

MPG 8730.5

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MARSHALL PROCEDURES AND GUIDELINES

AD01

CONTROL OF INSPECTION, MEASURING, AND TEST EQUIPMENT

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DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		5/14/99	Document converted from MSFC-P11.1 to a Directive. Previous history retained in system as part of cancelled or superseded ISO Document files.
Revision	A	8/16/99	Changed Responsible organization code. Added applicable documents. Added definition of "Calibration Contact Code". Added definition of "Interval". Deleted definition of NASA Metrology and Information System. Renumbered subsequent paragraphs. Added MCMS Web page to definition of "Marshall Calibration Management System". Modified definition of "NASA/MSFC Limited Calibration Sticker". Modified definition of "Non-Government Owned Test Equipment". Deleted reference to MSFC-P11.1 from definition of Test Software. Modified paragraph 2.1.7. Added paragraph 2.1.8. Renumbered subsequent paragraphs. Deleted Appendix H and added reference to MCMS Web Page from note associated with paragraph 2.1.19. Added paragraph 2.5.19. General revision to Appendix A. Added MSFC Form Numbers 4365 and 4364. Modified Form 4114. Modified Tag 15. Modified Appendix E. Changed Form 2035 to MSFC Tag 17. Deleted Appendix H. Deleted Appendix C, D, F, G, H. Re-labeled Appendix E to Appendix C. Deleted Referenced thereto. Updated table of contents. Added ISO 10012 to "References". Updated Organization Codes and names. Added permit to use indicators for Category III equipment to Appendix A and paragraph 1.8.
Revision	B	12/6/99	Add Appendix D to the Table of Contents. Add paragraph 2.5.26. Change Record Control Organization from the ULO to the MSFC Calibration Facility paragraph 4.1.2. Added Appendix D. Changed "should" to "is to" paragraph 2.2.3. Changed retention period paragraph 4.1.8. Modified paragraph 1.15. References to MSFC-P11.1 replaced with date paragraph 4.1.12. Changed retention period of paragraph 4.1.10 and 4.1.12 from 2 to 5 years. Added disposition statements to Section 4
Revision	C	6/13/00	Deleted references to MPG 1441.1 and replaced with applicable document MPG 1440.2. Incorporated title change of MWI 5330.1. Modified paragraph 2.1.18. Modified paragraphs 2.3 and 2.3.1. Added paragraph 2.5.27. Relocated note from paragraph 2.3.1 to 2.7. Modified paragraph 3.4.1. Added description of standard report #9 and #10 to Appendix C. Minor editorial changes throughout.
Revision	D	11/13/00	Revised definition of Recall Report (paragraph 1.16). Eliminated S&MA concurrence on extending calibration period with the exception of flight

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			hardware and associated ground support equipment (paragraph 2.1.21.1). Added note to paragraph 2.1.12. Modified Appendix A to include items requiring periodic servicing and maintenance as Category 1. Added Category VI to Appendix A for equipment requiring "initial calibration only" which also required change to paragraph 2.1.8. Changed "Laboratory" to "Facility" in paragraph 2.2.1.
Revision	E	2/27/01	Added paragraph 1.24 Definition of "Verification." Modified paragraph 2.1.3.3 to include verifications. Modified paragraph 2.1.3.4 to include verification.
Revision	F	7/02/01	Added Funding requirement to paragraph 1.15. Added automated calibration to note following paragraph 2.1.2. Added clarification to paragraph 3.2.2. Modified retention requirements in Section 4.

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PREFACE

P.1 PURPOSE

The purpose of this document is to establish a comprehensive calibration and metrology program which provides for the management of standards, inspection, measurement, test equipment, and test software in a controlled process. This procedure is to define the method and responsibilities for the control of Inspection, Measuring, and Test Equipment at Marshall Space Flight Center (MSFC) to meet the requirements of MPD 1280.1, "Marshall Management Manual."

P.2 APPLICABILITY

This Directive is applicable to all Center organizations and to all on-site contractors performing work under the MSFC Quality System or this Directive.

P.3 AUTHORITY

NPD 8730.1, "Metrology and Calibration"

P.4 APPLICABLE DOCUMENTS

- a. ISO 9002, Quality Systems - "Model for Quality Assurance in Production, Installation, and Servicing"
- b. MPD 1280.1, "Marshall Management Manual"
- c. MPG 5000.1, "Purchasing"
- d. MWI 5330.1, "Evaluation of Contractors, Suppliers, and Vendors"
- e. MPG 1440.2, "MSFC Records Management Program"
- f. MPG 1280.7, "Servicing"
- g. MWI 1280.3, "Corrective/Preventive Action Notification System"
- h. NCSL/ANSI Z540-1-1994, "American National Standard for Calibration Laboratories and Measuring and Test Equipment-General Requirements"

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i. NPD 8730.1, "Metrology and Calibration"

P.5 REFERENCES

a. ISO Guide 25, "General Requirements for the Competence of Calibration and Testing Laboratories"

b. ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"

P.6 CANCELLATION

MPG 8730.5E dated February 27, 2001

Original Signed by
Sidney P. Saucier for

A. G. Stephenson
Director

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DOCUMENT CONTENT

1. DEFINITIONS

1.1 Calibration. The set of operations which 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.

1.2 Calibration Contact. An individual appointed to act as a single point of contact for one or more pieces of test equipment.

1.3 Calibration Contact Code. A 6-digit code assigned by the MSFC Calibration Facility to a Calibration Contact. The calibration contact code is used by the Marshall Calibration Management System to tie Inspection, Measuring, and Test Equipment to the responsible Calibration Contact. The code generally consists of the first four digits of the contact's last name and the last two digits of the contact's building number. The current list of calibration contact codes is available from the MCMS Web Page. A Calibration Contact may have more than one contact code.

1.4 Calibration Decal - MSFC Form 4365. A decal (see Appendix B for example) which is assigned by the MSFC Calibration Facility to a calibrated piece of test equipment showing the test equipment has received a full calibration, the calibration due date, and the stamp of the technician who performed the calibration. The decal may be affixed to the equipment, to a tag affixed to the equipment, or the case or container associated with the test equipment. Note: A missing or illegible decal does not void the calibration of the test equipment provided the calibration records show the equipment calibration as current.

1.5 Equipment Control Number (ECN). A unique number assigned to equipment by the Property Management Group. The numbers are imprinted on a bar code label assigned to the test equipment. The bar code may be affixed to the equipment, to a tag affixed to the equipment, or the case or container associated with the test equipment. Note: A missing or illegible ECN does not void the calibration of the test equipment provided the calibration records show the equipment calibration as current.

1.6 Inspection, Measuring, and Test Equipment (IM&TE). All

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of the measuring instruments, measurement standards, reference materials, auxiliary apparatus, and software which are integral to an instrument. This term includes measuring equipment used in the course of testing and inspection, as well as that used in calibration. This term is used interchangeably with "test equipment" within this MPG.

1.7 Incidental Test Equipment. Equipment used in support of an inspection, measurement, or test that is not used to gather data. Incidental test equipment does not require calibration prior to use. Inputs/outputs of incidental test equipment will be monitored by calibrated equipment. Examples of incidental test equipment include (but are not limited to) power supplies and load banks.

1.8 Indicator. A decal or sticker that shows the calibration status of a piece of test equipment that was calibrated by a Using Line Organization of MSFC. An indicator may be similar to a calibration decal issued by the MSFC Calibration Facility but should be unique to the organization that performed the calibration. Indicators used on Category III equipment shall only indicate the equipment is classified as Category III.

1.9 Interval. The period of time between the day a calibration is performed and the day the calibration is scheduled to expire. Intervals are determined by manufacturer's recommendations, experience, or statistical analysis of the "as found" condition of the IM&TE. Intervals are expressed in terms of months in the MCMS.

1.10 Limited Calibration. A calibration which does not necessarily restore all parameters of an instrument to original specifications. A "Limited Use Calibration" decal is assigned by the MSFC Calibration Facility to those instruments and is to be supported by a NASA/MSFC Limited Calibration sticker, MSFC Form 4114 (see Appendix B for example), or other supporting document, providing additional information as to describe the limited calibration condition. This category applies to:

1.10.1 Instruments which cannot be restored to original specifications due to nonavailability of parts, prohibitive costs, lack of capability, or other considerations;

1.10.2 Instruments which have no parameters to be calibrated and for which a function or verification check only has been

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performed; or

1.10.3 Instruments for which full calibration of all ranges is not required by the user.

1.11 Limited Use Calibration Decal - MSFC Form 4364. A decal (see Appendix B for example) which is assigned to a piece of test equipment by the MSFC Calibration Facility, indicating the calibration was limited, the calibration due date, and the stamp of the technician who performed the calibration. The decal may be affixed to the equipment, to a tag affixed to the equipment, or the case or container associated with the test equipment. Note: A missing or illegible decal does not void the calibration of the test equipment provided the calibration records show the equipment calibration as current.

