

NASA Metric Transition Plan

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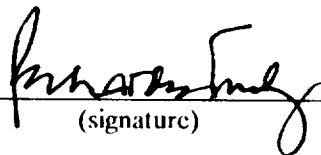
National Aeronautics and
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NASA METRIC TRANSITION PLAN

PREFACE

This document provides overall guidance for the transition of NASA programs to use of the metric system of measurement. It is responsive to Public Law 100-418 and Executive Order 12770, and implements the policy contained in NASA Management Instruction 8010.2A, "Use of the Metric System of Measurement in NASA Programs."

Questions concerning application of this document to NASA programs and projects should be referred to the Technical Standards Division (Code QE), Office of Safety and Mission Quality, NASA Headquarters, Washington, DC 20546.

 2/20/92
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EXECUTIVE SUMMARY

NASA science publications have used the metric system of measurement since 1970. Although NASA has maintained a metric use policy since 1979, practical constraints have restricted actual use of metric units. In 1988, an amendment to the Metric Conversion Act of 1975 required the Federal Government to adopt the metric system except where impractical.

In response to Public Law 100-418 and Executive Order 12770, NASA revised its metric use policy and developed this Metric Transition Plan. NASA's goal is to use the metric system for program development and functional support activities to the greatest practical extent by the end of 1995. The introduction of the metric system into new flight programs will determine the pace of the metric transition. Transition of institutional capabilities and support functions will be phased to enable use of the metric system in flight program development and operations. Externally oriented elements of this plan will introduce and actively support use of the metric system in education, public information, and small business programs. The plan also establishes a procedure for evaluating and approving waivers and exceptions to the required use of the metric system for new programs.

Coordination with other Federal agencies and departments (through the Interagency Council on Metric Policy) and industry (directly and through professional societies and interest groups) will identify sources of external support and minimize duplication of effort.

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ACRONYMS

ACRV	Assured Crew Return Vehicle
ANSI	American National Standards Institute
ATP	Authority to Proceed
AXAF	Advanced X-ray Astrophysics Facility
BIWM	International Bureau of Weights and Measures
DoD	Department of Defense
EOS	Earth Observing System
ESA	European Space Agency
GSA	General Services Administration
ICMP	Interagency Council on Metric Policy
IEEE	Institute of Electrical and Electronics Engineers
ISAS	Institute of Space and Astronautical Science
ISTP	International Solar-Terrestrial Physics (Program)
MOC	Metrication Operating Committee
NASP	National Aero-Space Plane
NIST	National Institute of Standards and Technology
NLS	National Launch System
NMI	NASA Management Instruction
NMPG	NASA Metrication Planning Group
OAET	Office of Aeronautics, Exploration, and Technology (now OAST)
OAST	Office of Aeronautics and Space Technology
OSC	Office of Space Communications
OSF	Office of Space Flight
OSL	Orbiting Solar Laboratory
OSMQ	Office of Safety and Mission Quality
OSSA	Office of Space Science and Applications
OSSD	Office of Space Systems Development
SEI	Space Exploration Initiative
SI	Le Systeme International d'Unites
SIRTF	Space Infrared Telescope Facility
SMQ	Safety and Mission Quality
SOFIA	Stratospheric Observatory for Infrared Astronomy
TDRS	Tracking and Data Relay Satellite

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I. OVERVIEW

The purpose of this Metric Transition Plan is to establish a comprehensive and integrated NASA program to adopt the metric system of measurement in accordance with Public Law 100-418. The plan is a practical and efficient approach to metric transition. It is consistent with NASA's primary responsibilities for preserving U.S. leadership in aeronautics, space science, and technology and conducting activities in space that expand human knowledge.

This plan discusses NASA's objectives, assumptions, overall metrication strategy, the general procedures for waivers, coordination with other groups, and progress reporting. Metric transition outlook is discussed for each major program office. Descriptions of support tasks address objectives, rationale, required actions, milestones, and responsibilities. The plan will be updated as needed to reflect major changes in NASA's program plans or metric transition efforts.

A. Background

Section 5164 of Public Law 100-418 (Ref. A) designates the metric system of measurement as the preferred system of weights and measures for United States trade and commerce. It further requires that:

"... each Federal agency, by a date certain and to the extent economically feasible by the end of fiscal year 1992, use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms, such as when foreign competitors are producing competing products in nonmetric units."

In Executive Order 12770 of July 25, 1991, Metric Usage in Federal Government Programs (Ref. B), the President assigned overall responsibility for oversight and coordination of Federal transition activity to the Secretary of Commerce. The Interagency Council on Metric Policy (ICMP), of which NASA is a member, coordinates Federal activities. The Order requires all Executive Branch departments and agencies, including NASA, to take an active role in the ICMP and to execute the Order.

B. NASA Metric Experience

NASA supports a wide range of research in aeronautics and space science; the latter encompasses the disciplines of astronomy and astrophysics, Earth and planetary sciences, life science, microgravity science, and space physics. Space science research and publications commonly use the metric system. A NASA policy established in 1971

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requires the use of metric units in technical publications. Although results are published in metric units, they often are obtained with laboratory or flight instruments designed with inch-pound units.

NASA has required consideration of the metric system in the development of major programs since 1979. Insufficient experience and support capabilities made program managers reluctant to design and build hardware using metric units. Cost, schedule, and safety factors generally account for continued use of inch-pound units for flight hardware.

NASA has acquired some engineering experience with metric units through joint flight programs with international partners. The most prominent example is Spacelab. The European Space Agency (ESA) built Spacelab's pressurized modules and payload carriers using metric units. Key interface drawings have both metric and inch-pound dimensions so that Spacelab can be integrated into the Space Shuttle's inch-pound cargo bay and can accommodate both metric and inch-pound experimental hardware. Another example is the International Solar-Terrestrial Physics (ISTP) program; the spacecraft and instruments provided by NASA are inch-pound where as those built by ESA and Japan are metric. Properly documenting the interfaces allows inch-pound spacecraft to carry metric experiments and metric spacecraft to support inch-pound instruments.

C. NASA Metric Transition Planning

In response to Public Law 100-418, NASA assigned responsibility for metric transition to the Office of Safety and Mission Quality (OSMQ) and formed the NASA Metrication Planning Group (NMPG). All program offices and key administrative offices at NASA Headquarters are NMPG members. The NMPG has assisted OSMQ in preparing NASA's metric use policy and transition plan, and will be responsible for oversight and reporting for the support activities in this transition plan.

