



**NESDIS
Policy
Directive**

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NOAA/NESDIS



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SATELLITE EXTENDED LIFE ESTIMATION POLICY

August 2017

COMPLIANCE IS MANDATORY



Prepared by:

U.S. Department of Commerce

National Oceanic and Atmospheric Administration (NOAA)

National Environmental Satellite, Data, and Information Service (NESDIS)



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Table of Contents

I. Purpose:	6
II. Scope:	6
III. Reference Documents:	6
IV. Roles and Responsibilities:	6
V. Guidelines	7
VI. Update and Revision Policy:	9
APPENDIX A.....	10



**NOAA Satellite and Information Service
NESDIS Satellite Extended Life Estimation Policy**

I. Purpose:

The purpose of this Policy Directive is to document the policy for conducting reliability-based estimates of extended life projections for on-orbit National Oceanic and Atmospheric Administration NOAA National Environmental Satellite, Data, and Information Service (NESDIS) satellites. Results of these analyses will provide additional data for NESDIS decision-making such as constellation replenishment, launch date planning, contingency planning, and end-of-life operations.

II. Scope:

The NESDIS Satellite Extended Life Estimation Policy applies to satellites that have been on orbit for at least one year beyond the formal commissioning date. NESDIS program offices and operations personnel may use this data for constellation management purposes. NESDIS program office and financial personnel may use this data to plan and execute various hardware and software sustainment contracts, for NESDIS to explore possible contingencies to assure continuity. Top-level results of these studies may be shown on public flyout charts or in other publications and presentations. NESDIS policy guidance regarding routine and contingency end-of-life disposal operations is beyond the scope of this Directive. The results will inform availability analyses and selection of launch dates and spare activation dates.

III. Reference Documents:

- (a) *National Space Policy of the United States of America*, June 28, 2010, or current version
- (b) *US Government Orbital Debris Mitigation Standard Practices*, August 14, 2001, or current version
- (c) Aerospace Corporation report TOR-2007(8583)-6889: *Reliability Program Requirements for Space Systems*, 10 July 2007, or current version
- (d) NASA Procedural Requirements 8705.4 (NPR 8705.4): *Risk Classification for NASA Payloads*, June 14, 2004, or current version,
- (e) NESDIS Office of Satellite and Product Operations (OSPO): Operational status pages found in <http://www.ospo.noaa.gov>

IV. Roles and Responsibilities:

- (a) NESDIS Assistant Administrator (AA): Final decision authority for operational and acquisition matters for which include extended life analysis data is a factor.



- (b) NESDIS Office of Systems Architecture and Advanced Plans (OSAAP):
 - (1) Determines the scope and frequency of satellite extended life estimation analyses using the list of data in Appendix 1;
 - (2) In conjunction with appropriate NESDIS offices, develops and maintains a list of spacecraft requiring extended life estimations;
 - (3) Ensures analysis results permit compliance with orbital debris guidelines;
 - (4) Coordinates with stakeholder NESDIS offices to ensure that the required reliability and operational data are available to support extended life analyses;
 - (5) Ensures quality and completeness of all reliability and extended life estimates; and,
 - (6) Performs as project manager for contractor team performing the extended life estimation analysis.
- (c) NESDIS Satellite Program and Project Offices:
 - (1) Ensures that spacecraft, instrument(s) and communications payload (if any) and ground system prime contracts contain tasks to produce and deliver to the OSAAP team reliability data outlined in Appendix 1;
 - (2) Provides appropriate subject matter expertise, as required, to the OSAAP team for analysis support and review of results; and,
 - (3) Facilitates execution of any required nondisclosure agreements between program and project office contractors and the OSAAP contractor team.
- (d) NESDIS Office of Satellite and Product Operations (OSPO):
 - (1) Jointly with OSAAP, ensures extended life operational procedures and plans comply with current U.S. orbital debris mitigation guidelines and other relevant U.S. space policy;
 - (2) Ensures that the on-orbit performance data for the spacecraft, instruments and communications payloads are made available to OSAAP for the reliability analyses;
 - (3) Provides appropriate subject matter expertise, as required, to the OSAAP team for analysis support; and,
 - (4) Reviews results of the analysis and provides feedback and comments as necessary.

V. Guidelines

NESDIS extended life estimates will be performed in a manner consistent with best practices of U.S. Government space agencies in the civil and national security sectors:

- (a) Categories of reliability information originating from the program office and its contractors are listed in Appendix A. For legacy satellite programs, the program offices shall make a best-effort attempt to provide as much data as possible to OSAAP, recognizing that some elements of Appendix A data may not have been part of the development contracts. For future NESDIS satellite programs, all NESDIS program offices shall ensure that the required reliability data is on contract and is provided to OSAAP unless the mission category does not require reliability data. (See Reference III. (d), and Paragraph V (j).)
- (b) Extended life estimates are not required for satellites that have been in orbit for less than one year or have not yet been commissioned. The date of the initial analysis may be



extended if an initial checkout period is greater than one year or if a longer period of time is necessary to align a new satellite with other satellites of the same constellation. OSAAP will determine, in consultation with the NESDIS AA, the appropriate timing of the initial analysis.

