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Space Administration

**John C. Stennis Space Center**  
Stennis Space Center, MS 39529-6000

**SPR 8730.4 Rev C**  
**July 2018**

## **COMPLIANCE IS MANDATORY**

### **John C. Stennis Space Center Metrology and Calibration Control Program**

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	<i>Number</i>	<i>Rev.</i>
	Effective Date: July 11, 2018	
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Responsible Office: RA20/Center Operations Directorate		
<b>SUBJECT: SSC Metrology and Calibration Control Program</b>		

## Document History Log

Status/Change/ Revision	Change Date	Originator/ Phone	Description
Basic	November 15, 2008	Clyde Dease/8- 1905	Initial Release. New document to include and combine all provisions of SSLP-8720-0001 and SCWI-8730-0001 which are superseded.
Rev A	03/21/14	Mark Hughes/8- 1657	Updated all references to include the latest revision of NPD8730.1 and ANSI/NCSL Z540.3-2006. Updated sections 1.5 and 1.7 to include the additional requirements documented in the references. Changed COTR to COR in all locations. Changed Center Director signature to Dr. Richard Gilbrech. Update Section 1.3 "Office of Safety and Mission Assurance" to "Safety and Mission Assurance Directorate". Added "Reliability" in the Appendix A Definitions. Removed the revision "C" from NPD 8730.1C under Sections P.1 and P.3b. Revised "Responsible Office" in the Header from "RA30" to "RA20".
Rev A-1	3/21/2016	Bruce Farner/8- 2967	Administration Change.
Rev B	06/18/17	Bruce Farner/8- 2967	Added to section P.4 with additional documents. Changed section 1.5 to require compliance with the NPD rather than a specific ANSI specification. Added additional requirements for NCR status in section 1.7
Rev C	7/9/18	Bruce Farner/8- 2967	Updated the authority document to reflect NASA-STD-8739.12, Metrology and Calibration; Updated Section 1.5.1 to reflect practice of notifying customer of out of tolerance condition. Removed LWR from Appendix A; Removed LWR from Appendix D and replaced with Laboratory Work Order Routing Slip; Updated Section 1.3.1 to reflect Procurement Office coordination through Center Operations, Engineering and Test, Safety and Mission Assurance, Directorates, during selection and approval of Contracting Officer's Representative (COR) and Alternate COR.

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## PREFACE

### P.1 PURPOSE

The purpose of this document is to define the method and responsibilities for the control of all Inspection, Measuring and Test Equipment (IM&TE) used to perform measurements to meet the requirements of SPR 1280.1, SPR 8500.1, and NASA-STD-8739.12.

### P.2 APPLICABILITY

- a. This SPR is applicable to John C. Stennis Space Center (SSC) and all NASA SSC personnel.
- b. This SPR is applicable to SSC contractors and subcontractors, to the extent specified in their respective contracts.
- c. This SPR is applicable to all NASA SSC organizational elements, contractors, and subcontractors performing work for or on any NASA program.
- d. This SPR is applicable to all IM&TE used at SSC to perform measurements associated with the following functions:
  - (1) Acceptance testing to ensure that a part, component, or system meets specifications.
  - (2) Testing or certification of flight hardware or qualification and acceptance of flight-related products.
  - (3) Measurements that are essential to the safety of personnel and the public or for the protection of Government property.
  - (4) Operation of telecommunications and transmission systems where exact signal interfaces and circuit confirmations are essential to mission success.
  - (5) Research, development, testing, or other applications where the specifications, end products, or data are accuracy sensitive, including instruments used in hazardous and/or critical applications.
  - (6) Measurement results that will be published or otherwise released for external review.
  - (7) Measurements used to apportion, levy, or otherwise assign cost(s), or ensure local, state, or Federal regulatory compliance.