In July 1990, the NASA Deputy Administrator committed the Agency to use of the metric system and established the following requirements:

- The metric system of measurement will be used in "Requests for Proposals for all flight program new starts for which Phase C/D or equivalent acquisitions are initiated after October 1, 1990."
- Ongoing programs "must plan to accommodate metric hardware that will result from this transition."
- "Waivers to this policy will be granted only when formally justified to the Deputy Administrator."

NASA Management Instruction (NMI) 8010.2A (Appendix C, issued June 11, 1991) gives a detailed statement of NASA's metric use policy and establishes responsibilities for defining and implementing the NASA Metric Transition Plan. NMI 8010.2A is

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consistent with Public Law 100-418 and Executive Order 12770 and strengthens previous NASA policy on use of the metric system. In particular, NMI 8010.2A adopts the metric system of measurement as the preferred system for all NASA activities.

Since 1989, NASA has prepared three Annual Metrication Reports to Congress (Refs. D through F). Each report summarizes metrication accomplishments and outlines planned activities for the upcoming year.

D. Transition Goals

This plan will enable NASA to use the metric system for all activities not restricted by practical limitations. The scope of this transition includes new hardware development and technical support operations as well as administrative functions and externally oriented activities that affect U.S. industry and the public. Some existing ground facilities and space systems will require modifications to support metric interfaces.

In concert with other Federal transition programs, NASA's transition should encourage and support U.S. industry in adopting the metric system to ensure its future competitiveness in world markets. NASA will maximize use of commercial capabilities to accomplish its transition. The fraction of NASA development programs that use the metric system will increase steadily. However, existing complex technical programs built using the inch-pound system may continue operating with that measurement system into the next century due to safety and cost considerations.

The end of 1995 is the target date by which NASA should complete all internal metric initiatives and establish the widest possible use of the metric system consistent with the availability of external support capabilities.

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II. APPROACH

A. Objectives

NASA policy (NMI 8010.2A) requires adoption of the metric system of measurement and establishment of a NASA Metric Transition Plan. As required by Public Law 100-418, NASA will increase use of the metric system by October 1992. Completion of ongoing programs using the inch-pound system, however, will take years. The focus of this plan is to establish a target date by which new programs will use the metric system. This plan defines the additional actions that NASA must take to achieve this metric transition and gives milestones for completing the initial steps.

B. Roles and Responsibilities

The NASA Administrator approved a revised policy on metric system use (NMI 8010.2A in Appendix C) on June 11, 1991. According to this NMI, the Administrator is responsible for approving this plan, approving waivers to use of metric units by major new programs, and transmitting NASA's Annual Metric Transition Report to Congress.

The Associate Administrator for Safety and Mission Quality (SMQ) is responsible for the following functions:

- Develop the NASA Metric Transition Plan.
- Establish procedures to implement the metric policy defined in NMI 8010.2A.
- Establish and direct supporting activities.
- Serve as the NASA Metrication Executive on the ICMP.
- Advise the Administrator on metric transition requirements and waivers for major programs.
- Prepare NASA's Annual Metric Transition Report.

Officials-in-Charge of Headquarters Offices must establish program plans for the metric transition, and report on transition progress and barriers. They may request waivers for major programs and approve waivers and exceptions for other programs after consulting with the Associate Administrator for SMQ.

Directors of Field Installations are responsible for defining and implementing a metric transition plan within their installations.

C. Metric Transition Strategy

NASA's strategy integrates metric transition with the established planning and approval process for hardware development programs that are a large part of NASA's activity and budget. Because new programs must adopt the metric system measurement before obtaining Authority to Proceed, the rate of new program approvals determines the pace

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of NASA's metric transition. Section III summarizes the metric transition plans of all NASA Program Offices.

Functional support activities such as standards, training, supply and equipment management, and other institutional capabilities are shared resources for all flight programs. To avoid delays and/or unnecessary spending, the pace of the metric transition for these activities must be matched to the needs established by flight programs. Section IV defines essential metric transition activities associated with NASA's support functions.

To minimize disruption and risk to ongoing activities, existing programs may continue to use the inch-pound system. Safety and cost considerations will limit use of soft metric descriptions of inch-pound quantities. An integral part of this plan is a carefully controlled procedure for processing requests for waivers and exceptions to the use of the metric system for new programs (Appendix B). This procedure balances the requirement that new programs use the metric system with program cost, schedule, safety, and performance.

D. Transition Environment

Because industry provides hardware and support services for most NASA programs, the success of NASA's metric transition depends on industry acceptance and support of the metric system. Another major consideration is NASA's substantial investment in inch-pound hardware. The designs of most current NASA flight and ground systems use the inch-pound system, including the Space Transportation System, Space Station Freedom, launch facilities, and wind tunnels. Although policy requires using the metric system for new programs, NASA is likely to continue using the inch-pound system to operate and maintain elements of existing programs.

III. NASA GROUND AND FLIGHT PROGRAMS

A. Introduction

NASA employs a systematic process of phased program development for initiating new ground and flight programs. The procedures used in this process have a major impact on NASA's ability to implement the metric transition. NMI 7100.14B (February 27, 1990) defines a five-phase development process for all major procurements:

Phase A	Conceptual Phase
Phase B	Definition
Phase C	Detailed Design
Phase D	Hardware Development
Phase E	Full-Scale Operation.

Normally, Phases C and D are approved and managed as a single effort. Other programs follow essentially the same procedures, although the reviews and approvals may be less rigorous and formal.

Use of the metric system from program onset is the ideal situation. For programs already in planning, introduction of the metric system can be considered at major program decision points such as the start of Phase B or C. The impact of metric system use can be determined only if a program thoroughly assesses requirements during the prior phase. Once a program enters Phase C, changing the measurement system is impractical because revision of completed design work has very adverse cost and schedule consequences. Although NASA's plan produces a gradual metric transition, it offers the fastest practical metric transition without incurring unnecessary program costs and delays.

This section summarizes metric transition plans developed by the NASA Program Offices (Refs. G through I). The summaries report on anticipated use of the metric system for each current and future major program identified by these Offices. Because NASA now requires use of the metric system, a waiver or exception must be obtained before using the inch-pound system for future programs, including programs identified here as hybrid or inch-pound.

B. Office of Space Flight

1. Scope and Mission

By performing missions that take crew-tended and automated spacecraft to Earth orbit and beyond, the Office of Space Flight (OSF) meets NASA's goals to expand human presence in space and use the space environment to conduct scientific studies. The Office of Space Systems Development (OSSD), which develops the new systems used by OSF, also supports this function.