1.12 Marshall Calibration Management System (MCMS). A database operated by the MSFC Calibration Facility. The MCMS generates the monthly recall report and stores calibration data for test equipment. Certain data reports are available to Center personnel through the MCMS Web Page. The MCMS Web Page is available at <http://inside.msfc.nasa.gov/CALLAB/>. Use of the MCMS Web Page is described in Appendix C.

1.13 NASA Calibration Control Number. A unique number assigned to equipment by the Calibration Facility. The numbers are imprinted on a bar code label assigned to the test equipment in lieu of or in conjunction with an ECN. The bar code may be affixed to the equipment, to a tag affixed to the equipment, or the case or container associated with the test equipment. Note: A missing or illegible Calibration Control Number does not void the calibration of the test equipment provided that the item is traceable through the serial number and the calibration records show the equipment calibration as current.

1.14 NASA/MSFC Limited Calibration Sticker - (MSFC Form 4114). A sticker (see Appendix B for example) which is attached to a piece of test equipment by the MSFC Calibration Facility indicating the calibration was limited. This sticker may be used in lieu of a Limited Use Calibration Decal. Additional information may be provided on an attached sheet or memo. The sticker may be affixed to the equipment, to a tag affixed to the equipment, or the case or container associated with the test equipment. Note: A missing or illegible sticker does not void the calibration of the test

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equipment provided the calibration records show the limits and conditions of the calibration and the calibration as current.

1.15 Non-Government-Owned Test Equipment. Any test equipment or measuring device owned by an MSFC employee, contractor employee, vendor, or corporation that is used as described in Appendix A, paragraph A-2, is required to have a calibration decal or a limited calibration decal issued by the MSFC Calibration Facility before the equipment can be used to collect test data. When performing work at a customer's off-site location, utilizing customer-owned IM&TE, it may not be possible for the MSFC Calibration Facility to issue decals required in this paragraph. Verification of calibration and use of customer-owned IM&TE is to be addressed in the servicing plan. The servicing plan is a requirement of MPG 1280.7, "Servicing." Funding is to be provided by the Using Line Organization to cover all costs associated with the calibration of non-Government-owned test equipment via customer agreement.

1.16 Recall Report. A report that is generated by the MCMS showing test equipment designated for recall. The recall report indicates items due for calibration, items that are due for calibration next month, and all items that are overdue (delinquent) for calibration. Recall reports issued to customers of the MSFC Calibration Facility that are beyond the scope of the MSFC Management System are issued as a courtesy only and will list overdue items only once.

1.17 Seal. Seals are attached to critical adjustment features of test equipment. The current calibration of the test equipment is void if a seal is broken.

1.18 Stamp. An imprint on the decal to authenticate the calibration and to identify the calibrator. Note: A missing or illegible stamp does not void the calibration of the test equipment provided the calibration records show the equipment calibration as current.

1.19 Technical Monitor. The Calibration Facility Technical Monitor is an MSFC employee assigned to monitor the Calibration Facility Contractor, who also serves as liaison between the Calibration Facility Contractor and the various organizations of MSFC. The Technical Monitor will also serve as the individual responsible for this directive.

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1.20 Test Equipment. Gages, instruments, inspection tools, fixtures, transducers, and measuring, monitoring, analysis, or diagnostic equipment used to measure static or transient phenomena to determine the characteristics or conformance to specifications of an article, material, system, process, or environment. This term is used interchangeably with "IM&TE" within this procedure.

1.21 Test Report. A report which gives correction, measured value(s), conditions of test, curves, charts, error limits, or other pertinent data required for achieving the lowest uncertainty from a standard or test instrument.

1.22 Test Software. Software which controls an automated test system or conditions a data signal from the point of measurement to the end point of use. Test software in use at MSFC must be verified. Test software used successfully prior to February 23, 1998, is deemed to be verified by demonstration. Any revisions to test software subsequent to February 23, 1998, must be verified prior to use.

1.23 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 of comparisons.

1.24 Verification. An inspection or comparison that is performed to ensure the quality of the measured quantity meets or exceeds the user's requirements for reliability and accuracy. A verification procedure may be used to issue calibration or limited calibration stickers in lieu of a calibration procedure when no adjustment to the IM&TE is necessary.

2. RESPONSIBILITIES

2.1 Directors/Managers of the Using Line Organization (ULO) or their designees shall:

2.1.1 Implement the calibration program as outlined herein.

2.1.2 Inform the MSFC Calibration Facility Technical Monitor when a requirement for new calibration support or additional capability is contemplated or realized to allow for coordination of manuals, spare parts, calibration standards, etc.

Note: MSFC personnel are cautioned to avoid purchasing IM&TE

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without a calibration procedure. Some manufacturers will not provide calibration procedures to owners. These vendors should be avoided to minimize sole-source servicing costs. Electronic equipment that is equipped with an IEE488 bus or a RS232 serial connection has the potential for automated calibration which results in faster turnaround times and reduced calibration costs.

2.1.3 Develop procedures that define calibration operations and software verifications performed by the ULO. Procedures must meet the following as a minimum:

2.1.3.1 Calibration of equipment must be performed prior to use of the equipment. Calibrations may be performed prior to use for a test series or at prescribed intervals.

2.1.3.2 Calibrations must be traceable to certified equipment having a known valid relationship to nationally or internationally recognized standards. Where no such standards exist, the basis used for calibration shall be documented.

2.1.3.3 Calibrations and verifications must employ a defined process (procedure), including details of equipment type, unique identification, location, frequency of checks, check method, acceptance criteria, and the action to be taken when results are unsatisfactory.

2.1.3.4 Calibrations and verifications must be documented. Records must address requirements of 2.1.3.1 through 2.1.3.3.

2.1.3.5 Indicators and their use must be described by Organizational Work Instruction.

2.1.3.6 Calibrations performed by the ULO will be valid for a limited time period. The period for a given piece of IM&TE should be as recommended by the manufacturer. In the absence of a recommendation from the manufacturer, the interval will not exceed 1 year.

2.1.3.7 Test software must be verified when it is installed into test equipment or a facility prior to use.

2.1.3.8 Revisions made to test software must be verified prior to use.

2.1.3.9 Proprietary software that is an integral part of test equipment purchased from a manufacturer shall be certified by the

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manufacturer. If this certification is not available or cannot be obtained from the vendor, the software must be verified by the user. Where this certification is limited, due to the nature of proprietary laws, verification will be performed by the user.

2.1.3.10 Test software verifications must be documented in sufficient detail as to permit the repetition of the validation. Record retention will be as determined by the ULO.

2.1.3.11 Test software verifications performed by the ULO are valid until the test software or hardware is modified.

Note: ISO 10012-1, Quality Assurance Requirements for Measuring Equipment - Part 1: Metrology Confirmation System for Measuring Equipment, can be used as a guide.

2.1.4 Designate and notify the MSFC Calibration Facility Technical Monitor, and one or more representatives (Calibration Contacts) in each using organization, to interface with the Calibration Facility concerning test equipment for that particular organization.

2.1.5 Inform the Calibration Facility of changes in the calibration contact.

2.1.6 Establish a tracking record for Category I, Category II, Category IV, and Category V test equipment to trace the use of test equipment in the event a piece of test equipment is found to be out of calibration after use. Equipment Categories are defined in Appendix A.

2.1.7 In the event a piece of test equipment has a disposition tag assigned or is otherwise found to be out of calibration, review documentation and disposition the validity of previous inspection and test results, and determine the subsequent action required. Refer to MWI 1280.3, "Corrective/Preventive Action Notification System."

2.1.8 Assist the Calibration Facility in maintaining the list of calibration contacts and calibration contact assignments of Category I, Category II, and Category VI test equipment contained in the MCMS. Input from the ULO is limited to the calibration contact, the calibration contact's organization code, proper calibration contact/IM&TE assignment, and equipment category code. Input from the ULO is to be kept current. Note: IM&TE will not be dropped from a calibration contact without a reassignment of the IM&TE to another calibration contact unless

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the item is classified as "EXCESS." This information may be viewed at: <http://inside.msfc.nasa.gov/CALLAB/>.

