PREFERRED RELIABILITY PRACTICES

QUALIFICATION OF NON-STANDARD EEE PARTS IN SPACEFLIGHT APPLICATIONS

Practice:

The source for selection of acceptable flight quality EEE parts for use on Goddard projects is GSFC Preferred Parts List (PPL-20)[2]. PPL-20 complements NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List (NSPL)(MIL-STD-975)[1] by listing additional part types and part categories not included in MIL-STD-975. Recognizing that it is neither possible nor desirable to include all parts in the GSFC PPL and in the NSPL, the GSFC parts requirements make provision that limited numbers of parts not included in the PPL or the NSPL may be used if it is demonstrated that the parts are acceptable[5, section 5]. The acceptability of nonstandard parts is enhanced by use of the part procurement specifications provided in Appendix E of PPL-20. The acceptability of these nonstandard parts must be demonstrated prior to commitment to design or use. Requests for approval to use nonstandard parts with supporting documentation are forwarded to the appropriate GSFC Project Office for review and approval. The practice described herein is used for demonstrating and documenting the acceptability of nonstandard parts for space flight use.

Benefits:

The practice of using approved nonstandard parts that have been appropriately demonstrated to be acceptable for the applications provides for a wider range of parts selection than are available with standard parts. These parts are at a quality level equal to that of Grades 1 or 2 standard parts.

Programs which Certify Use:

GFSC spaceflight projects approve the use of nonstandard parts on a per case basis.

Center to Contact for More Information:

GFSC

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Implementation Method:

Any EEE part that does not meet the criteria of a NASA Standard Part by being listed in the NSPL or the PPL is a nonstandard part that must be reviewed and accepted prior to use. It is the responsibility of the activity selecting the nonstandard part to demonstrate acceptability of the part prior to committing it to a design. Contractors document and approve their selection, application, evaluation, and acceptance criteria for nonstandard parts on a GSFC Form 4-15 (see Figure 1), Nonstandard Parts Approval Request (NSPAR)[5]. The NSPAR forms are forwarded to the GSFC Project Office for review and GSFC approval. Figure 2 depicts the process flow of the nonstandard parts approval process.

Nonstandard Parts Specifications:

Nonstandard parts must be at a quality level equal to that of Grade 1 or 2 standard parts and are procured in accordance with military, NASA, or contractor controlled specifications prepared in accordance with MIL-STD-490. Specifications for nonstandard parts are equal to the requirements of the nearest applicable standard part.

Specifications and drawings fully identify the item being procured and include the physical, electrical, and environmental test requirements and quality assurance provisions including parts screening necessary to control manufacturing and acceptance. Specifications also describe marking, handling, packaging, storage of parts and the criteria for testing of parts taken from storage, and address environmental controls for temperature, humidity, particulate contamination, and controls for electrostatic discharge (ESD) for parts which are susceptible to ESD damage.

Parts Qualification and Quality Conformance Inspection:

Nonstandard parts have qualification bases traceable to test and inspection data at the part level in a manner consistent with the specification requirements of the nearest standard parts. The qualification is based on parts which have been produce by the same manufacturer using the same manufacturing technology as the nonstandard parts for which approval is being sought. Nonstandard parts undergo quality conformance inspection consistent with the specification requirements of the nearest standard parts.

Hybrid Microcircuits:

Hybrid microcircuits that are not included in the NSPL or the PPL are subject to nonstandard parts control. Their selection and approval is consistent with the requirements of MIL-H-38534B, General Specification for Microcircuits.

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Additional Parts Requirements Applicable to Nonstandard Parts:

The following additional requirements pertain to nonstandard parts as applicable: Derating, Radiation Hardness, Screening Verification Tests, Destructive Physical Analyses, and Parts Identification List.[5]

Technical Rationale:

The competent selection and acceptance of the proper EEE Parts for spaceflight use is an essential part of design of spacecraft hardware. With the rapidly growing availability of EEE parts that perform major system functions, the selection of parts has become a mainstream activity of electronic design. Further, the assurance that the selected part will perform reliably in the application, whether it be a small component with a limited mission life or an entire spacecraft with a long expected lifetime, continues to be a primary engineering responsibility.

Impact of Nonpractice:

Noncompliance with the use of NASA qualified parts would result in the use of unqualified and untested parts in spaceflight hardware. These unqualified parts could result in marginal performance and failure to perform in or survive the environmental exposure of space.