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e. The use of test equipment not included in the calibration recall process shall be limited to the following applications:

- (1) Research and/or development, testing or special applications where substantiated measurement accuracy is not required.
- (2) For “indication only” purposes.

f. In this directive, all document citations are assumed to be the latest version unless otherwise noted.

### **P.3 AUTHORITY**

- a. National Aeronautics and Space Act of 1958, as amended, 51 U.S.C. 20113(a)
- b. NASA-STD-8739.12, Metrology and Calibration

### **P.4 APPLICABLE DOCUMENTS AND FORMS**

- a. American National Standards Institute/ National Conference of Standards Laboratories (ANSI/NCSL) Z540.3-2006, Requirements for the Calibration of Measuring and Test Equipment
- b. NPR 1441.1, NASA Records Management Program Requirements
- c. SPR 1280.1, SSC Management System Requirements
- d. SPR 8500.1, SSC Environmental Management System Procedural Requirements

### **P.5 MEASUREMENT/VERIFICATION**

Compliance with the requirements contained in this document will be verified through annual Stennis Management System (SMS) audits, observations, and internal self-assessments. Additional monitoring of contractor compliance is provided through Government approved inspectors (Safety and Mission Assurance Directorate (SMA) support services contractor).

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## P.6 CANCELLATION

SPR 8730.4 Rev B, John C. Stennis Space Center Metrology and Calibration Control Program dated July 28, 2017.

*Signature on file*

Richard J. Gilbrech, Ph.D.  
Director

### DISTRIBUTION

Approved for public release via NODIS and TechDoc; distribution is unlimited.

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## CHAPTER 1. ROLES AND RESPONSIBILITIES

### 1.1 General

It is the responsibility of all NASA SSC and Contractor personnel possessing Government supplied IM&TE requiring calibration to ensure compliance with the Stennis Metrology Program as outlined in this SPR.

### 1.2 NASA SSC Center Director

The NASA SSC Center Director shall appoint a voting representative to the NASA Metrology and Calibration Working Group (MCWG) to ensure formal representation in metrology and calibration issues at the Agency level.

### 1.3 Office of Procurement and Safety and Mission Assurance Directorate

1.3.1 NASA SSC Office of Procurement shall coordinate with Engineering and Test Directorate, Center Operations Directorate and Safety and Mission Assurance Directorate to assign a NASA Metrology and Calibration Technical Representative/Monitor (TM), a Contracting Officer's Representative (COR) and an Alternate Contracting Officer's Representative (ACOR) for laboratory services and the development of this document.

1.3.2 NASA SSC S&MA shall review necessary updates to this document and monitor compliance with the NASA Metrology and Calibration requirements.

### 1.4 NASA SSC Measurement Standards & Calibration Laboratory Technical Representative/Monitor, Contracting Officer's Representative and Alternate Contracting Officer's Representative

1.4.1 NASA SSC TM shall provide oversight of the development and implementation of MS&CL contract requirements, measurement assurance programs, and serve as a member of the MCWG.

1.4.2 The COR shall represent NASA's Contracting Officer in matters relating to contract definitions, changes, and implementation.

1.4.3 The COR/TM roles ensure SSC personnel perform the listed responsibilities and implement a Metrology and Calibration Program that meets the needs of the Agency and SSC programs.

1.4.4 The COR shall provide guidance and resolution on technical, scheduling, and prioritization conflicts within the SSC Metrology Program.

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1.4.5 The ACOR shall fill the same role as the COR during the absence or reassignment of the COR.