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2. Current Programs

The Space Shuttle Program (the Orbiter, External Tank, Solid Rocket Motor, and Main Engine) is NASA's only current capability for taking humans into space. The Space Shuttle uses the inch-pound system for all NASA-developed elements. ESA developed the Spacelab module for the Shuttle Orbiter using the metric system. Although upgraded hardware is being developed (such as the Advanced Solid Rocket Motor and new computers), the Space Shuttle is really in the operational phase. OSF also participates in planning for operation of Space Station Freedom, currently under development by OSSD.

3. Future Programs

Planned capabilities include the National Launch System (NLS) and the Assured Crew Return Vehicle (ACRV). These programs, described in the next section, will be developed by OSSD.

4. Transition Plan and Schedule

OSF has developed a metric transition plan (Ref. H). Except for Spacelab, all Space Shuttle hardware in inventory or in production uses the inch-pound system. Drawings of Space Shuttle payload interfaces give dimensions in both inch-pound and metric units, so metric payloads can be accommodated now. Any new or replacement hardware developed for the Space Shuttle will require either a metric interface description, a waiver, or an exception to use of the metric system. Because the Space Shuttle will be maintained and operated indefinitely, OSF will use the inch-pound system beyond the year 2000.

C. Office of Space Systems Development

1. Scope and Mission

The Office of Space Systems Development (OSSD) develops new systems that support humans in space and new launch vehicles for delivering automated spacecraft to space. Both functions are central to NASA's overall goals of expanding human presence in space and using the space environment to conduct scientific studies.

2. Current Programs

The Space Station Freedom Program will establish a crew-tended laboratory, leading to permanent human presence in space. Space Station Freedom entered Phase C before NASA policy required use of the metric system by new programs. In February 1987, NASA decided to use the inch-pound system for all elements developed in the U.S. Space Station Freedom does have elements designed by international partners (such as

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the modules from ESA and Japan) using the metric system. It should easily accommodate metric payloads.

3. Future Programs

Two major OSSD programs for the future are the NLS and ACRV. The NLS is a joint program with the Department of Defense (DoD) to develop a next-generation launch vehicle that accommodates payloads of varying size and is more economical to operate than the Space Shuttle. The NLS design can be upgraded to carry humans to space. The ACRV is a basic reentry vehicle that will provide an independent means of returning crew members stationed on Space Station Freedom.

4. Transition Plan and Schedule

As a result of a recent reorganization, the OSF metric transition plan (Ref. H) now applies to the programs managed by OSSD. Table I shows that Space Station Freedom's international elements have hybrid measurement systems. The foreign-built elements are metric and the NASA-built elements are inch-pound. Space Station Freedom interfaces, especially for payloads, generally express dimensions in both inch-pound and metric units, so future hardware built with the metric system can be accommodated. All elements now in development should be launched by the year 2000. After that date, the metric system will be used for most hardware design and development. Maintenance and production of direct replacement hardware for Space Station Freedom may be an exception. For continuity, Space Station Freedom will continue using the inch-pound system for operational support beyond the year 2000. The NLS and ACRV programs are expected to use the metric system of measurement.

Table I. Use of the Metric System for Future OSSD Programs

Major Program	Start Date	Anticipated Metric Use (Ref. H)
Space Station Freedom	Ongoing	Hybrid measurement systems; inch-pound hardware may replace existing inch-pound elements
National Launch System	1993	All hardware in metric system
Assured Crew Return Vehicle	1995	All hardware in metric system

D. Office of Space Science and Applications

1. Scope and Mission

The Office of Space Science and Applications (OSSA) plans, directs, executes, and evaluates NASA programs that use the space environment to conduct scientific studies of the universe, understand the Earth as an integrated system, develop a basis for solving some practical problems on the Earth, and provide a research base supporting human

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presence in space. OSSA pursues an integrated approach encompassing ground-based laboratory research; suborbital flights on airplanes, balloons, and sounding rockets; experiments conducted on Shuttle/Spacelab and Space Station Freedom; and automated Earth-orbiting and interplanetary spacecraft. A synopsis of major OSSA programs follows. "OSSA Strategic Plan 1991" (Ref. J) has detailed descriptions of the core science program, the Mission to Planet Earth, and the Mission from Planet Earth. The core science program includes other missions as described below that are not classified as major programs.

2. Current Programs

The Advanced X-ray Astrophysics Facility (AXAF), Cassini, and the Earth Observing System (EOS) are OSSA's current major development programs. AXAF will examine the universe at x-ray wavelengths. Cassini will inject a probe into Saturn's atmosphere and orbit Saturn to study the atmosphere, rings, and satellites. EOS, a series of well-instrumented spacecraft in polar orbit, will make concurrent observations of the atmosphere, oceans, land, and life on the Earth. All three development programs are using hybrid measurement systems.

OSSA's ongoing development activities include Spacelab experiments that will fly in 1992 and beyond, as well as some Explorers and small satellites. OSSA plans to develop all satellites and instruments initiated after 1992 using the metric system.

3. Future Programs

The future major core science missions are the Orbiting Solar Laboratory (OSL) and the Space Infrared Telescope Facility (SIRTF). Other major initiatives are the Stratospheric Observatory for Infrared Astronomy (SOFIA) in the core science research base, the Geostationary Platforms in Mission to Planet Earth, and the Mars Environmental Survey in Mission from Planet Earth. OSSA expects these major programs will be approved for development by FY 1998.

Additionally, OSSA plans to use metric units for a new class of "intermediate" missions proposed for initiation in FY 1994. An augmentation to the Explorer program would provide a series of small, university-developed satellites that also would be designed and built using the metric system. The initial Space Station Freedom experiments will be developed using the metric system.

4. Transition Plan and Schedule

OSSA has developed a metric transition plan (Ref. G). Scientific publications and procurements will now use the metric system. Most hardware now in the inch-pound system should be launched by 1998. As indicated in Table II, future programs will use the metric system unless a waiver is requested and approved. The same is true for future Spacelab and Space Station Freedom experiments. Therefore, by 1998, the metric system should be used for all new hardware design and development. Some use of the

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inch-pound system may continue as existing hardware is reflowed (e.g., Spacelab instruments) or copied for new missions. OSSA also plans to use the inch-pound system for on-orbit maintenance of the Hubble Space Telescope.