2.1.9 Maintain a list of Category IV and Category V test equipment for which each Calibration Contact is responsible. This list is to be kept current. The list shall include:

2.1.9.1 The Equipment Control Number, if assigned;

2.1.9.2 Equipment manufacturer;

2.1.9.3 Equipment model number;

2.1.9.4 Nomenclature;

2.1.9.5 Equipment serial number;

2.1.9.6 Category (as per Appendix A); and

2.1.9.7 Calibration Contact.

2.1.10 Ensure that test equipment utilized as Category I or Category II (see Appendix A) has a current calibration decal or limited use calibration decal before use.

2.1.11 Ensure that test equipment utilized as Category IV or V (see Appendix A) is calibrated before use.

2.1.12 Determine the measurements being made, the accuracy required, and select the appropriate IM&TE that is capable of the necessary accuracy and precision.

NOTE: Calibrations performed by the MSFC Calibration Facility and outside vendors are to manufacturer's specifications.

2.1.13 Request calibration test reports as required to support Line Organization activities.

2.1.14 Ensure that the environmental conditions are suitable for the calibrations, inspections, measurement, and tests being performed by the ULO.

2.1.15 Ensure that inspection, measuring, and test equipment is stored, handled, and used in such a manner as to maintain its accuracy and fitness for use.

2.1.16 Ensure that inspection, measuring, and test equipment is

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clean and free of process fluids prior to delivery or pick up to the Calibration Facility. Unacceptable items will be returned to the calibration contact unserviced.

2.1.17 Select Outside Calibration Vendors (OCVs) that are capable of performing the repair/calibration required when calibration services are procured by the ULO. The OCV must as a minimum meet the requirements of paragraph 2.7. A copy of the OCV's certification must accompany the calibration records.

2.1.18 Ensure the requirements of MWI 5330.1, "Evaluation of Contractors, Suppliers, and Vendors," are fulfilled for calibrations that are procured by the ULO.

2.1.19 Request for priority calibration should only be used when a normal 10 workday (see note below) turnaround is unacceptable and justified. Block 11 of the form will be authorized by a manager of the ULO.

NOTE: The MSFC Calibration Facility uses outside resources to perform some calibrations. Items may be sent to manufacturers, vendors, the Army at Redstone Arsenal, or any of the other NASA Centers. Turnaround times from these outside sources are typically 30 working days. The turnaround times stated are intended as a guide and are not a requirement of this procedure. Note: The MCMS Web Page displays the performing organization to assist the ULO in planning their calibration needs.

2.1.20 Direct complaints regarding the work performed by the Calibration Facility to the technical monitor of the Calibration Facility via E-mail.

2.1.21 The calibration period for IM&TE in use for a test or series of tests may be extended as needed to complete the test provided that:

2.1.21.1 The department manager concurs. S&MA concurrence is required when calibration periods are extended for IM&TE used on or in association with flight hardware or associated ground support equipment (documentation required per paragraph 4.1.15),

2.1.21.2 The IM&TE receives a "post-use verification" to determine the "as-found" condition of the IM&TE at the completion of the test, and

2.1.21.3 The results of the "post-use verification" are

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considered before final acceptance of the test.

Note: The "as-found condition" of most IM&TE is dependent on time, use, and handling.

2.2 The Calibration Contact shall:

2.2.1 Be the interface with the Calibration Facility for test equipment calibration for their organization. The calibration contact(s) will be identified to the Calibration Facility. All test equipment processed to the Calibration Facility shall be routed through the calibration contact. Each piece of test equipment shall be assigned to only one calibration contact. The calibration contact will assist the ULO Directors/Managers or their designees in meeting the requirements of Section 2.1.

2.2.2 Ensure that the Calibration Facility is given the following information with each piece of test equipment as it is submitted for calibration. The information is to be provided on an MSFC Tag 15 or an MSFC Form 4316. (A "marked up" copy of the recall report or an MCMS Web Page report is also acceptable.) The required information includes:

2.2.2.1 The Equipment Control Number (ECN), if assigned;

2.2.2.2 Item Name;

2.2.2.3 Custodian Account Number;

2.2.2.4 Building Number;

2.2.2.5 Room Number;

2.2.2.6 CAL MGR. No. (Calibration Contact); and

2.2.2.7 Organization (Mail Code).

2.2.3 Submit new Category I and Category II test equipment for an initial calibration after it arrives at the Center. If the test equipment was vendor-calibrated at the time of purchase, an initial calibration will be performed only at the request of the ULO. A copy of the calibration records is to be submitted to the Calibration Facility so that a calibration decal can be assigned to the equipment prior to use.

2.2.4 Respond to the monthly recall report by submitting the test equipment for calibration or requesting the item be removed

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from recall status. This is essentially the same as moving a piece of equipment from Category I to Category II.

2.2.5 Notify the Calibration Facility of all test equipment placed on excess so that the test equipment can be placed on a non-recall status and subsequently purged from the records after the retention period is satisfied.

2.3 The Director, Safety & Mission Assurance Office, shall:

2.3.1 Assist in ensuring the requirements of MWI 5330.1, "Evaluation of Contractors, Suppliers, and Vendors," are fulfilled for MSFC OCV contracts/purchase agreements.

2.4 The Director, Facilities Engineering Department, Center Operations Directorate, shall:

2.4.1 Provide a calibration service to operate the MSFC Calibration Facility. This service is to be purchased in accordance with MPG 5000.1, "Purchasing." The contractor must be satisfactory to institutional needs and in compliance with Agency regulations and standards.

2.4.2 Monitor and evaluate the contractor's performance in accordance with MPG 5000.1 and the provisions of the contract.

2.4.3 Designate a technical monitor for the MSFC Calibration Facility. The technical monitor will serve as the liaison between the Calibration Facility contractor, the ULOs at MSFC, other NASA installations, and other Government agencies. The technical monitor for the MSFC Calibration Facility will also serve as OPR of this directive.

2.4.4 Develop new calibration capabilities to support onsite MSFC program metrology requirements (within funding limits).

2.4.5 Provide formal and consistent representation and participation in the NASA Metrology/Calibration Working Group workshops, the National Conference of Standards Laboratories meetings, and other related activities.

2.4.6 Request periodic update of the ULO list of equipment (reference paragraph 2.1.8).

2.5 The MSFC Calibration Facility shall:

Note: This section applies to those functions performed by the

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Calibration Facility and not to those functions performed by the ULOs under Section 3.1.

2.5.1 Establish and maintain documented procedures to control the internal operations of the Calibration Facility.

2.5.2 Establish and maintain documented procedures to calibrate and maintain inspection, measuring, test equipment, and test software.

2.5.3 Maintain a record system that contains sufficient information to permit the repetition of the calibration. The records shall include the identity of personnel involved in the preparation and calibration.

2.5.4 Provide calibration records and test reports as requested by the ULO.

2.5.5 Utilize metrology data banks and coordinate with other NASA field installations for calibration procedures to avoid unnecessary repetition of procedure development effort.

2.5.6 Utilize existing calibration resources of the military services, other civil agencies, original manufacturers, and the private sectors where in-house capabilities are not available or are overextended.

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

2.5.8 Provide qualified personnel to perform repairs and calibration work instructions.

2.5.9 Provide pickup and delivery service for items that are to be calibrated.

2.5.10 Provide high-quality calibrations and reports for test equipment.

2.5.11 Provide each piece of equipment (calibrated within the Calibration Facility or outside calibration vendor) with a calibration decal or limited use calibration decal.

2.5.12 Maintain measurement standards and traceability to the National Institute of Standards and Technology.

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2.5.13 Operate and maintain the MCMS for MSFC.

2.5.14 Ensure that all test equipment submitted for service is assigned an ECN or a calibration control number. Privately-owned equipment used at MSFC will be tracked by serial number only.

2.5.15 Ensure that all test equipment submitted for service is entered into the MCMS.

2.5.16 Generate a monthly recall report. This report shall be sent monthly to the calibration contact for use in scheduling test equipment for calibration. The Calibration Laboratory will secure a signature receipt that the calibration contact has received the recall report unless the report was distributed electronically by E-mail.

2.5.17 Apply "calibration void if broken" seals on critical adjustment locations to prevent unauthorized adjustment of test equipment.

2.5.18 Provide repair service for test equipment to facilitate calibration or as part of a calibration procedure.

2.5.19 Assess the impact to IM&TE calibrated to a standard that was found to be out of tolerance. When the out-of-tolerance condition has been determined to have a detrimental effect on the accuracy of subordinate IM&TE, issue a Disposition Tag (MSFC Tag 17) to each affected piece of IM&TE and notify the calibration contact as described in paragraph 2.5.21.

