Ames Procedural Requirements

APR 8730.3
Effective Date: April 4, 2023
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COMPLIANCE IS MANDATORY

Subject: Electrostatic Discharge (ESD) Control Process

Responsible Office: Code Q / Safety and Mission Assurance Directorate

CHANGE LOG

Status [Baseline /Revision /Cancelled]	Document Revision	Date of Change	Description
Revision	1	4/4/2023	Change Responsible Office to Code Q. Updated sections P.1, P.3, P.4, and Chapter 1.

TABLE OF CONTENTS

PREFACE

P.1 PURPOSE

a. The National Aeronautics and Space Administration (NASA) quality requirements for Electrostatic Discharge (ESD) safety and control, which are defined herein and further defined in the Ames ESD Control Program Plan (AECPP) QS.8739.1, are specified in addition to the administrative and technical requirements guidelines listed in the American National Standards Institute (ANSI)/ESD S20.20 requirements document. The ANSI/ESD S20.20 is the ESD Association's standard for the development of an Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

b. This document establishes the NASA Ames Research Center (ARC) requirements for control of ESD and sets the standard for the development of an ESD Control Program Plan (ECPP) for all projects, programs, facilities, or any portion of any external project, where NASA ARC has the responsibility to build and handle ESD Sensitive (ESDS) hardware.

c. This APR, supplemented by QS.8739.1, describes the responsibilities and requirements for establishing and maintaining an ECPP that meets or exceeds the ESD Association (ESDA) ANSI/ESD S20.20 requirements, and provides specific instructions pertaining to ESD standards related to personnel, laboratories, tools, equipment, training, and safety.

d. The operation of the ESD control program at ARC involves the Ames Engineering Directorate, Safety and Mission Assurance Directorate, and Programs (or Projects). The execution of the Center ESD control program is the responsibility of the Project Manager, in close coordination with the Project Safety and Mission Assurance (SMA) Representatives and ESD Program Manager. The SMA Division Chief provides oversight responsibility.

e. The roles and responsibilities described below are in addition to those described in relevant organization work instructions; e.g. QS.8739.1.

P.2 APPLICABILITY

a. This directive is applicable to ARC.

b. This directive applies to contractors, grant recipients, or parties to agreements only to the extent specified or referenced in the appropriate contracts, grants, or agreements.

c. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term "shall." The terms "may" or "can" denote discretionary privilege or permission, "should" denotes a good practice and is recommended, but not required, "will" denotes an expected outcome, and "are/is" denotes descriptive material.

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

e. This document applies to all activities and individuals at ARC that conduct work involving ESDS hardware (e.g., electrical and electronic parts, assemblies, and equipment meeting one or more of the following criteria:

(1) Critical work, as defined by NPR 8735.2.

(2) Non-critical work, where ESD processes are self-imposed.

P.3 AUTHORITY

a. NPR 8735.2, Hardware Quality Assurance Program Requirements for Programs and Projects

b. NASA-STD-8739.6, Implementation Requirements for NASA Approved Workmanship Standards

P.4 APPLICABLE DOCUMENTS AND FORMS

a. APR 1440.1, Records Management Program Requirements

b. APR 8705.1, System Safety and Mission Assurance

c. APR 8735.3, Control of Nonconforming Products and Services

d. NRRS 1441.1, NASA Records Retention Schedules

e. NASA-STD-8739.6, Implementation Requirements for NASA Workmanship Standards

f. QS.8739.1, Ames ESD Control Program Plan

g. ANSI/ESD S6.1, For the Protection of Electrostatic Disharge Susceptible Items Grounding.

h. ANSI/ESD S8.1, For the Protection of Electrostatic Discharge Susceptible Items-Symbols-ESD Awareness

i. ANSI/ESD S20.20, Protection of Electrical and Electrostronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).

j. ESD TR20.20, Handbook for the Development of an Electrostatic Discharge Control Program for the Protection of Electronic Parts, Assemblies and Equipment.