## 1.5 NASA SSC Measurement Standards & Calibration Laboratory (MS&CL)

1.5.1 The MS&CL shall:

- a. Implement a calibration and metrology program to meet institutional and program needs and to be in compliance with directives in NASA-STD-8739.12, Metrology and Calibration.
- b. Develop new calibration capabilities to support current and future SSC program metrology requirements.
- c. Provide formal and consistent representation and participation in the MCWG, other industry and Governmental technical groups, and Measurement Assurance Programs sponsored by the MCWG.
- d. Provide and maintain the Stennis Metrology Management System (SMMS), which maintains historical calibration data of measurement standards and calibrated instruments. The data includes calibration status, calibration due date, and equipment calibration and repair data.
- e. Maintain a records system that contains sufficient information to permit the repetition of calibration.
- f. Maintain records, certificates and reports for a period no less than the period specified in NPR 1441.1, NASA Records Management Program Requirements.
- g. Establish and maintain documented procedures to control, calibrate, and maintain IM&TE (including software), and be able to demonstrate that calibrated equipment meets the specified requirements.
- h. Provide calibration records to the user organization when requested, for verification that the measuring equipment is functionally adequate.
- i. Ensure that qualified personnel calibrate the test equipment.
- j. Provide high quality, timely calibrations for SSC IM&TE. Each piece of calibrated test equipment will have a calibration decal denoting its status.
- k. Prioritize and schedule work to best accomplish the requirements in terms of mission support, multi-agency initiatives, and customer service. Scheduling conflicts that cannot be resolved with

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customers are coordinated with the COR and, if necessary, may be elevated to NASA Management.

l. Maintain traceable measurement standards as per ANSI/NCSL Z540.3-2006. Calibration standards require a known valid relationship to nationally recognized standards or represent a physical constant of nature.

m. Generate and provide monthly recall reports with instructions to each calibration manager (CM), alternate, and assigned Quality Assurance (QA) Manager. Monthly reports will consist of the following sections:

- (1) Master IM&TE List
- (2) IM&TE Due Calibration next 45 days
- (3) Stored out of calibration IM&TE
- (4) Overdue IM&TE
- (5) IM&TE found out-of-tolerance last 45 days

n. Notify the user, in writing, of any calibration standard found to be out-of-tolerance that brings into question the validity of the results given in the Calibration Maintenance Report (CMR).

o. Notify the user whenever an item is found to be out-of-tolerance by returning a copy of the CMR and the data for use in their determination of the effect on product quality.

p. Notify the user organization if an item cannot be economically repaired.

q. Notify the user organization when an item is found to be out-of-tolerance and cannot be adjusted to meet specifications.

r. Verify compliance of calibration suppliers to ANSI/NCSL Z540.3-2006 whenever possible. If not available, the hierarchy would be as follows:

- (1) ANSI/NCSL Z540.3-2006 compliant laboratory
- (2) ISO 17025 accreditation from nationally recognized accreditation body such as National Voluntary Laboratory Accreditation Program (NAVLAP) or American Associations for Laboratory Accreditation (A2LA)

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(3) In the case of original equipment manufacturer (OEM) proprietary materials and/or processes, the OEM laboratory would be acceptable after careful review of available documentation.

s. Provide CM, alternate CM, and cognizant Quality Assurance personnel training in the SSC Metrology Program requirements and process.

t. Document the accuracy ratio or uncertainty if the random and systematic errors in any calibration measurement process exceed 25% of the tolerance of the parameter being measured.

u. Review and coordinate requests for extension of equipment calibration cycles, up to 10% of cycle, for items in the recall system.

v. Support the calibration needs of other NASA installations, Government agencies, and SSC tenants when existing capacity and capability can provide for this support.

w. Ensure that laboratory environmental characteristics (e.g., temperature, humidity, vibration, and cleanliness) are compatible with the accuracy requirements of the IM&TE, material, and calibration measurement processes.

x. Select and apply calibration intervals based on industry standard metrology principles.

y. Ensure that each piece of IM&TE has a unique Equipment Control Number (ECN).

z. Utilize integrity controls to indicate and/or prevent tampering that may compromise the suitability of the IM&TE for use.