2.5.20 Attach a Disposition Tag (MSFC Tag 17) to all test equipment returned to the calibration contact that was:

2.5.20.1 Out of tolerance. A detailed explanation of the out-of-tolerance condition will be provided in the "Comments:" section of the tag;

2.5.20.2 An item that will not calibrate to appropriate standards. If the item is returned to the calibration contact without a calibration or limited calibration being performed, the item will be tagged with a Disposition Tag (MSFC Tag 17) and returned to the user with an explanation of the condition in the "Comments:" section of the tag; and

2.5.20.3 An item was found to have a broken seal. If an item is returned to the Calibration Laboratory with a broken seal, the last calibration is considered to be voided.

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2.5.21 Notify the calibration contact via memorandum or E-mail that a disposition tag was assigned to test equipment.

2.5.22 Ensure that inspection, measuring, and test equipment is stored and handled in such a manner as to maintain its accuracy and fitness for use.

2.5.23 Ensure that the environmental conditions are suitable for the calibrations being performed.

2.5.24 Maintain a listing of stamps used by employees performing calibrations that identifies the stamp and the individual to whom the stamp is assigned.

2.5.25 Be compliant with the ISO 9002 standard and the calibration laboratory competency requirements identified in ISO 9000, ISO Guide 25 equivalent, NCSL/ANSI Z540-1-1994.

2.5.26 Post current calibration data at the intranet location as described in Appendix D.

2.5.27 Notify the NASA Equipment Management System (NEMS) operator of any equipment that has been sent off-site for calibration or repair services that has required more than 55 days to complete to facilitate the tracking of the item by the NEMS system. The NEMS operator is also to be notified when the item has been returned.

2.6 The Institutional Services Contractor (ISC) shall remove any existing calibration or limited use calibration decal that a repair performed by the ISC may have voided. Decals that are removed are to be returned to the customer with the repair receipt.

2.7 An Outside Calibration Vendor (OCV) will:

NOTE: Outside Calibration Vendors must be compliant with the ISO 9002 standard and the calibration competency requirements identified in ISO 9000, ISO Guide 25 equivalent, NCSL/ANSI Z540-1-1994.

2.7.1 Determine and document the "as found" condition of IM&TE.

2.7.2 Repair (if necessary) and calibrate IM&TE against certified equipment having a known valid relationship to internationally or nationally recognized standards per approved

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procedure. Where no such standards exist, the basis used for the calibration shall be documented.

2.7.3 Return the IM&TE to MSFC and furnish a copy of the calibration records.

3. PROCEDURE

Note: The ULO will determine whether IM&TE will be calibrated by the MSFC Calibration Facility, OCV, or by the ULO itself. Due consideration will be given to the resources available.

For IM&TE that is in need of repair, the ULO should request repair from the ISC.

3.1 Calibration by the ULO.

<u>Actionee</u>		<u>Action</u>
ULO	3.1	Determines that calibration is performed by the ULO.
ULO	3.1.1	Determines if repairs are required.
ULO	3.1.2	Requests repair by the ISC. See Section 3.3.
ULO	3.1.3	Calibrates IM&TE against certified equipment having a known valid relationship to internationally or nationally recognized standards per approved procedure. Where no such standards exist, the basis used for the calibration shall be documented.
ULO	3.1.4	Documents and maintains calibration record of IM&TE.
ULO	3.1.5	Assigns indicators (if used).

3.2 Calibration by the Calibration Facility.

Note: Equipment sent to the Calibration Facility may be sent to a qualified OCV by the Calibration Facility.

ULO	3.2	Determines that calibration will be performed by or through the Calibration
-----	-----	---

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Facility.

- | | | |
|--------------------------|---------|---|
| Calibration Facility | 3.2.1 | Issues Recall Report. |
| ULO | 3.2.2 | Signs receipt for Recall Report and forwards to Calibration Facility. (Not required for e-mail recall.) |
| Calibration Contact | 3.2.3 | Contacts the Calibration Facility and requests calibration services. |
| Calibration Facility/ULO | 3.2.4 | Determines if the test equipment must be calibrated in-situ (where the test equipment is, i.e., "in place") or moved to the Calibration Facility for calibration. |
| ULO | 3.2.4.a | Notifies Calibration Facility that equipment is available for calibration. |
| Calibration Contact | 3.2.5 | Brings the test equipment to the Calibration Facility or requests pickup by the Calibration Facility. |
| Calibration Facility | 3.2.6 | Determines if the test equipment has been assigned an Equipment Control Number (ECN) or NASA Calibration Control Number. |
| Calibration Facility | 3.2.7 | Assigns a NASA Calibration Control Number to test equipment if an ECN or NASA Calibration Control Number does not already exist or has been lost. |
| Calibration Facility | 3.2.8 | Logs the test equipment into the MCMS. |
| Calibration Facility | 3.2.9 | Determines if calibration will be performed by the MSFC Calibration Facility or by outside calibration vendor. If equipment is calibrated by an OCV, go to Section 3.4. |
| Calibration Facility | 3.2.10 | Determines and documents the "as found" condition of the test equipment. |
| Calibration Facility | 3.2.11 | Determines if repairs are needed. If the |

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Facility repair is incidental to calibration, the repair should be performed by the Calibration Facility. If the equipment is inoperable or repair exceeds those incidentals for calibration, the repair should be performed by the ISC. If equipment is to be repaired by the ISC, go to Section 3.3.

Calibration Facility 3.2.12 Repairs the test equipment.

Note: Items considered as infeasible to repair will be tagged with a Disposition Tag (MSFC Tag 17) and returned to the user with an explanation as to why the equipment was not repaired in the "Comments:" section of the tag.

Calibration Facility 3.2.13 Calibrates IM&TE against certified equipment having a known valid relationship to internationally or nationally recognized standards per approved procedure. Where no such standards exist, the basis used for the calibration shall be documented.

Calibration Facility 3.2.14 Assigns a calibration decal or limited calibration decal to the test equipment and other tags and stickers as required.

Calibration Facility 3.2.15 Updates the test equipment records.

Calibration Facility 3.2.16 Returns the test equipment to the Calibration Contact.

3.3 Repair by Institutional Services Contractor (ISC).

Note: Equipment repaired by the ISC will be repaired and adjusted to manufacturer's tolerances. This adjustment does not constitute calibration.

ULO/
Calibration Facility 3.3.1 Requests repair.

ISC 3.3.2 Assigns a service order number for repair.

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- ISC 3.3.3 Repairs (and adjusts) customer item.
- ISC 3.3.4 Removes any existing Calibration or Limited Use Calibration decal that the repair may have voided.
- ISC 3.3.5 Returns the test equipment to the organization that requested repair. Calibration or Limited Use Calibration decals that were removed by the ISC are to be returned to the user with the Service Order Form.

3.4 Calibration by Outside Calibration Vendor (OCV).

Note: Calibration by OCV may be procured directly by the ULO or through the MSFC Calibration Facility. A NASA Calibration or NASA Limited Use Calibration decal is required for items calibrated by OCV.

Note: For items that are routinely serviced by the manufacturer and are anticipated to have continued use, it may be cost effective to procure calibration services through a service agreement with the manufacturer. Service agreements may not be all inclusive and may contain exceptions.

- ULO/
Calibration
Facility 3.4.1 Selects OCV that has the capability to repair (if required) and calibrate IM&TE. The OCV must meet the requirements stated in section 2.7. The ULO is responsible for ensuring the requirements of MWI 5330.1, "Evaluation of Contractors, Suppliers, and Vendors," are fulfilled for the OCV (see paragraph 2.3). Services procured by the Calibration Facility contractor will be in accordance with their quality plan.
- OCV 3.4.2 Determines and documents the "as found" condition of the IM&TE.
- OCV 3.4.3 Repairs and calibrates IM&TE against certified equipment having a known valid relationship to internationally or nationally recognized standards per

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approved procedure. Where no such standards exist, the basis used for the calibration shall be documented.

- OCV 3.4.4 Vendor returns IM&TE to MSFC with calibration records.
- ULO 3.4.5 Forwards copy of calibration records to MSFC Calibration Facility for record retention and issuance of decal, stickers, and tags.
- Calibration Facility 3.4.6 Performs steps 3.2.14 through 3.2.16.