P.5 MEASUREMENT/VERIFICATION

a. Verification of conformance to requirements in this directive are measured through Center and Responsible Organizational management reviews, self-assessments, and subsequent analysis and reports of conformance to requirements, as well as periodic internal audits.

b. Verification of compliance is measured through the internal audit process and management review and those results. Measuring effectiveness will at a minimum use customer satisfaction data.

c. Compliance with the requirements contained within this APR will be measured as part of project-life-cycle milestone reviews and the Certificate of Flight Readiness (CoFR) assessment.

P.6 CANCELLATION

a. APR 8730.3, Ames Electrostatic Discharge (ESD) Control Process dated May 16, 2018.

Eugene Tu
Director

DISTRIBUTION STATEMENT:

Internal and external distribution.

CHAPTER 1 ROLES AND RESPONSIBILITIES

1.1 Safety and Mission Assurance Directorate (Code Q) shall:

a. Lead the development and maintenance of the center ESD procedures.

b. Lead the development and maintenance of QS,8739.1, the AECPP.

c. Verify ESD compliance.

1.2 Engineering Directorate (Code R) shall:

a. Work closely with Code Q regarding development and maintenance of ESD control requirements.

b. Facilitate center-wide access to the Materials Control Station (MCS), which allows storage, distribution, and traceability of certified ESD controls for project use.

1.3 System Safety and Mission Assurance Division (Code QS) Chief shall:

a. Create a verifiable ESD-Control Program Plan, compliant with agency requirements.

b. Appoint the ESD Program Manager.

c. Manage and implement QS.8739.1, the AECPP.

d. Provide support staff, as required, to assist the ESD Program Manager.

e. Assign SMA Personnel to ARC spaceflight projects, per APR 8705.1, to monitor the execution of the project ESD plans to ensure compliance to this document.

1.4 The ESD Program Manager (EPM) shall:

a. Facilitate and analyze ESD compliance across the center.

b. Develop and maintain the AECPP in accordance with NASA-STD-8739.6, ANSI/ESD S20.20, and ANSI/ESD TR20.20 requirements.

c. Retain, access, and produce training, certification, and survey records to support internal/external audits.

d. Provide or facilitate ESD training for ARC personnel.

e. Retain the NASA ESD Program Manager Certification (required every 2 years per NASA-STD-8739.6).

f. Manage ESD-related waivers and deviations in accordance with QS.8739.1.

1.5 The Project SMA Representative shall:

a. Verify that Project ESD processes and controls are implemented per the AECPP.

b. Verify that ESD requirements, controls, training, and certifications are established and integrated into the project processes and team.

c. Verify that ESD requirements were included in project contracts and agreements.

d. Verify that vendor and contractor documentation regarding ESD control programs and certificates of conformance (CoCs) are submitted to the project when spaceflight hardware or instruments are procured externally.

1.6 The Program/Project Manager (PM) for each ARC project shall:

a. Determine and document the mission needs, in terms of hardware safety, reliability, and mission success, to determine the ESD sensitivity level needed for the project.

b. Ensure that proper controls are selected for the work performed and are documented with ESD Program Manager concurrence.

c. Assess system level trades, decision making, risks, and processes against the requirements in this document.

d. Flow down applicable ESD requirements of this APR in project contracts and agreements.

1.7 Organizations responsible for an ESD Protected Area (EPA) shall designate a primary and an alternate ESD Program Monitor for that area. ESD Program Monitors may be responsible for more than one EPA.

1.8 The ESD Program Monitor shall:

a. Perform ESD Protected Area (EPA) Maintenance.

b. Maintain ESD signage in the area.

c. Perform scheduled EPA verifications.

d. Conduct random inspections and audits of EPAs.

e. Maintain up-to-date verifications records (logs) and maintenance records.

f. Perform reactivation of EPAs with less than six months of inactivity.

g. Transfer records during projects transitions.

h. Monitor and maintain additional protective measures when needed to meet specialty certification requirements for handling highly sensitive devices.

i. Authorize use of EPAs (except Class 0 rated EPAs) for non-ESD sensitive work.

j. Verify and reactivate EPA after it was used for non-ESD sensitive work.

k. Notify ESD Program Manager of any deviations sought against the AECPP.