## **1.6 Inspection, Measuring, and Test Equipment (IM&TE) Property Custodian/Organization**

1.6.1 The IM&TE Property Custodian or User Organization shall:

a. Assign IM&TE CM, assistant CM, and QA personnel to interface with the MS&CL for calibration services of assigned IM&TE within the SMMS.

b. Develop internal procedures necessary to support and implement the requirements of this document within their area of responsibility.

c. Provide a method to review and document the impact to measurement processes due to out-of-tolerance IM&TE.

d. Provide for the proper storage and handling of assigned IM&TE.

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e. Ensure that the equipment in their possession requiring calibration as per section P.2.d is calibrated/recalibrated within the requirements.

## 1.7 Calibration Manager (CM)

1.7.1 The assigned CM or alternate shall:

a. Ensure that all IM&TE have been entered into the SMMS as evidenced by assignment of an Equipment Control Number and a calibration decal placed upon it by the MS&CL indicating the calibration expiration date.

b. Submit IM&TE to the MS&CL for the established cyclic calibration in accordance with the event or due date, as indicated on the SMMS Calibration Recall Report.

c. Coordinate calibration needs in a timely manner including any unique calibration techniques, cleaning, or procedure requirements.

d. Notify the MS&CL in writing regarding IM&TE that no longer requires calibration for removal from the SMMS Calibration Recall Report.

e. Verify the integrity of the SMMS monthly Calibration Recall Report against IM&TE calibration status to ensure Calibration Recall Report accuracy. Report any discrepancies to MS&CL.

f. Notify the MS&CL in writing of changes to IM&TE calibration status when conditions warrant. Notification shall include the following:

(1) IM&TE ECN, name, model number, etc.

(2) Requested change

(3) Name of the requester and date

g. Forward any out-of-tolerance conditions to the IM&TE user for evaluation of impact to user measurements. Follow organization procedure to review and document the impacts.

h. Request calibration due date extensions of IM&TE to meet mission requirements. Extensions must be in writing and are granted at the discretion of the MS&CL after review. The extension shall not exceed 10% of the calibration interval. Requests for extensions of IM&TE shall include, but are not limited to, the following:

(1) IM&TE ECN, name, model number, etc.

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(2) Justification for the requested change

(3) Name of the requester and date

i. When the user organization desires to use the vendor's certification of new IM&TE, the vendor must be qualified to the guidelines established in Stennis Standard Operating Procedure (SSOP)8730-0016-MT, SSC Operating Procedure for Qualification and Use of Off-Site Vendor Calibration Services prior to submittal. The user organization will submit to MS&CL all new IM&TE requiring calibration, along with the Certificate of Calibration and other supporting documentation to meet the requirements.

j. Maintain the calibration status and all appropriate quality records for equipment on-loan from other NASA Centers. The CM shall notify the MS&CL of all NASA-loaned equipment for entry into the MS&CL equipment recall system.

k. Equipment not requiring periodic calibration, limited calibration, functional test, performance test, or laboratory standards designated as intrinsic (physical constant of nature), shall not have a decal applied unless otherwise captured by directorate level document for example SOI-8080-0019. The user/custodian of the equipment shall:

- (1) Initiate a request in writing to the Measurement Standards and Calibration Lab manager for the equipment to be placed in "no calibration required" status. Include the NASA Property (N-PROP) number from the bar code tag if attached. Also include the item name, manufacturer's model number and serial number and briefly state the intended use of the piece of equipment. Obtain Quality Assurance's concurrence with the request.
- (2) Upon approval of the request by the Measurement Standards and Calibration Lab manager and Quality Assurance, any existing calibration decal shall be removed.
- (3) The written request will be forwarded to Laboratory Services for generation of the CMR and entry/modification into SMMS.

## 1.8 IM&TE Users

1.8.1 IM&TE users (anyone at SSC using IM&TE to make measurements) shall:

- a. Review specified requirements for necessary measurements and tolerances of measured value(s).
- b. Evaluate environmental conditions (e.g., temperature, humidity, etc.) at user's IM&TE location that may affect the measurement performance of the IM&TE.

