**NRO**—National Reconnaissance Office

**OPR**—Office of Primary Responsibility

**PPBE**—Planning, Programming, Budgeting and Execution

**PNT**—Positioning Navigation and Timing

**RDS**—Records Disposition Schedule

**REA**—Reliability Engineering Assessment

**REWG**—Reliability Engineering Working Group

**SMAF**—Space Mission Assurance Framework

**SMC**—Space and Missile Systems Center

**V&V**—Verification and Validation

**VV&A**—Verification, Validation, and Accreditation

### *Terms*

**Launch Vehicle Success Probability**—The probability of a specific booster or upper stage achieving successful satellite deployment in an acceptable orbit.

**Mission Area**—The capability provided by one or more satellite constellations. These mission areas can be composed of existing or future satellite constellations.

**Modeling, Simulation, & Analysis (MS&A)**—The discipline that comprises the development and use of models and simulations. Using mathematical representations, prototypes, phenomenological observations, and experiential data to project life expectancies and mission reliability estimates.

**Parameters**—Analysis inputs to include launch reliability estimates and both wear-out, and on-orbit reliability projections provided by SMC, NRO, or REWG representatives.

**Reliability Engineering Assessment (REA)**—Provides a constellation availability forecast as an analytical baseline for subsequent SMAF analyses.

**Reliability Engineering Assessment Working Group (REWG)**—This advisory group is convened by the REWG Lead, appointed by the appropriate mission area lead and is responsible for reviewing and validating the reliability parameter list. The REWG develops and coordinates the REA and submits it to the HQ AFSPC/A2/3/6 for approval. This group consists of, at a minimum, the REWG Lead, acquisition organization representatives, pertinent payload and platform operational managers, USSTRATCOM and other stakeholders, launch schedulers, M&S analysts/specialists, and user community representatives, as appropriate.

**Reliability Parameter List**—A report and file depicting an explicit and summary level listing of key input reliability parameters, values, and assumptions for use in REAs.

**Satellite Constellation**—A satellite constellation is comprised of those on-orbit satellites capable and intended to support a unique satellite constellation mission. A given satellite may be considered part of more than one constellation and support more than one mission.

**Satellite Constellation Mission**—A unique performance requirement of a satellite constellation that is traceable to a specific customer need.

**Space Mission Assurance Framework (SMAF)**—The framework to assess space mission assurance, develop requirements for US space systems, describe the impact of space-based effects on the Joint campaign, and ensure the ability to provide those effects to combatant commanders. The SMAF enables the Air Force Space Command (AFSPC) Commander to develop future architectures and inform space operation planning in support of combatant commanders (CCDRs).

**Verification and Validation (V&V)**—Validation is the process of determining the degree to which a model is an accurate representation of the real-world from the perspective of the intended uses of the model. Verification is the process of determining that M&S accurately represent the developer's conceptual description and specifications. This is accomplished by identifying and eliminating mistakes in logic, mathematics, or programming.