Table II. Use of the Metric System for Future OSSA Programs

Major Program	Start Date	Anticipated Metric Use (Ref. G)
Space Infrared Telescope Facility	1995	Metric telescope, instruments, and spacecraft systems
Stratospheric Observatory for Infrared Astronomy	1996	Metric telescope and instruments; inch-pound aircraft systems
Orbiting Solar Laboratory	1998	Metric instruments, hybrid spacecraft due to inherited inch-pound hardware

E. Office of Aeronautics and Space Technology

1. Introduction

The Office of Aeronautics and Space Technology (OAST) conducts an Aeronautics Research and Technology program for civil, commercial, and military aircraft. This program provides a foundation of advanced technology upon which U.S. industry can maintain a competitive position in global aviation markets. OAST's Space Research and Technology program advances technologies for future space missions and strengthens U.S. industrial and academic engineering and research capabilities. This program supports technology development for new launch capabilities, scientific observations, human presence in space, and ground and space operations.

2. Current Programs

NASA's Aeronautics Research and Technology program develops emerging technologies for subsonic transports, high-speed transports, high performance aircraft, and hypersonic/transatmospheric vehicles. The program develops, operates, and maintains unique national laboratories and facilities and addresses critical barriers to technology introduction. With DoD, OAST funds technology development for the National Aero-Space Plane (NASP). The stated goal for NASP is a single-stage-to-orbit vehicle. During its current technology phase, the program is advancing technology in key areas such as propulsion, materials, structures, and computational sciences. Application of these technologies is critical to future aerospace vehicles and extends beyond aerospace into other U.S. industries. NASA's Space Research and Technology program provides near- and long-term support for space and Earth science missions, space transportation systems, utilization of Space Station Freedom, ground and space operations, and human solar system exploration missions.

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3. Future Programs

The OAST program elements generally evolve slowly, with shifts in emphasis to meet program needs. OAST concentrates on technology advancement and validation, not developing major flight programs. The objective of NASP is also technology development, but it is a major program as defined in NMI 1700.14B.

4. Transition Plan and Schedule

OAST has developed a metric transition plan (Ref. I). Currently, hardware designs, research reports, and engineering publications use the inch-pound system. Table III states that the Aeronautics Research and Technology program requires a Multiproject Waiver to metric system use as described in Appendix B. This waiver is needed because the inch-pound system is the international standard for research, production, and operations in the aircraft industry. Through advisory committees and other liaison with the aeronautics industry, OAST is monitoring industrial plans for conversion to metric. Because NASA is a source of information for this industry, not a major customer, NASA and industry must have parallel metric transitions. NASP also requires a waiver because the aeronautics industry uses the inch-pound system. The decision to proceed with Phase Three of NASP, the design, construction, and flight test of a research vehicle, is scheduled for 1993. The decision on metric system use can be included in the DoD Phase Three approval process. The Space Research and Technology program currently uses the inch-pound system. Because NASA's future missions plan to use the metric system, OAST's supporting projects in the Space Research and Technology program shall use the metric system.

Table III. Use of the Metric System for Future OAST Programs

Major Program	Start Date	Anticipated Metric Use (Ref. I)
Aeronautics Research and Technology	Ongoing	Needs Multiproject Waiver.
Space Research and Technology	Ongoing	The metric system shall be used when OAST supports an Agency program using the metric system; some new projects and aeronautics-related base research and technology may require exceptions.
National Aero-Space Plane	1993	NASP shall use the metric system; some program elements will require exceptions.

F. Office of Space Communications

1. Scope and Mission

The Office of Space Communications (OSC) is responsible for key communications, mission control, and data management systems. Communications involves sending signals between the Earth and spacecraft and also between critical NASA facilities. OSC's role in mission control focuses on routing commands from an operations center to the intended spacecraft. The data management function accomplishes data transport from an individual satellite to the appropriate mission operations facility. OSC has many ground facilities and operates the Tracking and Data Relay Satellite (TDRS) system.

2. Current Programs

TDRS is the only major space hardware development program in OSC. Four of the seven satellites are now operational; one was lost in the Challenger accident. The sixth TDRS will be launched in a late 1992; the seventh is in production. All spacecraft are nearly identical designs using the inch-pound system.

3. Future Programs

TDRS II is intended as a next-generation replacement for the current TDRS. NASA needs these advanced spacecraft to support increased demand from the Space Station Freedom and Earth Observing System programs. The Phase B study for TDRS II has been completed.

4. Transition Plan and Schedule

Table IV states that TDRS II is a hybrid design that needs a waiver or exception for use of inherited elements developed with the inch-pound system. The results of the Phase B studies will be evaluated and decisions will be made regarding waivers and exceptions before TDRS II proceeds to Phase C/D.

Table IV. Use of the Metric System for Future OSC Programs

Major Program	Start Date	Anticipated Metric Use
Tracking and Data Relay Satellite II	1986	Hybrid spacecraft using inherited inch-pound hardware

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G. Office of Exploration

1. Introduction

The Office of Exploration manages the Space Exploration Initiative (SEI).^{*} The long-term goal of SEI is a permanent presence on the Moon and human exploration of Mars.

2. Current Programs

SEI focuses on developing the knowledge, experience, and cost estimate base needed to make the ultimate decision of how to proceed. The SEI activities include life sciences research, technology development, solar systems data gathering, and opportunity definition. Mission feasibility studies will shape and integrate the other activities.

3. Future Programs

NASA is formulating an implementation approach for SEI. A detailed master plan for development programs will follow. Clearly, SEI is establishing a basis for major programs.

4. Transition Plan and Schedule

SEI uses the metric system for many technical reports and publications. As indicated in Table V, future programs will use the metric system.

Table V. Use of the Metric System for Future SEI Programs

Major Program	Start Date	Anticipated Metric Use
Space Exploration Initiative	1997	All flight projects use the metric system; some technology development may require exceptions.

^{*} OAST formerly managed SEI.

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IV. TRANSITION SUPPORT TASKS

The overall pace of NASA's metric transition will be determined by the rate at which the metric system of measurement can be introduced into individual hardware development programs. Since these programs need timely functional support, the success of the metric transition depends on coordinating the support function transition with development program requirements.

This section defines eight functional support tasks that NASA must perform to ensure a smooth transition to the metric system of measurement. The tasks involving direct hardware support address metric standards, specifications, and supply and equipment management. Other tasks deal with basic support functions at the NASA Field Installations such as facility construction, personnel training, and institutional capability development. A third set of tasks focuses on metric information and awareness, specifically public affairs, education, and small business.