3.5 New Equipment.

Note: Calibration of new equipment by Equipment Vendor (OCV) may be procured directly by the ULO at the time of purchase. A NASA Calibration or NASA Limited Use Calibration decal is required for items calibrated by OCV.

- ULO 3.5.1 Takes possession of new equipment.
- ULO 3.5.2 Assigns calibration contact.
- ULO 3.5.3 Categorizes equipment per Appendix A.
- ULO 3.5.4 Determines if new IM&TE was calibrated by vendor.
- Calibration Contact 3.5.5 Forwards copy of calibration records to Calibration Facility for record retention and issuance of calibration decal.
- Calibration Facility 3.5.6 Performs steps 3.2.14 through 3.2.16.
- ULO 3.5.7 Calibrates new equipment that requires calibration via Section 3.1, 3.2, or 3.4 of this procedure.

4. RECORDS

4.1 Quality records will be retained in accordance with MPG 1440.2. The quality records required by other procedures referenced herein are not included here. The quality records required by this procedure are as follows:

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4.1.1 "Calibration Records" and "Software Verifications" generated by the ULO - (paragraphs 2.1.3.4 and 2.1.3.10) - The record control organization for these records is the ULO. The retention period for these records will be determined by the ULO. The minimum retention for Calibration Records is 3 years. The minimum retention for software verification is 3 years after the software was last modified or retired. Disposition of these records at the end of the retention period will be determined by the ULO.

4.1.2 "Calibration Contact" - (Paragraph 2.1.4) - The record control organization for this record is the MSFC Calibration Facility. The MSFC Calibration Facility is to maintain a list of calibration contact(s) in the MCMS. The list is available from the MCMS Web Page.

4.1.3 "Tracking Record" - (Paragraph 2.1.6) - The record control organization for this record is the ULO. The ULO is to determine and document the retention period for this record with due consideration as to the use of the test equipment involved. The minimum retention period for this record is 3 years or until the "as found" condition of the equipment was determined to be within tolerance at the subsequent calibration. Disposition of these records at the end of the retention period will be determined by the ULO.

4.1.4 "Disposition" - (Paragraph 2.1.7) - The record control organization for this record is the ULO. This record is to be retained for a minimum of 3 years. Disposition of these records at the end of the retention period will be determined by the ULO.

4.1.5 "Test Equipment" - (Paragraph 2.1.8) - The record control organization for this record is the ULO. This record is to be maintained current in the MCMS. Disposition of these records is as described in paragraph 4.1.10.

4.1.6 "Calibration Test Report" - (Paragraph 2.1.13) - The record control organization for this record is the Calibration Facility. The retention period for this record is as determined by the ULO. The minimum retention period for this record is 3 years. These records are to be discarded after the retention period is satisfied.

4.1.7 "Vendor Certification" - (Paragraph 2.1.17) - The record control organization for this record is the MSFC Calibration Facility. "Vendor Certifications" obtained by the ULO will be

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forwarded to the MSFC Calibration Facility. The retention period for this record is 3 years. These records are to be discarded after the retention period is satisfied.

4.1.8 "Calibration Records from Outside Calibration Vendors" - (Paragraph 3.4.5) - The record control organization for these records is the MSFC Calibration Facility. Reports obtained by the ULO will be forwarded to the MSFC Calibration Laboratory. The retention period for these records will be as specified in paragraph 4.1.10. These records are to be discarded after the retention period is satisfied.

4.1.9 "Traceability" - (Paragraphs 2.5.3 and 2.5.12) - The record control organization for the referenced paragraphs is the MSFC Calibration Facility. These records will be retained for 3 years beyond their expiration date. These records are to be discarded after the retention period is satisfied.

4.1.10 "MCMS System" - (Paragraph 2.5.13) - The record control organization for the MCMS is the Calibration Facility. This record will be kept current with a minimum of the last five (5) calibrations performed on each piece of test equipment entered into the system. The MCMS shall also be maintained so that production reports for the previous calendar year, the previous fiscal year, and the previous contract year are available. The database of the obsolete NMIS System will be retained either electronically or in hard copy form for at least 5 years. These records are to be erased after the retention period is satisfied.

4.1.11 "Signature Receipt" - (Paragraph 2.5.16) - The record control organization for the referenced paragraphs is the MSFC Calibration Facility. These records will be retained for 3 years. These records are to be discarded after the retention period is satisfied.

4.1.12 "Metrology Control Document - (NASA Form 1621)" - The record control organization for the Metrology Control Documents is the MSFC Calibration Facility. These records will be retained either hard copy or electronically for at least 5 years. Note: NASA Form 1621 was deleted on August 3, 1998. Records generated after August 3, 1998, will be maintained electronically. These records are to be discarded after the retention period is satisfied.

4.1.13 "Disposition Tag Notifications" - (Paragraph 2.5.21) - The record control organization for the referenced paragraph is the MSFC Calibration Facility. These records will be retained

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for 3 years. These records are to be discarded after the retention period is satisfied.

4.1.14 "Listing of Stamps" - (Paragraph 2.5.24) - The record control organization for the referenced paragraph is the Calibration Facility. The list shall be kept current and maintained as a permanent record. This record is to be destroyed 3 years after the calibration activity at MSFC is discontinued.

4.1.15 "Concurrence" - (Paragraph 2.1.21.1) - The record control organization for the referenced paragraph is the Using Line Organization. The record should be maintained until final acceptance of the affected test(s). Disposition of these records at the end of the retention period will be determined by the ULO.

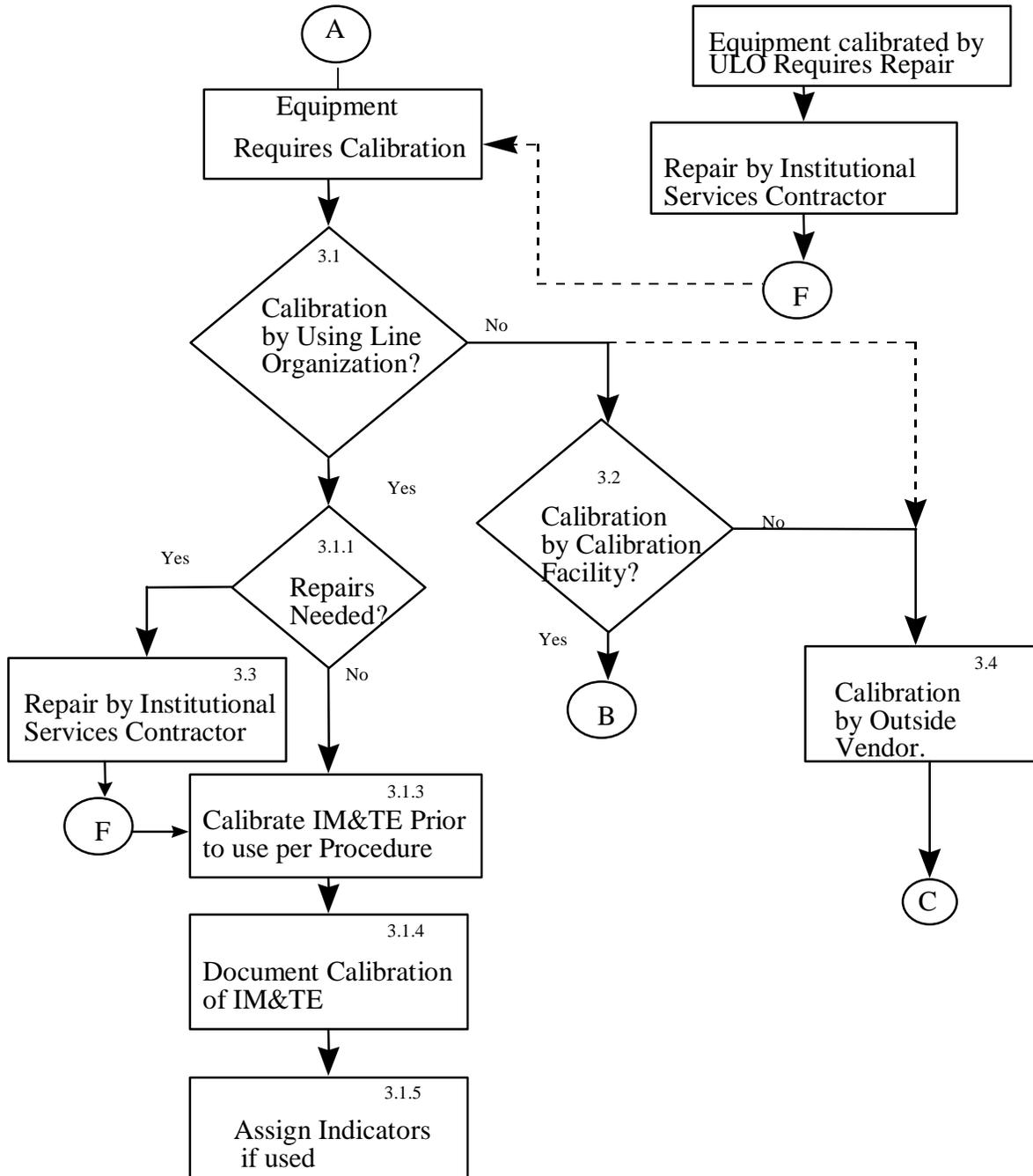
5. FLOW DIAGRAM

The following flow diagrams represent the activities outlined in the procedure for control of inspection, measuring, and test equipment:

