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COMPLIANCE IS MANDATORY

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

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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, Measurement, and Test Equipment (IM&TE) used to perform measurements to meet Management Manual (SPR 1280.1) requirements, the requirements of SSC's Environmental Management System (SPR 8500.1), and the NASA Metrology & Calibration Program Requirements (NPD 8730.1B).

P.2 APPLICABILITY

- a. This SPR is applicable to Stennis Space Center 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 applies to all NASA/SSC organizational elements and contractors/sub-contractors performing work for or on any NASA program.
- d. This SPR is applicable to all Instrumentation, Measuring, and Test Equipment (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 which 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 which 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.
- e. The use of test equipment, which is not included in the calibration recall system, shall be limited to the following applications:
 1. Research and/or development, testing or special applications where substantiated measurement accuracy is not required.

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2. For “indication only” purposes.

P.3 AUTHORITY

- a. National Aeronautics and Space Act of 1958, as amended , 42 U.S.C 2473 (c)(1).
- b. NPD 8730.1B, Metrology and Calibration.

P.4 APPLICABLE DOCUMENTS

- a. ANSI/NCSL Z540.1-1994(R2002), Calibration Laboratories and Measuring and Test Equipment General Requirements.
- b. NPR 1441.1, NASA Records Retention Schedules.

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 Defense Contract Management Agency (DCMA).

P.6 CANCELLATION

- a. SSLP-8720-0001, Control of Inspection, Measuring, and Test Equipment dated January 2007
- b. SCWI-8730-0001, Metrology and Calibration Control Program dated June 2004

Signature on file

Arthur E. Goldman
Director

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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 Inspection, Measuring and Test Equipment (IM&TE) and requiring calibration, to insure 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 Center Operations Directorate and Office of Safety and Mission Assurance

- a. NASA/SSC Center Operations Directorate shall assign a NASA Metrology and Calibration Technical Representative/Monitor(TM) and a Contracting Officer Technical Representative (COTR) for laboratory services and the development of this document.
- b. NASA/SSC Office of Safety and Mission Assurance (OSMA) shall review necessary updates of this document and monitor compliance to the NASA Metrology and Calibration requirements.

1.4 NASA/SSC MS&CL Technical Representative/ Monitor (TM) and Contracting Officer Technical Representative (COTR).

- a. NASA/SSC Technical Representative/Monitor shall provide oversight of the development and implementation of Measurement Standards and Calibration Laboratory (MS&CL) contract requirements, measurement assurance programs, and serve as a member of the MCWG.
- b. The Contracting Officer Technical Representative (COTR) shall represent NASA's Contracting Officer in matters relating to contract definitions, changes, and implementation. COTR/TM ensures SSC personnel perform the listed responsibilities and implement a Metrology and Calibration Program that meets the needs of the Agency and SSC programs.
- c. The COTR shall provide guidance and resolution on technical, scheduling, and prioritization conflicts within the SSC Metrology Program.

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

The MS&CL shall:

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- a. Implement a calibration and metrology program to meet institutional and program needs and to be in compliance with ANSI/NCSL Z540.1-1994(R2002).
- b. Develop new calibration capabilities to support on-site current and future SSC program metrology requirements.
- c. Provide formal and consistent representation and participation in the NASA Metrology and Calibration Working Group (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 calibration historical data of measurement standards and calibrated instruments to indicate calibration status, due date of the next calibration, and equipment calibration and repair data.
- e. Maintain a record 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 Retention Schedules.
- 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. Provide prioritization for services on a "first in, first out" basis, with an average turn-around time of 2 weeks. Any customer may request special services, i.e. expedite (less than 3 day service), or special (other uniquely identified schedule of service). Scheduling conflicts that cannot be resolved with customers are elevated to NASA management.
- l. Maintain traceable measurement standards as per ANSI/NCSL Z540.1-1994(R2002). Calibration standards require a known valid relationship to nationally recognized standards or represent a physical constant of nature.

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- m. Generate and provide monthly recall reports with instructions to each Calibration Manager, 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, indicating that it is out of tolerance, with the data to indicate the degree of deviation and condition received, 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 will not calibrate to appropriate standards.
- r. Verify compliance of calibration suppliers to ANSI/NCSL Z540.1-1994(R2002).
- s. Provide Calibration Managers, alternates, 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.