CHAPTER 2 PROCESS

2.1 Process Requirements

Where appropriate, ESD process requirements may be tailored to a specific organization or project when it meets all of the objectives stated in this document. The tailoring approach is initiated by the Project or Organizational Manager (or their delegate) and requires documented ESD Program Manager approval.

2.2 ESD Program Plan

2.2.1 The EPM shall establish, release, and maintain an AECPP (QS.8739.1), in compliance with NASA-STD-8739.6.

2.2.2 The EPM shall distribute proposed revisions of QS.8739.1 to ESD stakeholders outside of Code Q.

2.2.3 At a minimum, at least one person in each of the Engineering, Science, and Exploration Technology Directorates (Codes R, S, and T, respectively) shall be included in the distribution of revisions of QS.8739.1.

2.2.4 ESD stakeholders should respond within fifteen (15) working days of receipt.

2.3 Training

2.3.1 All Ames personnel (including contractors and grantees to the extent specified in their contracts) handling exposed ESDS items shall be trained in accordance with QS.8739.1.

2.3.2 All Ames personnel (including contractors to the extent specified in their contracts) who occasionally enter EPAs (e.g. custodians, maintenance, security), shall be briefed on ESD control and security (e.g. escort) procedures appropriate for that EPA.

2.3.3 Project staff shall provide evidence of current ESD certification to the EPM, upon request.

2.3.4 Projects may honor current certification from visiting NASA personnel, but should fund on-site training for any visits that exceed six (6) months.

2.4 ESD Protected Areas

2.4.1 All handling of exposed ESDS items shall be performed within an EPA.

2.4.2 All work areas where ESDS items are handled or processed shall conform to QS.8739.1 and be certified, surveyed, audited, and decommissioned per QS.8739.1.

2.4.3 Projects shall utilize QS.8739.1 to determine the level of ESD controls for their application and document their analysis.

2.4.4 Spaceflight ESDS shall be processed at a certified EPA.

2.4.5 An EPA that is certified for processing of spaceflight hardware shall be clearly labeled per Figure 2-1.

SPACE-FLIGHT CERTIFIED ESD PROTECTED AREA (EPA)

EPA RATING: <RATING>

CERTIFIED PER QS.8739.1 THROUGH: <DATE>

Figure 2-1: Minimum required content for labeling a Spaceflight EPA

2.5 Documentation

2.5.1 A project or mission's SMA Representative may generate an ESD Control Plan specific to that project.

2.5.2 An ESD Control Plan may be incorporated as part of the project's overall Mission Assurance Plan (or equivalent).

2.5.3 A project's ESD Control Plan shall include the latest revision of AECPP QS.8739.1 for which the plan was developed.

2.6 ESD Control Requirements

2.6.1 Determining the ESD Level

2.6.1.1 Projects shall provide the EPM with an ESD sensitivity level for their ESDS hardware.

2.6.1.2 By default, or in situations where an ESD sensitivity level cannot be reasonably determined, all EPAs shall be certified per QS.8739.1.

2.6.2 Field Service Kits

2.6.2.1 A portable ESD Field Service Kit (e.g. Figure 2-2) may be used to control ESD in locations where an EPA is unavailable, such as in the field or on deployment.

2.6.2.2 An ESD Field Service Kit used for on-site work is governed per QS.8739.1.

2.6.2.3 Field Service Kits shall be certified by the EPM prior to initial use and re-certified yearly.

2.6.2.4 A Field Service Kit shall consist of a foldable, grounded mat, wrist-strap, and a plug-in, portable grounding unit, at a minimum.