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CALIBRATION FLOW PATH

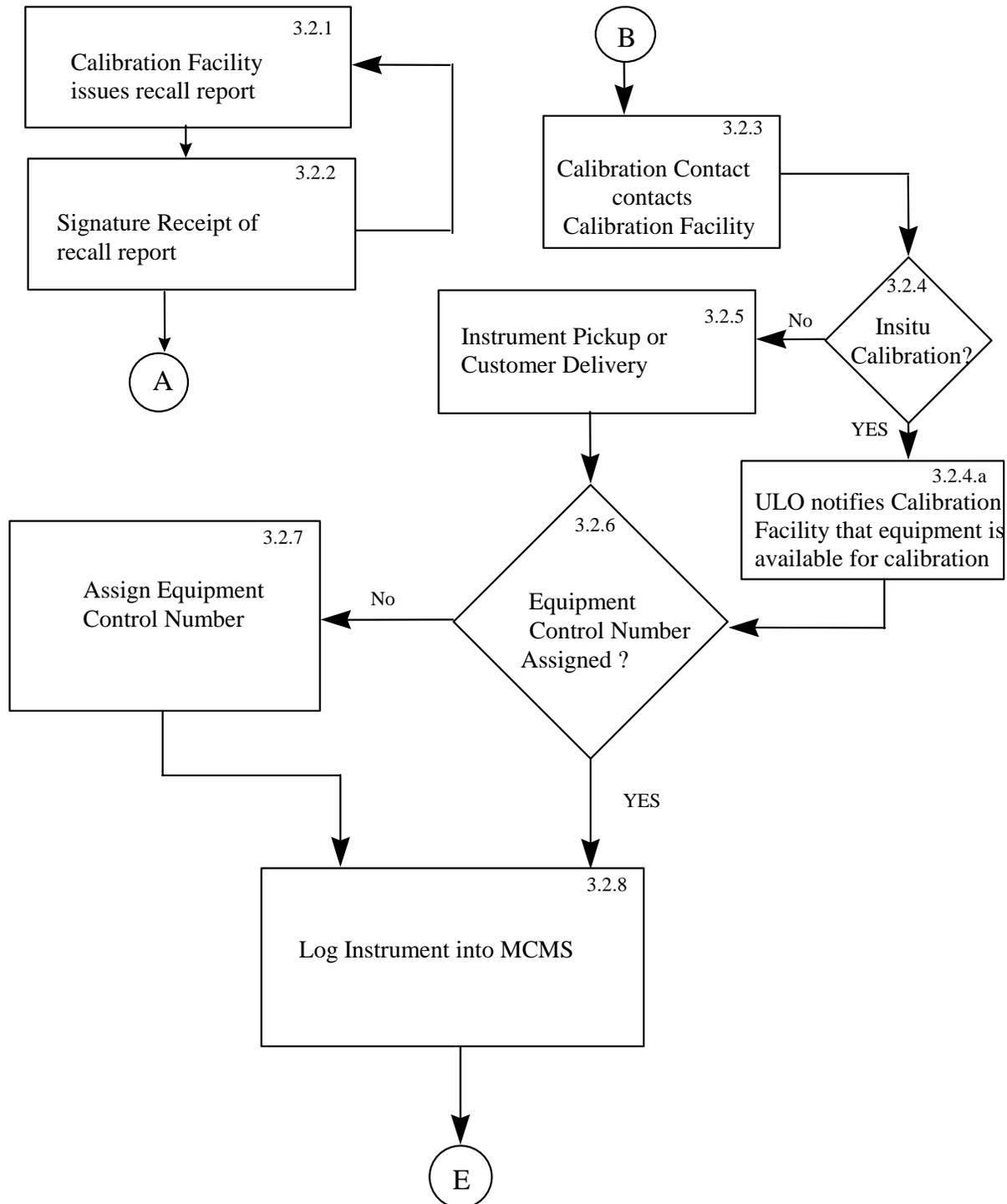
USING LINE ORGANIZATION (Procedure Section 3.1)