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- 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 IM&TE Property Custodian / Organization

The IM&TE Property Custodian or User Organization shall:

- a. Assign IM&TE Calibration Managers, Assistant Calibration Managers, and Quality Assurance Personnel to interface with the MS&CL for calibration services of assigned IM&TE within the Stennis Metrology Management System (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.
- 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

The assigned Calibration Manager 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.

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- e. Verify the integrity of the SMMS monthly Calibration Recall Report against IM&TE calibration status to insure 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.
 - 2. Justification for the requested change
 - 3. Name of the requester and date
- i. When the user organization desires to use vendor's certification of new IM&TE, the vendor must be qualified to ANSI/NCSL Z540.1-1994(R2002) 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 ANSI/NCSL Z540.1-1994(R2002).
- j. Maintain the calibration status and all appropriate quality records for equipment on-loan from other NASA Centers. The Calibration Manager shall notify the MS&CL of all NASA-loaned equipment for entry into the MS&CL equipment recall system.

1.8 IM&TE Users

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).

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- 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.
- c. Ensure the measuring device or system such that the 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. Where IM&TE does not require calibration, the user/property owner affixes a "no calibration required" label, SSC Form SSC 361, to the item. This label shall be validated by an inspection stamp or initialed by the user/property owner of the IM&TE.
- f. Submit IM&TE requiring calibration through their Calibration Manager. 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.
- g. Assess and document the impact to their measurements when notified of an out-of-tolerance standard (Reverse Traceability).
- h. Assess and document the validity of previous inspections/tests when their IM&TE are found to be out-of-tolerance.
- i. 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

- a. Every month, MS&CL shall distribute the recall reports to the Calibration Managers, Assistants, and QA persons previously identified by the user organization.
- b. When an IM&TE calibration interval expires, within a 30-day period, the Calibration Manager shall take one of the following actions:
 1. Submit item for calibration.
 2. 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.
 3. Provide the MS&CL with written direction to change the status of IM&TE. The MS&CL updates SMMS appropriately.
- c. If the Calibration Manager does not take appropriate action within a 30-day period, as defined in Section 2.2.b, the MS&CL shall generate and distribute an overdue report to the Calibration Manager's supervisor and the MS&CL NASA Technical Monitor.
- d. 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.
- e. 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

- a. The following minimum records and/or forms shall be generated and/or maintained in accordance with this procedure or as defined in a requirements document.
 1. 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).
 2. Laboratory Work Request (LWR) – The LWR includes the unique ECN, item description, manufacturer and model number, serial number, description of service requirements, and, as needed, required completion date and not to exceed cost of calibration.
- b. Records shall be identified in the 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 AND DEFINITIONS

A.1 Acronyms

ANSI	American National Standards Institute
CM	Calibration Manager
CMR	Calibration Maintenance Report
COTM	Contracting Officers Technical Monitor
COTR	Contracting Officers Technical Representative
ECN	Equipment Control Number
ETR	Equipment Transmittal Record
IM&TE	Inspection, Measuring, and Test Equipment
LWR	Laboratory Work Request
MCWG	Metrology and Calibration Working Group
MS&CL	Measurement Standards and Calibration Laboratory
NCSL	National Conference of Standards Laboratories
NIST	National Institute of Standards and Technology
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

A.2 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.

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Calibration 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.

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).

Primary Standard: Standards generally of the highest metrological quality available at a NASA Field Installation from which all other measurements are derived. They are typically one echelon below the national standards maintained by NIST.

Required Completion Date: The date that the laboratory services must complete the calibration work order as stipulated in the LWR.

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.

Secondary Standard: Standards whose values are fixed by comparison with a primary standard.

Shelf Life: An established interval time over which an item can be stored without suffering deterioration or changes in characteristics which would cause the item to perform unsatisfactorily when removed from storage and placed into service.

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

Working Standard: Standards which, usually calibrated against a primary standard, are used routinely to calibrate or check material measures or measuring instruments.