Each task description states the task objective, gives a brief rationale, lists specific required actions and near-term milestones, and identifies key organizations participating in the task.

A. Metric Standards, Specifications, and Practices

1. Objective

Ensure the availability of the standards, specifications, and processes required to support the design, fabrication, and operation of metric systems.

2. Rationale

Cost-effective design, fabrication, and operation depends on timely availability of adequate metric standards, specifications, and processes.

3. Tasks/Required Action

NASA makes abundant use of nationally developed standards, specifications, and procedures such as those prepared by DoD and professional societies. NASA also develops its own specifications, standards, and procedures to meet specific needs of individual programs. Because NASA hardware presently uses the inch-pound system, current NASA specifications, standards, and procedures use the inch-pound system almost exclusively. To use the metric system, NASA's new development programs require metric versions of these documents. Dimensionless documents and specifications and standards for technologies using the inch-pound system internationally do not require revision. New procedures may be required to ensure consistent use of metric units.

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The following tasks must be accomplished to ensure the availability of the required standards, specifications, and practices:

- a. Establish a master list of all standards, specifications, and practices required by NASA organizations.
 - b. Identify the specifications and standards in the master list that require conversion to metric.
 - c. Establish priorities and need dates for development or conversion of specifications and standards required by NASA programs.
 - d. Establish joint programs with industry, national standards organizations, and other agencies (such as DoD) to expedite development and coordination of metric versions of standards and specifications.
4. Milestones/Schedule
- a. Complete master list of specifications and standards by April 30, 1992.
 - b. Identify priorities for metric standards, specifications, and procedures by July 31, 1992.
 - c. Establish plan/schedule for preparation of the required metric standards, specifications, and procedures by October 31, 1992.
5. Organizational Responsibilities
- a. Overall management: Technical Standards Division, Code QE.
 - b. Identification of needs: NASA installations and Program Offices.

B. Supply and Equipment Management

1. Objective

Ensure that NASA installations are able to use the metric system of measurement for supply and equipment management.

2. Rationale

To support the operations of NASA technical and administrative offices, supply and equipment management systems must be able to identify, describe, and maintain records of stocked metric items including spares, materials, and supplies. In the metric transition process, supply and equipment management organizations are "providers," not "drivers,"

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of supplies and services. Supply and equipment management "customers" (program and institutional) establish the requirements for spares, materials, and supplies, including descriptions, standards, and specifications. Consequently, customer requirements drive the rate of the metric transition for supply and equipment management.

3. Tasks/Required Action

Descriptions of cataloged items are primarily in the inch-pound system. However, the capability to describe items in metric units is inherent to all supply and equipment records and systems. Similarly, many established units of order/issue are applicable to both systems of measurement, i.e., each, box, reel, etc. The use of metric units of issue will be driven by customer needs and supply source availability. Clearly, supply and equipment management programs can help users with metric system use.

The following tasks must be completed to ensure availability of the required support:

- a. Tell all installation supply and equipment management organizations that metric is the preferred system of measurement.
- b. Establish a preference for material acquisition in metric measures when cost, schedule, safety, and performance requirements can be met.
- c. Evaluate near- and long-term transition effects on all supply and equipment management elements.
- d. Ensure that automated information and functional operating systems have the capability to accommodate metric weights and measures.

4. Milestones/Schedule

- a. At the April 1992 Annual Supply and Equipment Management Conference, state that metric is the preferred system of measurement and that material should be acquired in metric measure when cost, schedule, performance, and safety requirements can be met.
- b. Survey all NASA installation supply and equipment functional operating systems to ensure they can accommodate metric weights and measures by May 1992.
- c. Determine near- and long-term effects of metric transition on all supply and equipment management operational elements by June 1992.

5. Organizational Responsibilities

- a. Overall management: Logistics, Aircraft, and Security Division, Code JIE.
- b. Identification of needs: NASA Field Installations.

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C. Public Affairs

1. Objective

Inform NASA civil service and contractor personnel about the Agency's transition to the metric system. Prepare for and incorporate metric units in NASA news materials.

2. Rationale

Publicizing the Agency's planned metric transition to NASA employees is an essential part of gaining internal acceptance. Employees get information about NASA activities through television, the NASA Magazine, and Field Installation newsletters and bulletins.

External public affairs materials currently use the inch-pound system. Experience indicates that news media reporting on NASA activities will use the metric system only if the public widely accepts and understands this system. Public Affairs employs a wide range of tools and activities to provide the "widest practical and appropriate dissemination of information" to the media and general public. Practical and efficient ways must be found for incorporating metric units so that the Public Affairs Office can support NASA programs.

3. Tasks/Required Action

The required action has two phases: publicize NASA's metric transition activities to employees, then support metrication of NASA programs by incorporating metric units in NASA media materials. (Public Affairs would use the inch-pound system when the program uses this measurement system.)

The following tasks will implement use of the metric system in public operations:

- a. Provide training and metric conversion tools to NASA public affairs personnel.
- b. Publicize NASA's metrication activities via NASA Select Television and internal newsletter publications.
- c. In coordination with other Federal agencies, develop common metric information to prepare the media and public for the Federal Government's metric transition.

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4. Milestones/Schedule

- a. Begin submitting articles about the metric system to newsletters, bulletins, and the NASA Magazine by January 31, 1992.
- b. Provide metrication information to Agencywide public affairs personnel by June 30, 1992.
- c. Begin incorporating dual units in NASA media materials by September 30, 1992.

5. Organizational Responsibilities

- a. Overall management: Office of Public Affairs, Code P.
- b. Identification of needs: NASA Field Installations and Program Offices.

D. Training

1. Objective

Prepare NASA personnel for routine use of the metric system of measurement.

2. Rationale

Although NASA personnel generally have some knowledge of the metric system, few use it regularly and comfortably. NASA personnel need a solid working knowledge of the metric system to use metric units routinely without constantly converting between systems. Administrative support personnel need a general familiarity, and engineering staff require an operational capability. Private sector experience indicates that general education takes 1 or 2 days. Common modules should be used wherever practical to avoid unnecessary duplication in course development. NASA should assess training programs developed by other Federal agencies such as the General Services Administration (GSA). Information about the metric system should be incorporated into professional development, skills upgrade, and apprentice programs. In addition, brochures briefly explaining the metric system and its application within NASA should be distributed to all NASA personnel.

3. Tasks/Required Action

The following tasks must be accomplished to develop and implement a common metric education program for NASA personnel:

- a. Determine the variety, scope, and timing of training in metric system use required for administrative, engineering, research, and fabrication personnel.