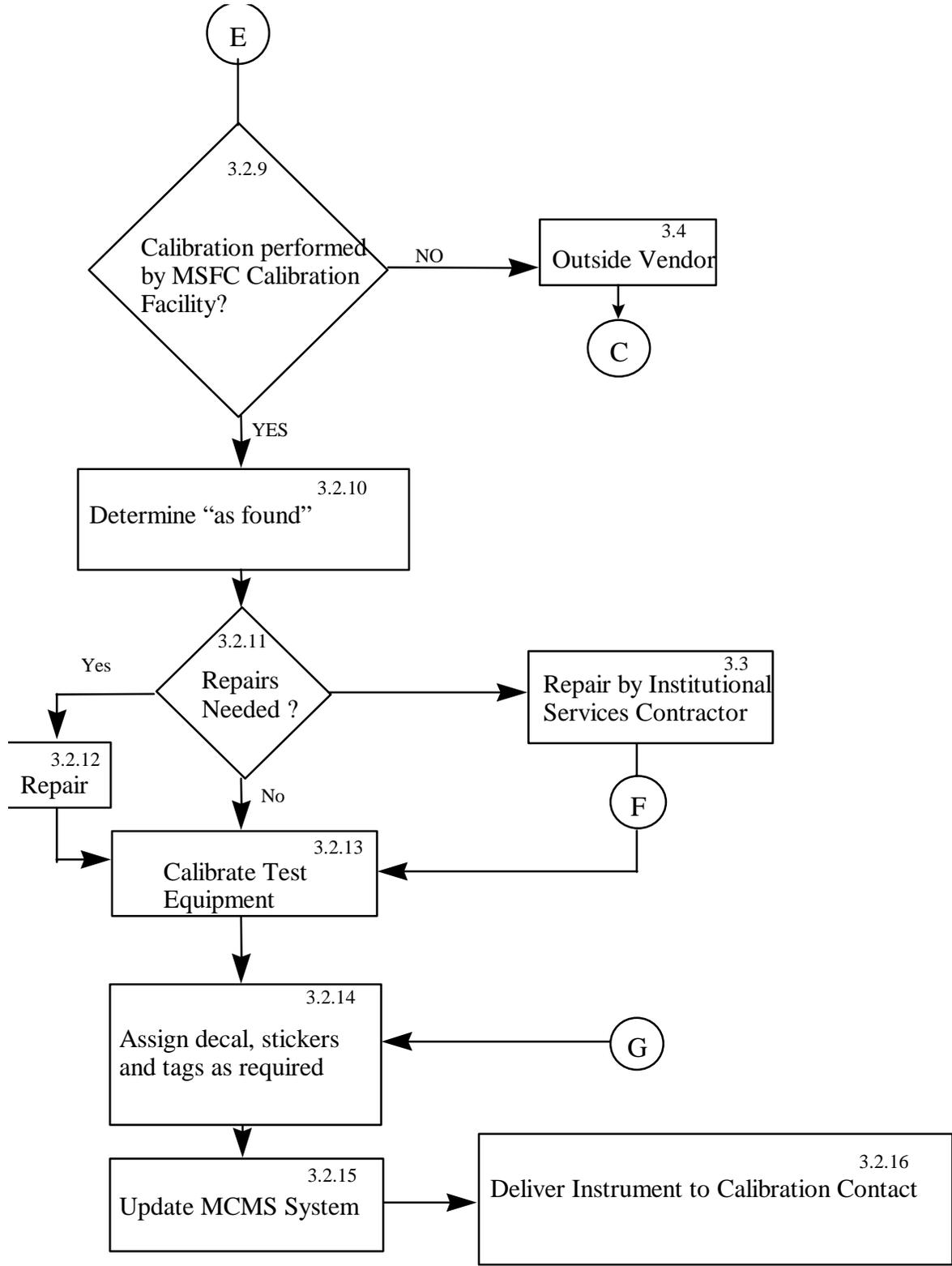


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CALIBRATION FLOW PATH

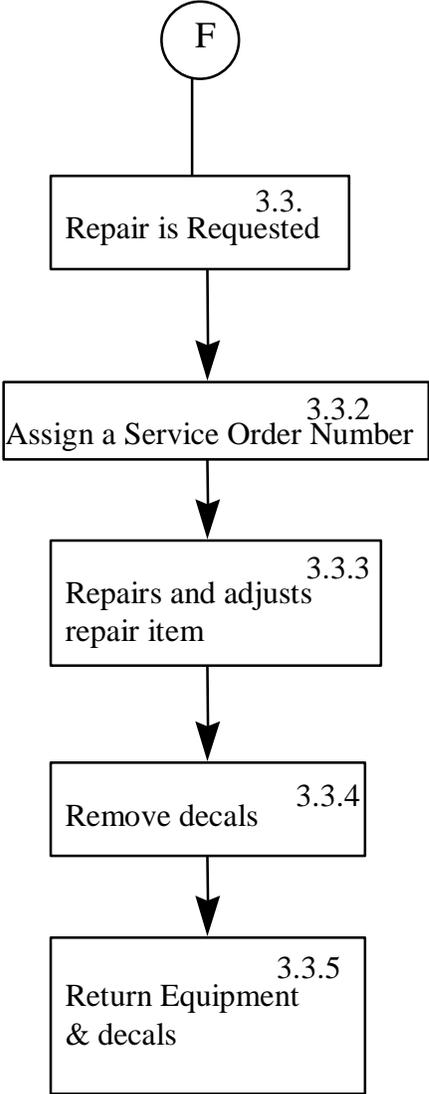
MSFC CALIBRATION FACILITY (Procedure Section 3.2)





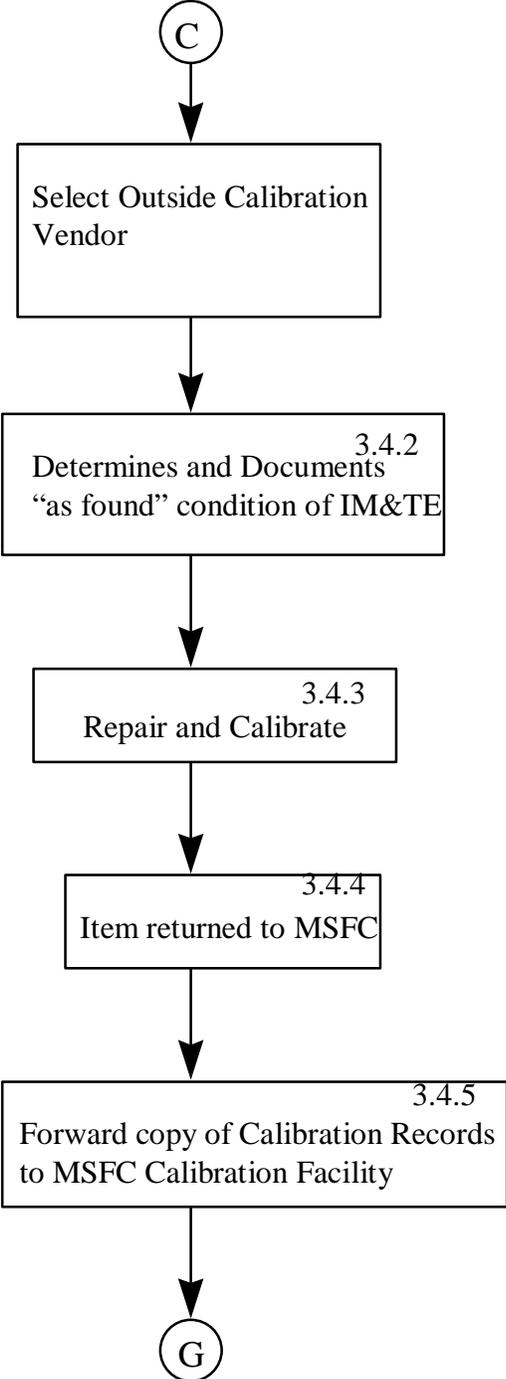
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**REPAIR BY INSTITUTIONAL SERVICES CONTRACTOR (Procedure
Section 3.3)**



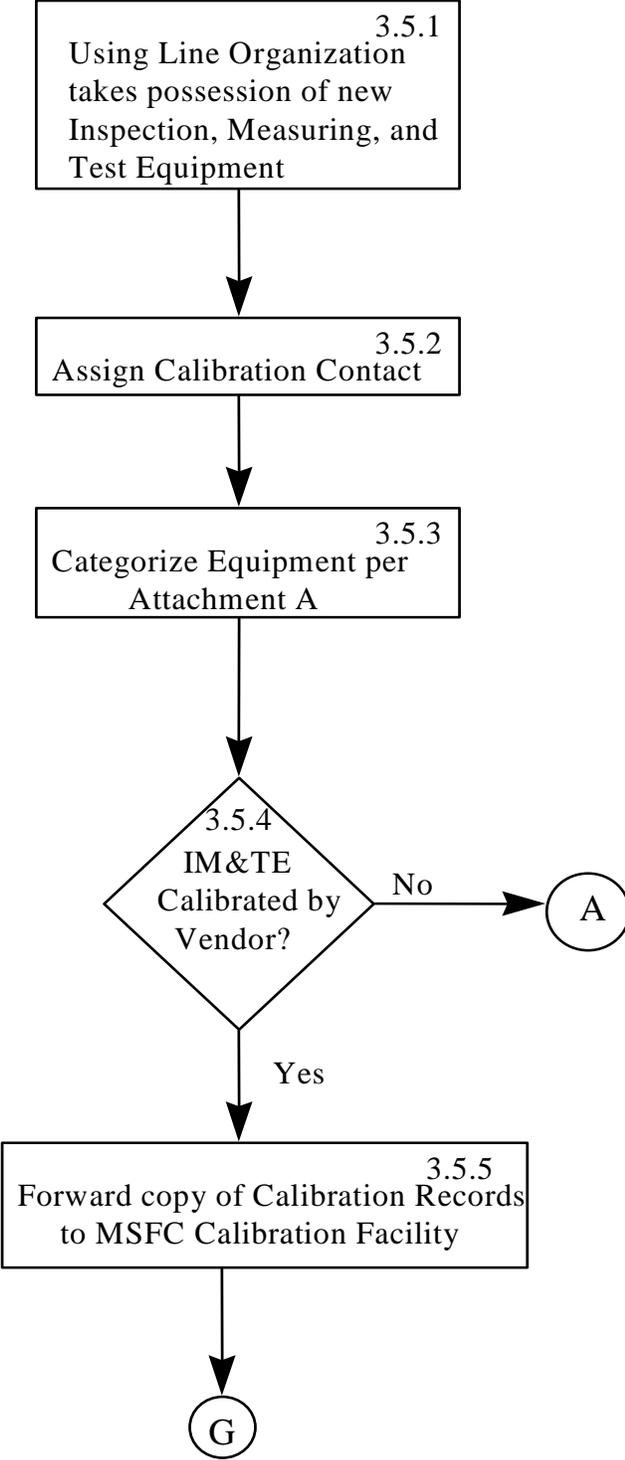
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CALIBRATION BY OUTSIDE CALIBRATION VENDOR (Procedure Section 3.4)



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CALIBRATION OF NEW EQUIPMENT (Procedure Section 3.5)



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APPENDIX A

INSPECTION, MEASUREMENT, AND TEST EQUIPMENT CATEGORIES

A-1 Any measurement process where test equipment accuracy and dependability is essential for the safety of MSFC personnel shall be included in the MCMS system, calibrated at established intervals, and labeled to indicate the calibration status along with the expiration date of the current calibration. These items shall be classified as Category I as described below to assist the ULO in maintaining the calibration status of these items.

A-2 Test equipment used to perform acceptance testing, inspections, maintenance, calibration, and/or qualification of flight hardware or ground support equipment that interfaces with flight hardware, telecommunication, transmission, and test equipment where exact signal interfaces and circuit confirmations that are essential to mission success, development testing, or special applications where the specification/end products and data are accuracy sensitive, shall be calibrated prior to use. These items shall be classified as Category I, II, IV, or V, as described below, at the sole discretion of the ULO.