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

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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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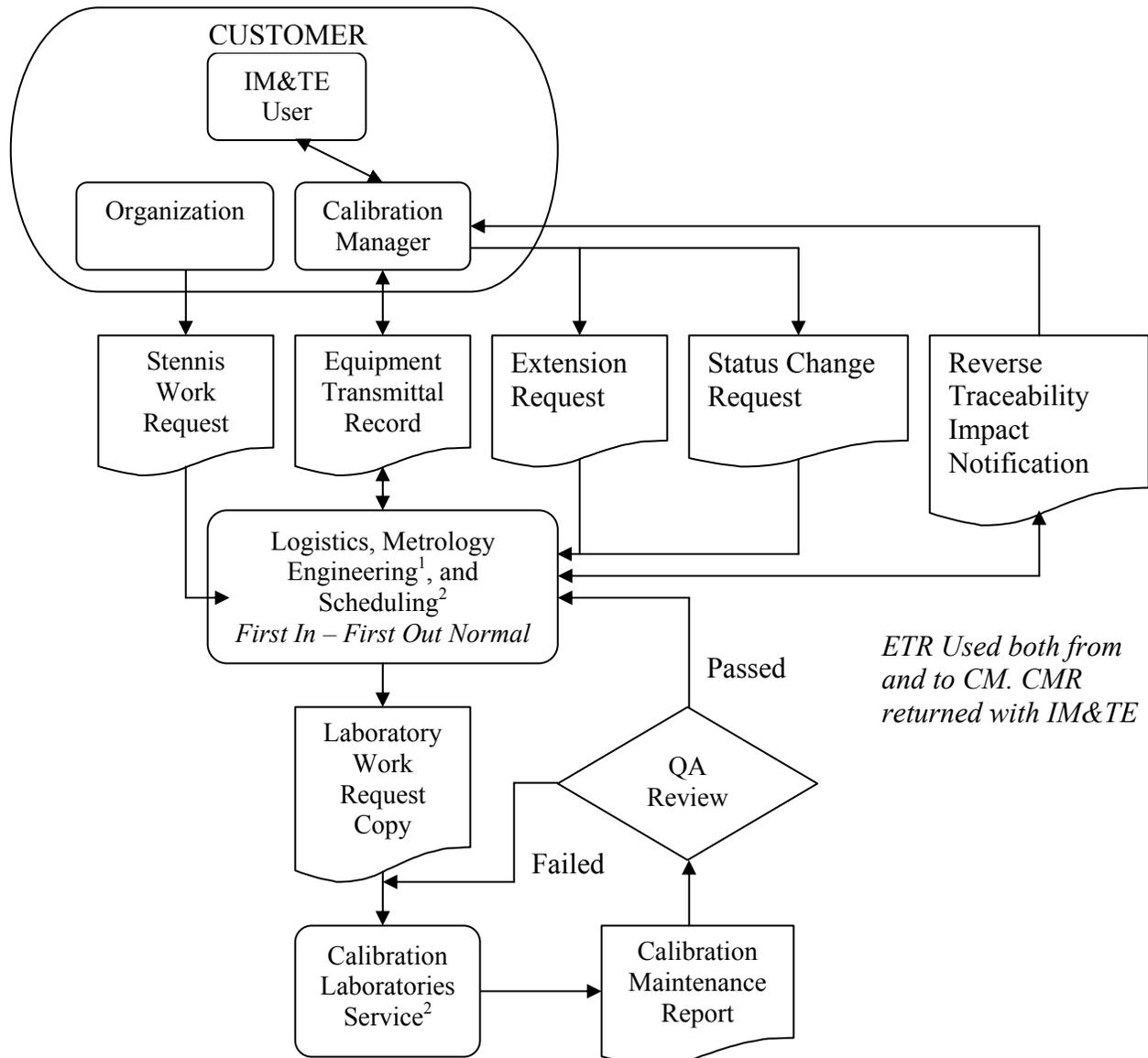
APPENDIX B – CALIBRATION TYPES

Calibration Types Available

- a) *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.
- b) *Limited Calibration* – Calibration of a device to meet some, but not all, the performance requirements stated by its manufacturer, and/or not calibrated 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.
- c) *Functional Check* – *Functional Check* devices are tested to user specifications and intervals (no recall). A *Functional Check* device is not suitable as IM&TE.
- d) *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.
- e) *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 used very infrequently but must be ready when needed.
- f) *No Calibration Required* – Equipment used such that system performance is independent of the measured value. The equipment will be marked *calibration not required* and is not suitable as IM&TE.

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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 and/or the LWR copy. The LSC COTR resolves scheduling issues and priority conflicts.