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- b. Adapt currently available training courses to meet established training requirements.
 - c. Develop metric modules for existing training and professional development programs. Conduct pilot training courses.
 - d. Implement a metric awareness program to prepare NASA personnel for use of the metric system.
4. Milestones/Schedule
- a. Identify training requirements for NASA personnel and implementation approaches by March 31, 1992.
 - b. Initiate pilot orientation and training courses by July 31, 1992.
5. Organizational Responsibilities
- a. Functional oversight of all training programs: Training and Development Division, Code FT.
 - b. Technical oversight of requirements and content: Technical Standards Division, Code QE.
 - c. Identification of needs and development of programs: NASA Field Installations and Program Offices.

E. Education

1. Objective

Improve public awareness of the metric system through its use in the educational materials, publications, and video and computer products developed by NASA.

2. Rationale

NASA supports mathematics, science, and technology education from grade school through graduate school. NASA has developed metric instructional materials such as "Space Mathematics" and "Metrics in Space" (Ref. K) that schools frequently request. In writing new materials and revising existing materials, text and figures will be prepared using the metric system. These efforts will be coordinated with other Federal agencies through the Metrication Operating Committee.

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3. Tasks/Required Action

The following tasks must be accomplished by NASA's Education Division to implement the metric system:

- a. Adopt the metric system as the primary system of measurement for NASA educational materials and publications.
- b. Identify topics for publications that offer particularly good opportunities to expose students and teachers to practical use of the metric system of measurement.

4. Milestones/Schedule

- a. Use the metric system as the primary system of measurement for new educational materials and publications; implemented on October 1, 1991.
- b. Select topics for educational materials that expose students and teachers to practical metric system use by March 31, 1992.

5. Organizational Responsibilities

- a. Overall management of the educational programs: Education Division, Code FE.
- b. Identification of needs: NASA Field Installations and Program Offices.

F. Construction of Facilities

1. Objective

Prepare for use of the metric system of measurement in NASA facilities and construction programs.

2. Rationale

The metric system of measurement has been used for constructing a few NASA facilities in foreign countries such as Space Shuttle support sites and tracking stations. NASA's conventional facility and construction needs totally depend on commercial practice. Generally, the materials and equipment needed for metric construction are not available in the United States, although a growing number of U.S. manufacturers are exporting metric building materials. The Construction Subcommittee of the Metrication Operating Committee (MOC) initiated an assessment of transition requirements for facility construction. The subcommittee, including NASA, is working closely with industry groups to develop product specifications and design standards for metric construction. The subcommittee has established January 1994 as the date by which industry should be

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ready to submit bids for metric construction. To maintain its current facilities, NASA recognizes that a dual system capability must be maintained after the metric system becomes established.

3. Tasks/Required Action

NASA has coordinated its plan for converting to metric construction with the Construction Subcommittee plan and will participate in subcommittee actions intended to produce the following results:

- a. Develop a generic master transition plan applicable to organizations, at any level within the Federal Government, responsible for managing facility design and construction efforts.
- b. Develop design criteria requiring metric system use that Federal agencies will insert into statements of work.
- c. Publish a "How To" pamphlet that will guide Federal agencies, architect and engineer (A&E) firms, and construction contractors through the process of designing and constructing to both soft and hard metric standards.
- d. Motivate and assist organizations responsible for construction standards to develop and publish both soft and hard metric standards.

By November 1992, NASA's Facilities Engineering Division will solicit participation among Field Installations, A&E firms, construction contractors, and material suppliers to estimate the growth rate of construction capability in metric units. The study should also identify methods to accelerate and ease NASA's ultimate transition to "hard metric."

4. Milestones/Schedule

- a. Develop a generic metric transition plan for construction by December 1991.
- b. Develop metric standards and specifications for construction by July 1992.
- c. Develop a NASA metric implementation plan for construction by November 1992.
- d. Coordinate metric standards and specifications for construction by July 1993.
- e. Conduct training for use of metric standards and specifications for construction by December 1993.
- f. Implement design of NASA facilities per metric standards and specifications by January 1994.

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5. Organizational Responsibilities

- a. Overall management: Facilities Engineering Division, Code JX.
- b. Identification of needs: NASA Field Installations and Program Offices.

G. Small Business

1. Objective

Assist small businesses in preparing to use the metric system and to support NASA's transition for hardware development and functional support.

2. Rationale

Small businesses are key partners with NASA in both hardware development and functional support. NASA cultivates and maintains strong relationships with small businesses, particularly with disadvantaged firms. When NASA announces future procurement opportunities, all businesses should be told about the Metric Transition Plan. Small businesses especially are responsive to NASA's needs. Once informed, they could make valuable contributions to NASA's metric transition and to the competitiveness of U.S. industry in international (metric) markets. A 1990 survey of small machine shops indicated most had metric experience.

3. Tasks/Required Action

The following tasks must be accomplished to assist small businesses supporting NASA in converting to the metric system.

- a. Prepare materials that inform small businesses about the NASA metric transition and opportunities for providing metric products and services.
- b. Include information about the metric transition in NASA workshops for small businesses.
- c. Insert questions concerning metric capabilities into the Small Supplier Quality Survey form to collect information from a broad sample of small businesses.
- d. Conduct targeted surveys of metric experience and capability for key small businesses areas.
- e. Ensure that NASA personnel responsible for contacts with small business are aware of plans for the metric transition and further information sources on metric system use.

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4. Milestones/Schedule

- a. Prepare materials by February 28, 1992, that inform small businesses about the NASA metric transition.
- b. Incorporate metric capabilities into workshop activities directed at small businesses by March 31, 1992.

5. Organizational Responsibilities

- a. Overall management: Office of Small and Disadvantaged Business Utilization, Code K.
- b. Identification of needs: Code K and small business advocates at each NASA installation.

H. Institutional Capability Development

1. Objective

Establish support capabilities at each NASA Field Installation for conducting research and technology development using the metric system of measurement.

2. Rationale

Previous sections addressed metric transition from the functional support and program points of view. Requirements for supporting the metric system also must be defined from an institutional point of view. Each NASA installation must conduct an internal survey that compares available metric capabilities with program requirements for metric system use, and estimates the resources needed for new capabilities. NASA Headquarters Program Offices responsible for institutional support and oversight (OSF, OAST, and OSSA) must determine how to implement metric transition at their Field Installations. Metric capability development should be phased so that Field Installations can support metric programs as assigned. Wherever practical, development of metric capabilities should be incorporated into normal maintenance and replacement activities, thus avoiding additional transition costs.