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- c. Ensure the measuring device or system accuracy satisfies the measurement requirements.
- d. Determine if IM&TE are used in a manner that requires calibration as in Section P.2.d.
- e. Submit IM&TE requiring calibration through their CM. The user notes any special work instructions, including calibration type (see Appendix B) and special handling on the work authorization document. Where necessary, the user/property owner provides an operation and service manual for the IM&TE.
- f. Assess and document the impact to their measurements when notified of an out-of-tolerance standard (Reverse Traceability).
- g. Assess and document the validity of previous inspections/tests when their IM&TE are found to be out-of-tolerance.
- h. Prior to each use, ensure the IM&TE bears evidence of current calibration.

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## CHAPTER 2. RECALL PROCESS

### 2.1 General

The SSC Metrology Program institutes a rigorous recall program to ensure IM&TE are properly categorized and maintained to meet the requirements of the Agency and SSC programs.

### 2.2 Process

2.2.1 Every month, MS&CL shall distribute the recall reports to the CM, assistant CM, and QA persons previously identified by the user organization.

2.2.2 When an IM&TE calibration interval expires within a 30-day period, the CM shall take one of the following actions:

- a. Submit item for calibration.
- b. Provide the MS&CL with a written request for an extension. At the end of the extension, the IM&TE is then submitted for calibration.
- c. Provide the MS&CL with written direction to change the status of IM&TE. The MS&CL updates SMMS appropriately.

2.2.3 If the CM does not take appropriate action within a 30-day period, as defined in Section 2.2.2.b, the MS&CL shall generate and distribute an overdue report to the CM's supervisor and the MS&CL NASA Technical Monitor.

2.2.4 If no action is taken within a 60-day period, the MS&CL shall notify the NASA Technical Monitor who will notify the appropriate program manager.

2.2.5 If items remain overdue after 90 days, the MS&CL shall notify the NASA Technical Monitor who will also notify the Center Director.

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## CHAPTER 3. RECORDS MANAGEMENT

### 3.1 Records

3.1.1 The following minimum records and/or forms shall be generated and/or maintained in accordance with this SPR or as defined in a requirements document:

- a. Calibration Maintenance Report (CMR) – The CMR includes, as a minimum, the IM&TE’s unique ECN, the condition received, documentation of any nonconformance found during calibration and final calibration data (if requested).
- b. Work Order Routing Slip – The Work Order Routing Slip includes the unique ECN, item description, manufacturer and model number, serial number, and description of service requirements.

3.1.2 Records shall be identified in the appropriate SSC Master Records Index (SMRI). All records and forms are assumed to be the latest version unless otherwise indicated.

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## APPENDIX A – ACRONYMS

A2LA	American Association for Laboratory Accreditation (A2LA)
ACOR	Alternate Contracting Officer's Representative
ANSI	American National Standards Institute
CM	Calibration Manager
CMR	Calibration Maintenance Report
COR	Contracting Officer's Representative
TM	NASA Metrology and Calibration Technical Representative/Monitor
ECN	Equipment Control Number
ETR	Equipment Transmittal Record
IM&TE	Inspection, Measuring, and Test Equipment
LSC	Laboratory Services Contract
MCWG	Metrology and Calibration Working Group
MS&CL	Measurement Standards and Calibration Laboratory
NAVLAP	National Voluntary Laboratory Accreditation Program
NCSL	National Conference of Standards Laboratories
NIST	National Institute of Standards and Technology
OEM	Original Equipment Manufacturer
QA	Quality Assurance
S&MA	Safety & Mission Assurance
SPR	Stennis Procedural Requirement
SMMS	Stennis Metrology Management System
SMRI	Stennis Master Records Index
SSC	Stennis Space Center

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## APPENDIX B – DEFINITIONS

Accuracy – The deviation between the result of a measurement and the value of the measured quantity.

Calibration – The set of operations that establish, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system, and the corresponding standard or known values derived from the standard. Calibration may include adjustment and/or minor repair.