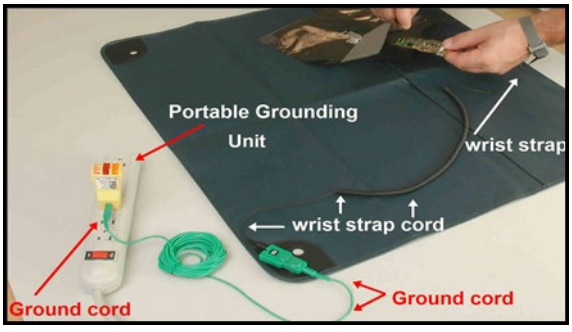

Figure 2-2: An example of a Field Service Kit

2.6.3 ESD Control Product Authenticity

2.6.3.1 Prior to purchase, ESD control products shall be reviewed by the EPM (or their delegate) per QS.8739.1.

2.6.3.2 ESD product qualification data generated by other centers should be given preference over purchasing other products or qualifying like products in-house.

2.6.3.3 Program/Project Managers (or their delegate) shall perform at least one of the following to establish conformance for ESD controls:

a. Request Certificates of Conformance (CoCs) for newly purchased products and retain all documentation with project records for the lifetime of the product.

b. Qualify products in-house or using a third-party laboratory and retain all documentation with project records for the lifetime of the product.

> *Note: ESD control products purchased before 3/1/2018 without CoC or qualification data will be evaluated for conformance. All non-qualified products will be considered nonconforming and controlled for non-ESD use.*

2.6.3.4 The EPM may utilize the Materials Control Station (MCS) in the Flight Processing Center (FPC) to provide projects with pre-certified ESD controls including the following:

a. ESD jackets

b. ESD containers (bags, tubs, totes, etc.)

c. ESD paper

d. Field Service Kits

2.6.3.5 Projects should check if appropriate, pre-certified controls are available from MCS before procuring controls themselves.

2.6.3.6 Projects shall store, distribute, and provide traceability of certified ESD controls or return MCS-provided controls at the conclusion of a project or work activity.

2.6.4 ESD Packaging and Receiving Inspection

2.6.4.1 All ESDS items shall be packaged within approved ESD-protective containers for movement between ESD-protected areas, per QS.8739.1.

2.6.4.2 Packages or containers, received at ARC, that display ESD warning symbols or text shall be opened and inspected by personnel with current ARC ESD certification at a certified EPA rated for that hardware.

2.6.4.3 Packages or containers containing ESDS items that are not properly identified or packaged per QS.8739.1 shall be treated as a non-conforming item per APR 8735.3.

2.6.5 Records Retention

2.6.5.1 Training and Survey Quality Records

Any ESD-related quality records generated shall be managed and retained per APR 1440.1.

2.6.5.2 Records Retention Schedule Classification

ESD-related record retention durations, as defined in QS.8739.1, shall be in accordance with NRRS 1441.1, Schedule 8, Items 103 and 104.

APPENDIX A. DEFINITIONS

Electrostatic Discharge (ESD)	A transfer of electrostatic charge between bodies at different electrostatic potentials caused by direct contact or induced by an electrostatic field. ESD is a physical and electrical phenomenon, whereby electronic components can be adversely affected by other nearby objects, including humans.
ESD Protected Area (EPA)	An area that is constructed and equipped with the necessary ESD-protective materials and equipment to limit ESD voltage below the sensitivity level of ESDS items handled therein. This may include benches, rooms or buildings.
Ground	A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the Earth, or to some conducting body that serves in place of earth (e.g. spacecraft structure).

APPENDIX B. ACRONYMS

AECPP	Ames ESD Control Program Plan
ANSI	American National Standards Institute
APR	Ames Procedural Requirement
ARC	Ames Research Center
CoC	Certificate of Conformance
ECPP	ESD Control Program Plan
EPA	ESD Protected Area
EPM	ESD Program Manager
ESD	Electrostatic Discharge
ESDS	Electrostatic Discharge Sensitive
FPC	Flight Processing Center
MCS	Materials Control Station
NASA	National Aeronautics and Space Administration
NPR	NASA Procedural Requirement
NRRS	NASA Records Retention Schedule
PM	Program/Project Manager
SMA	Safety and Mission Assurance