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3. Tasks/Required Action

The following tasks must be accomplished to implement a metric transition at each NASA Field Installation:

- a. Establish groups to conduct assessments and coordinate the metric transition at each NASA Field Installation.
- b. Involve the Field Installations in NASA Headquarters metric planning, information exchange, and reporting.
- c. Conduct surveys at each NASA Field Installation to assess current metric capabilities, define the rate of conversion that can be accomplished with available resources, and identify additional resources needed to meet program support requirements.
- d. Establish a metric transition plan at each NASA Field Installation with concurrence of the responsible Program Office.
- e. Ensure that each Field Installation knows the status of metric transition activities at other NASA, Government, and industrial facilities.

In addition to supporting Field Installation transition planning, the surveys will establish an overall baseline for assessing NASA's metric transition progress and will identify resources that can be shared among NASA programs.

4. Milestones/Schedule

- a. Submit a metric transition plan for each NASA Field Installation to the cognizant Program Office and the NASA Metrication Planning Group by July 31, 1992.
- b. Establish baseline institutional plans by September 30, 1992.

5. Organizational Responsibilities

- a. Overall management: Program Offices (OSF, OAST, and OSSA) with institutional management responsibility.
- b. Identification of needs: NASA Field Installations.

V. REPORTING AND EVALUATION

Internal progress reports will be compiled quarterly. Organizations participating in transition tasks will prepare information for review by the Associate Administrator for Safety and Mission Quality and the NASA Metrication Planning Group.

As required by Public Law 100-418, NASA will report annually to Congress describing NASA's metric programs and projects, accomplishments in the past year, and plans for the current year.

Metric transition plans and reports on progress and issues will be reviewed by the NASA Metrication Planning Group, the NASA Headquarters working group responsible for transition planning and coordination. Results will be given to the Engineering Management Council whose members are the principal management officials for engineering and for safety and mission quality at each NASA Field Installation. The Council reports to the Deputy Administrator and advises NASA management on engineering issues for NASA flight and ground programs.

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VI. REFERENCES

- A. Section 5164 of Public Law 100-418, 1988.
- B. Executive Order 12770 of July 25, 1991, Metric Usage in Federal Government Programs.
- C. NMI 8010.2A, Use of the Metric System of Measurement in NASA Programs, June 11, 1991 (Appendix C).
- D. Annual Metrication Report to the Congress, NASA Administrator, January 1989.
- E. Annual Metrication Report to the Congress, NASA Administrator, January 1990.
- F. Annual Metrication Report to the Congress, NASA Administrator, January 1991.
- G. Initial Metrication Transition Plan, Office of Space Science and Applications, September 1990.
- H. Metric Transition Plan, Office of Space Flight, April 1991.
- I. Metrication Transition Plan, Office of Aeronautics, Exploration, and Technology, July 1991. (Note: OAET is now OAST).
- J. OSSA Strategic Plan 1991, Office of Space Science and Applications, April 6, 1991.
- K. Space Mathematics (EB-176), 1985, and Metrics in Space (EB-82-2), reprinted 1987.

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APPENDIX A

DEFINITIONS

- Dual dimensions. Use of both metric and inch-pound units to specify the same dimension in a drawing view.
- Hard Metric. Use of metric as the baseline measurement system to create a new item requiring a new identification.
- Hybrid system. Contains a combination of metric and inch-pound components.
- Inch-pound system. Customary U.S. system of measurement as defined by the National Institute of Standards and Technology (NIST). These units include the inch, foot, pound, BTU, horsepower, degree Fahrenheit, etc. (Note that units having the same names in other countries may differ in magnitude.)
- Metric system. International System of Units known formally as "Le Systeme International d'Unites (SI)" of the International Bureau of Weights and Measures (BIWM). ANSI/IEEE Standard 268, Metric Practice, defines the meter, kilogram, second, etc. Electrical units (volts, amps, and ohms) are common to both systems.
- Metriation. Process by which programs move from common use of inch-pound units to common use of metric units through actions that are case-appropriate, economically feasible, and technically reasonable.
- Soft Metric. Mathematical conversion of measurements from inch-pound units to the equivalent metric units, without changing the item's characteristics.

APPENDIX B

METRIC WAIVER PROCESS

1. INTRODUCTION

NMI 8010.2A (Appendix C) establishes metric units as NASA's preferred measurement system. If a new program plans to use inch-pound units, Paragraphs 3.b and 3.e of the NMI require approval of a waiver. Paragraph 4.b.2 of the NMI authorizes establishment of this Metric Waiver Process.

2. APPLICABILITY

This process applies to NASA Headquarters and Field Installations, and to all new NASA programs and projects initiated after July 1, 1991. Existing programs may continue to use the inch-pound system of measurement without a waiver or exception.

3. REQUESTS FOR WAIVER OR EXCEPTION

3.1 Justification

A waiver of the required use of metric units will be considered only when one of the following conditions applies:

- a. Hardware would be built to an existing inch-pound design.
- b. Recognized international standards for the intended application use inch-pound units.
- c. Commercial practice beyond NASA's control dictates inch-pound use.
- d. Metrication would be impractical or have significant adverse effect on program costs, schedule, or performance.

3.2 Supporting Assessment

Use of the metric system must be considered from program onset, beginning with Phase A. Prior to or during Phase B, requirements for metric use and barriers to its use must be identified. A Request for Waiver must be supported by an assessment of the entire program that demonstrates metric system use has significant adverse impact. For conditions a and d above, the evaluation must address the following:

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- a. Cost/budget--specifically **incremental** costs for developing and operating metric versus inch-pound hardware.
- b. Schedule--particularly delays in meeting requirements for developing or operating metric hardware.
- c. Safety--where unavoidable risks would result from changing or mixing measurement units.

The assessment also should identify activities that can be initiated to address and remove barriers to future metric system use and must show that the Request for Waiver, if approved, would not impede metric system use for other programs.

4. WAIVER AND EXCEPTION APPROVAL PROCESSES

One of the processes defined below must be used to approve a waiver or exception allowing use of inch-pound units by a program entering Phase C/D. There are separate processes for: (1) major programs, (2) other than major programs, (3) multiple programs, and (4) program elements. These processes require meeting at least one condition given in Paragraph 3.1 and preparing an assessment pursuant to Paragraph 3.2. Requests should be submitted through established program management channels.