References:

1) NASA Standard Electrical, Electronic, and Electromechanical Parts List, MIL-STD-975 (NSPL)
2) GSFC Preferred Parts List (PPL)
3) MIL-STD-490, Specification Practices
4) MIL-H-38534B, General Specification for Hybrid Microcircuits
5) Guidelines for Standard Payload Assurance Requirements (SPAR) for GSFC Orbital Projects

QUALIFICATION OF NON-STANDARD EEE PARTS IN SPACEFLIGHT APPLICATIONS

NONSTANDARD PART APPROVAL REQUEST
(See Instructions on Back)

1. CONTRACT NUMBER NAS 5-	2a. NSPAR NUMBER	
3. PROJECT NAME	2B. RESUBMITTAL ☐	
4a.CONTRACTOR		
4b.SUBCONTRACTOR		
5. SYSTEM & COMPONENT		
6. PART NAME		7. PART GRADE 1 2
8. PART NUMBER	9. COMMERCIAL PART NUMBER	
10.MANUFACTURER		FSCM -
11.PROCUREMENT SPEC.		REVISION
12.SCREENING SPEC.		REVISION
13.RATIONALE FOR USE OF NONSTANDARD PART:		
14.BASIS FOR ACCEPTANCE:		

15.CONTRACTOR CERTIFICATION

PREPARED BY: _____ Title _____ Date

PREPARED BY: _____ Title _____ Date

PREPARED BY: _____ Title _____ Date

PREPARED BY: _____ Title _____ Date

GFSC 4-15 Revised (1/83) Previous Editions Obsolete

Figure 1. Nonstandard Part Approval Request (NSPAR) / GSFC Form 4-15

QUALIFICATION OF NON-STANDARD EEE PARTS IN SPACEFLIGHT APPLICATIONS

INSTRUCTIONS FOR ENTERING DATA ON GSFC NONSTANDARD PARTS APPROVAL REQUEST

GENERAL

This NSPAR form is to be used to request approval of the use of a nonstandard part or device for a specific project, i.e., those parts or devices not listed in the GSFC Preferred Parts List or MIL-STD-975.

DETAIL

Block 1 - Enter the prime contract number

Block 2a - The contractor may assign a serial number to each NSPAR (optional)

Block 2b - If this NSPAR is being resubmitted as a result of a prior disapproval, check this block.

Block 3 - Enter project name in full

Block 4a - Enter the name of the prime contractor

Block 4b - Enter the name of the subcontractor, if applicable

Block 5 - Enter the name of the system and component (box) in full for spacecraft systems
Enter the name of the experiment or instrument for payload items

Block 6 - Enter in full, the name of the part; i.e., capacitor, solid tantalum, resistor, wire wound power. (use listing in the GSFC Preferred Parts List as a guide.) Multiple parts listings on a single NSPAR is not permitted.

Block 7 - Check the part grade requirement as defined by the Project Parts Program Plan (grade 1 or grade 2).

Block 8 - Enter the part number which uniquely identifies the part. If it is a nonstandard mil part, enter the mil part number. If it is procured to a source control drawing (SCD), enter the SCD number and dash number associated with the source used. Otherwise use the commercial designation.

Block 9 - Enter the commercial number for the parts (manufacturer's commercial catalog no.)

Block 10 - Enter in full, the name and location of the manufacturer of the part or device and/or the FSCM number. (See DOD HANDBOOK H4-1.) For non-standard MIL-Spec parts, the designation QPL may be used on lieu of manufacturers identification if the actual source is not known. Multiple source listings may appear on a single NSPAR form.

Block 11 - Enter the procurement specification and appropriate revision letter to which the part or device is to be procured. If no procurement specification is used enter "Commercial." Attach one copy of applicable document to NSPAR for review.

Block 12 - Enter the screening specification and appropriate revision letter to which the part or device is to be tested. Attach one copy of applicable document to NSPAR for review.

Block 13 - Compare the nonstandard part with the closest standard part. Differences may include unique electrical characteristics, package size, etc.

Block 14 - Enter the basis for acceptance of a nonstandard part. Indicate the qualification status of nonstandard part. Attach one copy of the qualification test data including attributes and variables data. The criteria for qualification by similarity includes similarity of design and function and includes fabrication by same manufacturer using the same process and quality controls as the standard part. If prior usage on NASA spacecraft is used as basis for acceptance, indicate the programs where used with launch dates and orbital life. The part application must be congruent with that used in prior programs. Attach one copy of the qualification test plan to be used if none of the above is applicable.

