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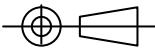
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RELIABILITY DEMONSTRATION FOR
LIQUID PROPELLANT ROCKET ENGINES

FOREWORD

This standard has been prepared for the guidance of contractors and procuring activities interested in the liquid propellant rocket engine as a separate entity.

The extent of available funding and time for development are important factors in planning and attaining a suitable demonstration of reliability. Thus, in the interests of economy of both funding and time, this standard recommends against separate tests of engine or subsystem strictly for reliability demonstration purposes. Also, since the number of engines normally available for test are few in number, and since the number of tests suitable for reliability demonstration are usually limited, in the interest of practicality this standard permits use of subsystem test results for computing engine reliability and recommends that engine and subsystem tests required for other purposes be designed and conducted so as to give suitable data for reliability demonstration purposes. The reliability demonstration program should also provide early insight to engine reliability. For these reasons the recommended reliability demonstration program uses Design and Development, Production, Qualification and Flight Test data to satisfy its purposes.

Validity of any reliability demonstration program is always enhanced when the results are obtained at the highest practical level of assembly. Although techniques described for engine/subsystem demonstration may be applicable to subsystem/component demonstration, this standard restricts itself to demonstration at the engine/subsystem levels. Component reliability tests, although important and desirable, are recommended only for application in improving or advancing the overall reliability of the engine/subsystems.

Because of the complexity and need for almost individual tailoring of such plans, this standard only briefly mentions and does not attempt to fully cover variables or combined variables and attributes plans for reliability demonstration - nor those involving statistical dependence.

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No.	Rev.	No.	Rev.	No.	Rev.
1	NEW	6	NEW	11	NEW
2	NEW	7	NEW	12	NEW
3	NEW	8	NEW	13	NEW
4	NEW	9	NEW	14	NEW
5	NEW	10	NEW	15	NEW

CUSTODIAN: RELIABILITY COMMITTEE

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SPECIFICATION
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TITLE
RELIABILITY DEMONSTRATION OF
LIQUID PROPELLANT ROCKET ENGINES

CLASSIFICATION
STANDARD PRACTICE

NAS 1717
SHEET 1 of 15

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1.0 SCOPE

1.1 Purpose

This standard specifies reliability demonstration guidelines and practices for liquid rocket engines.

1.2 Application

This standard provides methodology for conducting reliability demonstration programs suitable for use with liquid rocket engines. To be most meaningful and statistically correct, a demonstration program should be conducted at the highest practical level of assembly and under conditions representative of those experienced in the use environment.

Program limitations in conjunction with need for data at early dates in the program force certain compromises which historically have proven acceptable. The first of these compromises is that it is necessary to utilize static test results. Second, design and development configuration engines which closely approximate the planned flight engines may be included in the demonstration sample. Finally, certain programs may not provide for sufficient complete engine tests and subsystem test results may be combined with tests of the complete engine to produce a sufficient sample for reliability demonstration.

Validity of the reliability demonstration program is adversely affected as the samples depart from the use configuration and environment. The extent to which subsystem data is combined with data obtained from tests of the complete engine system shall be mutually agreed to between the contractor and procuring activity.

General requirements and the reliability demonstration criteria described in the detailed requirements (Section 5) will be the principal basis for assessment of liquid rocket engine reliability. Specific demonstration plans will be prepared by the contractor in keeping with customer requirements, as part of the overall reliability program plan.

This standard applies primarily to large liquid rocket engines but may be adapted for other liquid rocket engine applications as an option of the contractor and procuring activity.

2.0 REFERENCED DOCUMENTS

2.1 Appendix 2 herein lists several useful references. The current issues of the following documents form a part of this standard practice to the extent referenced herein:

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2.1.1 Governmental

MIL-STD-280, Definition of Terms for Equipment Divisions

MIL-STD-721, Definition of Terms for Reliability Engineering

2.1.2 Non-Governmental

References No. 1, 9, and 10 listed in Appendix 2 herein.

3.0 DEFINITIONS

3.1 The definitions included in MIL-STD-280 and MIL-STD-721 apply.

4.0 GENERAL REQUIREMENTS

4.1 Engine Demonstration

Because of cost and schedule considerations, in general, it is not expected nor normally desirable that liquid rocket engine tests be undertaken solely for the purposes of reliability demonstration. For the same reasons, short duration firings shall usually replace full duration firings, to terminate upon accumulation of sufficient data to permit valid decision without complicated manipulation. Such short duration tests will be equated to full duration tests by methods indicated in paragraph 4.1.5.2. Optimum use will be made of test data from all sources, which can be considered applicable (see paragraph 5.3.1) for reliability demonstration purposes, such as:

- a. Development and continuing development tests
- b. Pre-flight rating tests (PFRT)
- c. Qualification Tests
- d. Production acceptance tests
- e. Applicable field and storage tests
- f. Applicable information for other similar programs

4.1.1 Principal Activities

Development of a liquid rocket engine reliability demonstration program involves four principal activities:

- a. Establishment of a declaration policy as to the applicability of engine configuration and test conditions.
- b. Establishment of criteria for classification of test results.

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