Calibration Interval – An established period of time between calibrations designed to meet a specified end-of-period reliability as determined by calibration history, vendor manuals, and usage.

Calibration Manager – An individual who is responsible for the calibration and status of the IM&TE and is the interface between the MS&CL and the user organization.

Equipment Control Number (ECN) – A unique number assigned to the test equipment by the Measurement Standards and Calibration Laboratory.

Inspection, Measuring and Test Equipment (IM&TE) – Any devices used to perform measurement(s) where distinct values are required for system performance or to demonstrate conformance to specified requirements.

Metrology – The field of knowledge concerned with measurement.

National Standard – Standards recognized by official national decisions as the basis for fixing the value, in a country, of all other standards of the quantity concerned. In the United States, national standard are established, maintained, and disseminated by the National Institute of Standards and Technology (NIST).

Reliability – With respect to measurement reliability, the probability that all the applicable measurement quantities of measuring and test equipment are within tolerance during a calibration cycle.

Required Completion Date – The date that the laboratory services must complete the calibration work order as stipulated by the customer on the ETR.

Reverse Traceability – The process by which IM&TE are identified that have been calibrated with standards that have been found to be out-of-tolerance.

Standards – Equipment of known accuracy against which items of unknown accuracy are calibrated. Standards include certified reference material.

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Tolerance – The total permissible variation of a quantity from a designated value.

Traceability – The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain.

Uncertainty – A parameter associated with a measurement that characterizes the dispersion of a value that could be reasonably attributed to the measured quantity.

User Organization – The organizational element having responsibility for the use of IM&TE affecting SSC programs.

Validation – Confirmation by examination and objective evidence that particular requirements for a specific intended use are fulfilled.

Verification – Confirmation by examination and objective evidence that specified requirements have been fulfilled.

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## APPENDIX C – CALIBRATION TYPES

### Calibration Types Available

Calibrated – Calibration of a device to meet the performance requirements stated by its manufacturer, throughout its stated range of operation. The device will be calibrated at specified intervals. A calibrated device is suitable as IM&TE.

Limited Calibration – Calibration of a device to meet some, but not all, of the performance requirements stated by its manufacturer, and/or calibration that does not calibrate the device throughout its stated range of operation. The limitations of the calibration will be documented on the device's calibration record. It will be calibrated at the same regular intervals as a calibrated device. A limited calibration device is suitable as IM&TE only when its limitations are known by the user, and a copy of its calibration record is available. Limited Calibrations may also be used to specify a special test or better accuracy than the manufacturer specifies.

Functional Check – Functional Check devices are tested to user specifications and intervals (no recall). A Functional Check device is not suitable as IM&TE.