4.1 Major Programs*

For major programs or systems, the cognizant Associate Administrator reviews the Request for Waiver and the supporting assessment and sends both to the Associate Administrator for SMQ for evaluation. After consulting with the Associate Administrator for SMQ, the cognizant Program Associate Administrator may forward the Request to the NASA Administrator. The Administrator (or Deputy Administrator) must decide to approve or disapprove the Waiver before granting ATP.

4.2 Other than Major Programs

For programs not classified as major programs,* the Request for Waiver and supporting assessment must be submitted to the cognizant Program Associate Administrator who sends both to the Associate Administrator for SMQ for evaluation. After consultation with the Associate Administrator for SMQ, the cognizant Associate Administrator (or Deputy Associate Administrator) approves or disapproves the Request for Waiver for such programs and notifies the Associate Administrator for SMQ of the decision. The Waiver decision must be made before granting ATP.

* As defined in Paragraph 2.h of NMI 7100.14B, "Major System Acquisitions."

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4.3 Program Element Exception

For discrete elements within approved programs, the cognizant Program Associate Administrator designates the official authorized to approve Exceptions. (This official may be the Project Manager or more senior official.) This official evaluates Exceptions, makes the decision, and sends copies of approved Exceptions to the cognizant Program Associate Administrator and the Associate Administrator for SMQ.

For example, an element that is "inherited" or "off-the-shelf" hardware and has an inch-pound design is a suitable candidate for an Exception. Exceptions should not impede future use of metric units. The element should have a metric interface when the program uses metric units.

4.4 Multiproject Waiver

A Multiproject Waiver covers a group of projects for which the recognized international standards use inch-pound units or commercial practice beyond NASA's control dictates use of inch-pound units. The group may be a list of specific projects, or a well-defined class of related projects or applications. In the latter case, the period of the waiver will be no more than 3 years. When removal of barriers cannot be completed during the initial waiver period and the need for a waiver continues, an extension may be granted under this procedure.

The cognizant Program Associate Administrator reviews Multiproject Waivers and the supporting assessments, and sends both to the Associate Administrator for SMQ for evaluation. After consulting with the Associate Administrator for SMQ, the cognizant Program Associate Administrator may forward the Request to the NASA Administrator for a final decision.

5. ROLES AND RESPONSIBILITIES

5.1 Administrator or Designee

- Approves or disapproves the Request for Waiver for a major system or program and Multiproject Waivers.

5.2 Associate Administrator for Safety and Mission Quality

- Administers the waiver process.
- Reviews all Requests for Waivers for consistency with NASA policy and metric transition objectives.

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- Advises the cognizant Program Associate Administrator regarding all Requests for Waivers.
- Advises the Administrator regarding metric transition requirements, Waivers for major programs, and Multiproject Waivers.

5.3 Cognizant Program Associate Administrator

- Reviews Requests for Waivers for all programs under their cognizance.
- Provides all Requests for Waivers and supporting assessments to the Associate Administrator for SMQ for evaluation.
- Submits Requests for Waiver for a major system or program and Requests for Multiproject Waiver to the NASA Administrator for approval.
- Approves or disapproves the Requests for Waiver for systems or programs not classified as major programs.
- Designates the official (Project Manager or more senior official) that may approve Requests for Exceptions.

5.4 Official Authorized to Approve Requests for Exceptions

- Reviews and approves or disapproves the Request for Exception for a program element.
- Sends information copies of all approved Exceptions to the cognizant Program Associate Administrator and the Associate Administrator for SMQ.

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APPENDIX C

NASA MANAGEMENT INSTRUCTION 8010.2A

USE OF THE METRIC SYSTEM OF MEASUREMENT IN NASA PROGRAMS

NASA
MANAGEMENT
INSTRUCTION

NMI 8010.2A
Effective Date June 11, 1991
Expiration Date June 11, 1995

Responsible Office: Q/Office of Safety and Mission Quality

Subject: USE OF THE METRIC SYSTEM OF MEASUREMENT IN NASA PROGRAMS

1. PURPOSE

This Instruction establishes policy and responsibilities for use of the metric measurement system in NASA programs.

2. APPLICABILITY

This Instruction applies to NASA Headquarters and Field Installations.

3. POLICY

In consonance with Section 5164, Public Law 100-418, the Omnibus Trade and Competitiveness Act of 1988, it is NASA policy to:

- a. Adopt the metric system of measurement, defined by ANSI/IEEE Standard 268, as the preferred system of weights and measurements for NASA.
- b. Require use of the metric system for all major flight program new starts unless a waiver is granted.
- c. Use the metric system of measurement in NASA procurements, grants and business related activities to the extent economically feasible by the end of Fiscal Year 1992.
- d. Establish a NASA Transition Plan for transition of all NASA activities to use of the metric system by a date to be determined, except to the extent that such use is impractical or will cause significant inefficiencies or loss of markets to U.S. firms.
- e. Permit continued use of the inch-pound system of measurement for existing systems; other uses of inch-pound measurements will require a waiver.
- f. Cooperate with the private and public sectors to overcome barriers to use of the metric system and increase understanding of the metric system.
- g. Report annually to the Congress on NASA's metric transition program and perceived barriers to metric.

4. RESPONSIBILITIES

- a. The Administrator or designee is responsible for:
 - (1) Approving the NASA Metric Transition Plan.
 - (2) Approving waivers to the use of metric measurement where required for major systems/programs (defined by NMI 7100.14, "Major System Acquisitions).
 - (3) Approving NASA's Annual Metric Transition Report. (Report Control System, Report No. 10-0000-00934)
- b. The Associate Administrator for Safety and Mission Quality (S&MQ) is responsible for:
 - (1) Developing the NASA Metric Transition Plan.
 - (2) Establishing procedures to implement this policy.
 - (3) Establishing and directing supporting activities.
 - (4) Serving as the NASA Metrication Executive on the Interagency Committee on Metric Policy.
 - (5) Advising the Administrator on metric transition requirements and waivers for major systems.
 - (6) Preparing NASA's Annual Metric Transition Report.
- c. Officials-in-Charge of Headquarters Offices are responsible for:
 - (1) Establishing program plans for transition to use of the metric system.
 - (2) Reporting on transition progress and barriers.
 - (3) Forwarding to the Associate Administrator for Safety and Mission Quality requests for waivers to use of metric.
- d. Directors of Field Installations are responsible for establishing plans for transition to use of the metric system at their Installation.

5. CANCELLATION

NMI 8010.2 dated October 9, 1980.


Administrator

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