- (c) Operational data derived from telemetry analysis will be used to augment the “factory” data in Appendix A. OSPO shall provide the telemetry data, along with any required subject matter expertise, to OSAAP when needed.
- (d) OSAAP’s analysis contractor will research a broader range of U.S. Government and commercial satellites for similar parts and subsystems in an effort to increase the statistical sample size of similar subsystems or critical components.
- (e) The OSAAP contractor will develop validated reliability curves. As is the standard practice, projected lifetime is plotted against a percentage confidence level.
- (f) For purposes of publication, NESDIS will publish extended life estimation dates corresponding to the 60% confidence level
- (g) If appropriate, separate lifetime estimates will be performed for spacecraft having two dissimilar missions. For example, NOAA’s polar and geostationary spacecraft have both a remote sensing and a communications relay mission. For situations where a satellite can no longer perform its remote sensing mission but is still operational in all other respects, OSAAP may perform an additional reliability assessment for remaining spacecraft systems in order to estimate continued lifetime as a communications satellite.
- (h) Reliability-based extended life estimations will be performed on a yearly basis. The resulting life extension estimates will be used for operational planning upon OSAAP review and subsequent recommendation to the NESDIS AA.
- (i) Out-of-cycle analyses may be performed if a significant event involving NOAA satellites or similar systems on other satellites occurs in large enough numbers to present an increased risk to NOAA satellite systems. For example, a contractor may discover a design flaw in NOAA and other spacecraft that has the potential to severely reduce mission life.
- (j) On a case-by-case basis, the NESDIS AA may direct, or the responsible office director may determine, that an extended life reliability estimate will be conducted for NESDIS spacecraft built to NASA Class C or D standards (See Reference III.(d)) or equivalent standards if the spacecraft is procured from another agency. These criteria also apply to NESDIS-procured hosted payloads. OSAAP will assist the responsible program office, as requested, in determining if sufficient reliability data exists for Class C or D missions in order to perform a meaningful analysis.

Note 1: For joint programs (except those described in Paragraph V (j)) with a domestic and/or international partners, the stakeholder NESDIS office will consult with OSAAP during development of the partnership agreement to determine the extent to which NESDIS will be responsible for conducting reliability and extended life analyses. OSAAP guidance will take into account the relevant outer space treaties and best practices concerning end-of-mission planning and execution to recommend the responsible party. Any exchange of technical information between NESDIS and an international partner will be in compliance with export control laws and procedures.



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Note 2: For NESDIS hosted payloads, NESDIS program and project offices will not be required to perform extended life estimation analyses for the host spacecraft, per accordance with accepted space industry best practices. NESDIS reserves the right, however, to require host spacecraft reliability data from the hosting entity as appropriate, using elements in Appendix A.

VI. Update and Revision Policy:

- (a) Extended life estimates for on-orbit NOAA satellites covered by this policy will be performed on an annual basis or sooner based on criteria in Paragraph V.(i). Initial estimates for newly-launched spacecraft will be performed according to Paragraph V.(b).
- (b) At the appropriate time after an updated analysis is completed, NESDIS will publish updated flyout charts according to the current version of NPD 1411.01A: *NESDIS Flyout Chart Policy*.



APPENDIX A

Reliability Data Requirement List (Ref: Aerospace Corporation)

- *Reliability*
 - Success criteria
 - Design life
 - Probability at design life
 - Mean mission duration
- *Reliability models*
 - Reliability vs. mission time (table and/or curve)
 - Reliability Block Diagrams (RDBs) for all systems/subsystems/components
 - Function block diagrams
 - Failure rates and breakdown
 - *Sources and traceability*
 - *Temperatures*
 - Single point failure list
 - Critical item list
 - Re-entry analysis (required for low-altitude spacecraft that must perform a controlled deorbit at end of mission)
 - Transfer to final orbit analysis (required for spacecraft that will be maneuvered to a proscribed disposal orbit rather than deorbited)
 - Deployment analysis (required for spacecraft that must separate from an upper stage or require mechanical operations for systems such as solar panel arrays)
- *A list of wear out items*
 - Items do not meet 2x life testing
- *EXCEL spreadsheet or RELEX* input files which contain all reliability models and calculations should be furnished*

*RELEX is a commercial product for reliability analysis