Category I - Recall - IM&TE used as described in paragraph A-1 or A-2 above, that the ULO depends on the MSFC Calibration Facility for calibration and recall services. Items that are calibrated by the MSFC Calibration Facility or an outside vendor will be labeled with applicable decals to indicate the calibration status and due date of the next calibration. Items that are included in this category will be recalled at established intervals by the recall system. IM&TE requiring scheduled service or scheduled maintenance should also be included in this category.

Category II - Non-recall - IM&TE used as described in paragraph A-2 above, that the ULO depends on the MSFC Calibration Facility for calibration services. Items that are calibrated by the MSFC Calibration Facility or an outside vendor will be labeled with applicable decals to indicate the calibration status and the due date of the next calibration. Calibration of IM&TE included in this category will be performed only when requested by the ULO.

Note: Frequently used IM&TE should be included as Category I. Infrequently used IM&TE should be included as Category II to reduce associated cost. A "post-use" verification

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is not required but will be performed at the request of the Using Line Organization. "Post-use" verification should be considered when critical measurements are performed.

Category III - Not Calibrated

IM&TE that is not calibrated shall not be used to perform inspections, take measurements, or collect data on flight hardware or ground support equipment that interfaces with flight hardware. Indicators may be used on this category of equipment only to show that the equipment is Category III. Use of Category III indicators is at the sole discretion of the ULO. Use of IM&TE that is not calibrated shall be limited to:

- a. Applications where substantiated measurement accuracy is not required.
- b. "Indication Only" purposes of nonhazardous, non-critical applications.

Note: Category III equipment may be used as incidental test equipment on flight hardware or ground support equipment that interfaces with flight hardware to facilitate an inspection or test.

Note: Category I, Category II, Category IV, or Category V may be used for any Category III type measurement.

Category IV - IM&TE used as described in paragraph A-2 above that is calibrated prior to use for each test series by the ULO. The ULO accepts the responsibility of calibrating the equipment prior to use and maintaining the required documentation as described in paragraphs 2.1.3.1 through 2.1.3.4 of this procedure. Indicators may be used on this category of equipment but are not required.

Category V - IM&TE used as described in paragraph A-2 above that is calibrated on a periodic (established interval) basis by the ULO.

The ULO accepts the responsibility of calibrating the equipment on a periodic basis and maintaining the required documentation as described in paragraphs 2.1.3.1 through 2.1.3.4 of this procedure. Use of indicators to show the calibration status of equipment calibrated by the ULO will be at the discretion of the ULO.

Category VI - Initial Calibration Only (ICO) - IM&TE that is

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calibrated as part of the manufacturing process that requires no periodic calibration as the item is physical object whose properties remain stable with respect to time and use. The calibration label assigned to a Category VI item will show the date received at MSFC as the calibration date. The due date of the calibration label will be marked "ICO." Recalibration would only be necessary if a good reason to suspect the item had been altered or damaged.

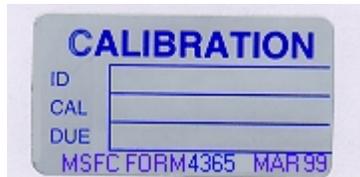
Note: The calibration due date of Category I and Category V IM&TE may not be exceeded except as provided in paragraph 1.7 and paragraphs 2.1.21, 2.1.21.1, 2.1.21.2, and 2.1.21.3.

Note: Items not identified as Category I, Category II, Category IV, Category V, or Category VI are relegated to Category III whether listed or not.

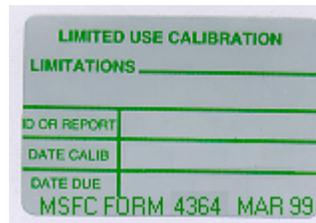
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APPENDIX B

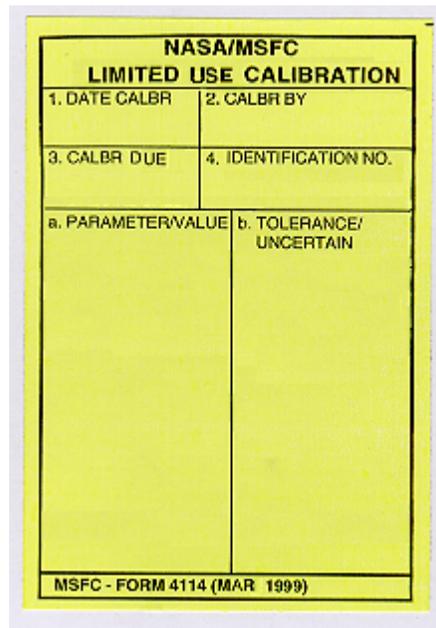
**CALIBRATION DECAL, LIMITED USE CALIBRATION DECAL, AND LIMITED
CALIBRATION STICKER EXAMPLES**



(SILVER/BLUE)



(SILVER/GREEN)



(YELLOW/BLACK)

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APPENDIX C

THE MARSHALL CALIBRATION MANAGEMENT SYSTEM WEB PAGE (<http://inside.msfc.nasa.gov/CALLAB/>)

The MCMS Web Page is available to MSFC personnel at web location <http://inside.msfc.nasa.gov/CALLAB/>. Information displayed from the web page is read directly from the "live" MCMS database and is as current as the operators of the system. The web page provides the user eight standard query features that are described as follows:

1. Calibration Contacts - the report displays the Contact Code, Name, and Organization Code for each Calibration Contact included in the MCMS.

2. Work Order Information by ECN Number - the report displays open work order information for an individually specified piece of test equipment. Along with basic equipment information, the equipment category code, work order priority status, the date received, date to be returned by, and the work order status is displayed.

3. Open Work Orders by Contact Code - the report displays the complete list of open work orders for a specified Calibration Contact. Information displayed is similar to the report for an open work order for an individual piece of test equipment. The Contact Code is required.

NOTE: Open work order information is provided as information only. Work order status or failure to return a piece of test equipment to the ULO by the date shown shall not be considered a non-conformance. Closure of an open work order may lag completion by several days.

4. Search by Description - the report lists all equipment in the MCMS that contains the Users entry in the Description field. The report displays basic equipment information, the Calibration Contact assigned to the equipment, and calibration status. This report may be useful in locating needed equipment.

5. Equipment Information by ECN number - the report displays basic equipment information, category code, Calibration Contact, calibration status, and the organization that normally performs the calibration.

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6. Equipment Information by Contact Code - the report provides a complete list of equipment for a Contact Code. The report is similar to the equipment report for a single piece of equipment. The Contact Code is required.

7. Search by Model Number - the report lists all equipment in the MCMS that contains the Users entry in the Model No. field. The report displays basic equipment information, the Calibration Contact assigned to the equipment, and calibration status. This report may be useful in locating needed equipment.

8. Equipment Expiration Next 60 Days by Contact Code - the report lists all test equipment in the MCMS that has a calibration due date appearing within the next 60 days for a given Contact Code. This report is not filtered by equipment category. The Contact Code is required.

9. Delinquent Category I Items by Contact Code - the report lists all Category I test equipment for a given Calibration Contact with an expired calibration.

10. Category I Equipment List by Contact Code - the report lists all test equipment in the MCMS that has been designated Category I for a given Calibration Contact.

HELPFUL HINTS

1. The ECN number is the primary tracking number for each piece of test equipment.

2. ECN numbers in the database match the 6 or 7 digit ECN or NASA Calibration Control numbers associated with the IM&TE.

3. Some Calibration Contacts have an extremely large list of equipment that may overwhelm your computer. The Calibration Facility will assign additional contact codes to individuals and redistribute equipment between the codes to facilitate data handling on request.

4. The Performing Organization is displayed as a guide. If the performing organization is showing ARMY, it is likely that the ARMY will be performing the next calibration for that item. Turnaround times for items sent off Center continue to be a problem.

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5. There are a number of items that were "orphaned" as Calibration Contacts retired that were not reassigned to a current Calibration Contact. The contact code for these items is UNKWN. Items that have been excessed are shown with a contact code of EXCESS.

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APPENDIX D

MSFC CALIBRATION FACILITY CALIBRATION DATA ON THE INTRANET

Calibration data may be found at intranet location \\MSFCDATA4\AD-D4G\AD20. A separate file folder exists for accelerometers, flow measurement devices, load cells, LVDTs, pressure transducers, etc.

The calibration data is filed by the ECN number of the IM&TE. Calibration data posted at this site is maintained current by the MSFC Calibration Facility.

File "attributes" are used to provide date.

The ULO is responsible for the proper use and application of the data posted.