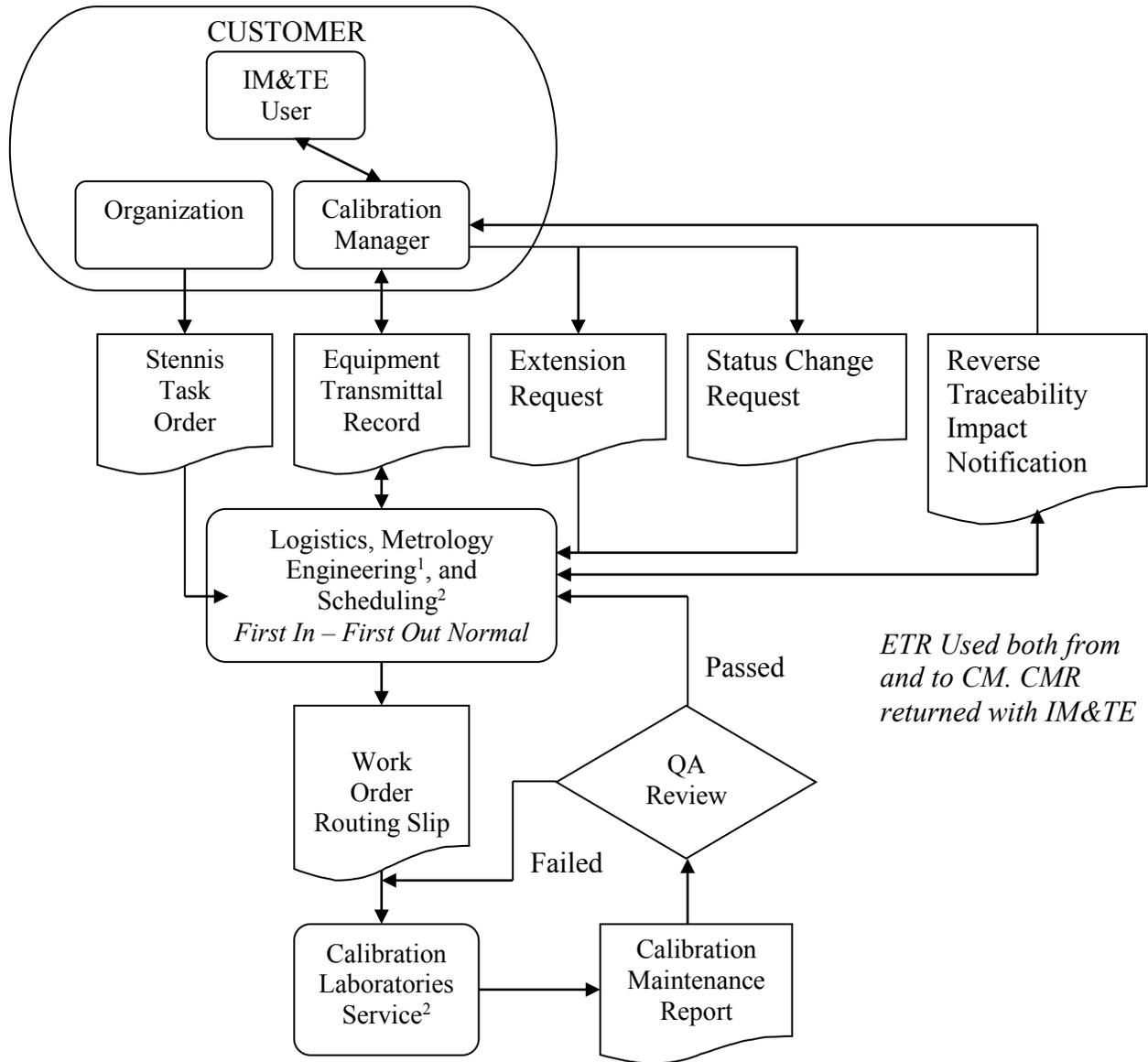
Stored Out of Calibration – Equipment that has been removed from service and stored such that fitness for use is maintained. It must be calibrated before use.

Stored In Calibration – Equipment that has been calibrated and stored unused in controlled conditions. When needed, the item can be activated and used as IM&TE. IM&TE not safety critical can generally be Stored in Calibration for up to twice the normal calibration interval, not to exceed 12 months. Stored in Calibration is useful for IM&TE that is used very infrequently but must be ready when needed.

No Calibration Required – Equipment used such that system performance is independent of the measured value. The equipment is not suitable as IM&TE.

Stennis Procedural Requirements	SPR 8730.4	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: July 11, 2018	
	Expiration Date: July 11, 2023	
Responsible Office: RA20/Center Operations Directorate		
<b>SUBJECT: SSC Metrology and Calibration Control Program</b>		

## APPENDIX D – PROCESS SUMMARY FLOW CHART



- Notes
1. Laboratory Services coordinates need and special requirements with Laboratories and customer.
  2. Laboratory supervisors coordinate discrepancies and schedule through Laboratory Services, communicate problems to the customer, and document changes on the Calibration Maintenance Report. The LSC COR resolves scheduling issues and priority conflicts.