Block 15 - For NSPAR's generated by the prime contractor and/or subcontractor, enter the signature and title of the preparer, the parts/reliability engineer and the project program manager or his designated representative. Subcontractor NSPARs shall be submitted to the prime contractor for review and sign-off prior to forwarding to GSFC. The signatures provide that the NSPAR has been reviewed by appropriate contractor personnel and that the information included is accurate and complete.

Figure 2. Nonstandard Part Approval Request / GSFC Form 4-15 (Second Page)

QUALIFICATION OF NON-STANDARD EEE PARTS IN SPACEFLIGHT APPLICATIONS

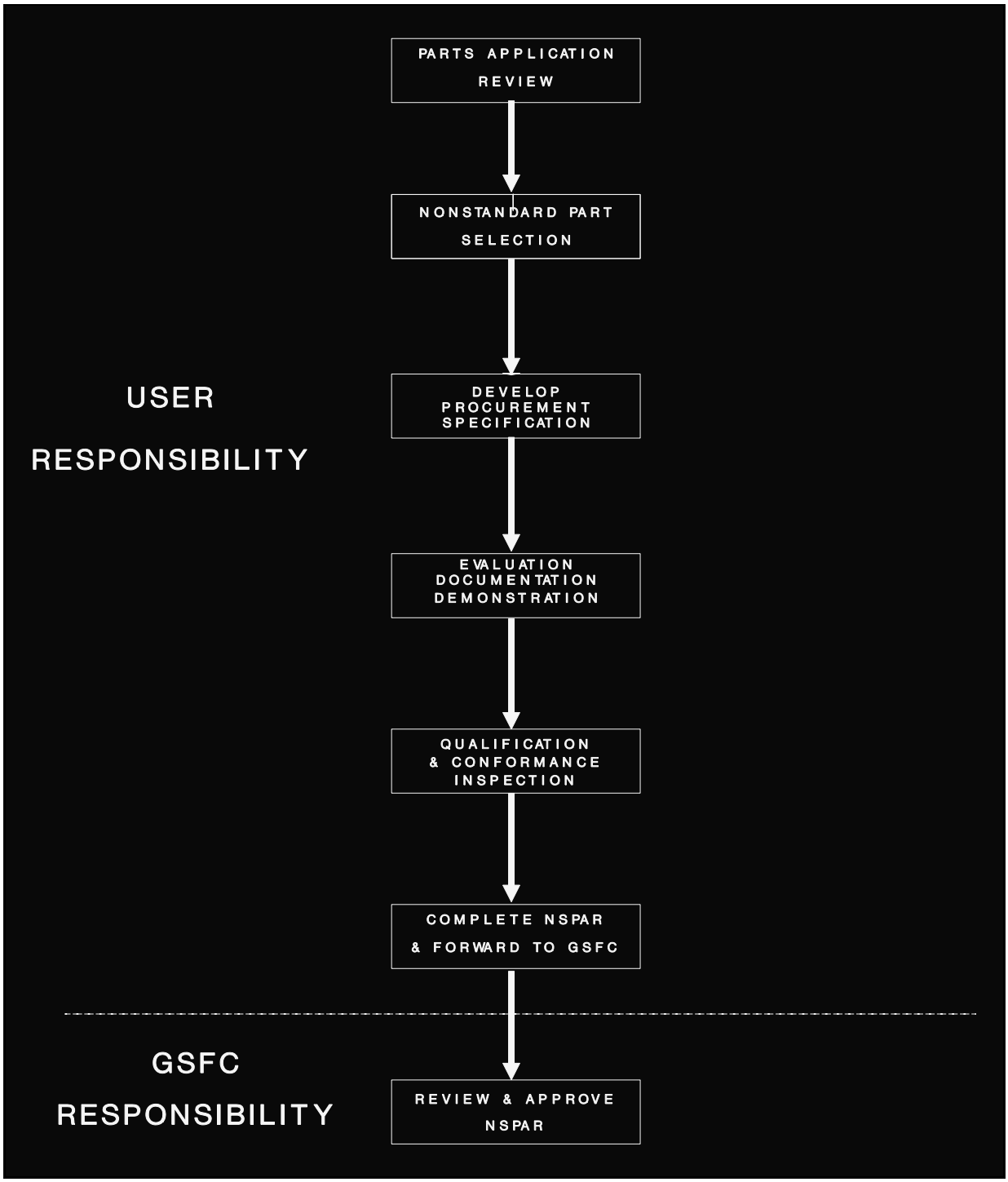

Figure 3. Nonstandard Part Approval Process Flow