



May 3, 2010

TO: Michael G. Ryschkewitsch
Office of Chief Engineer

FROM: /signed/
Paul K. Martin
Inspector General

SUBJECT: Addendum to Final Report, "Review of the Constellation Program's Request to Discontinue Using the Metric System of Measurement"
(Report No. IG-10-011, March 29, 2010)

We requested additional comments from the Chief Engineer on Recommendation 2 in the subject final report because we did not consider his comments on the draft version to be fully responsive. The intent of the two-part recommendation was to ensure that the Chief Engineer more clearly defined the parameters for an exception to Federal law and Executive Orders for Federal agencies to implement the metric system and that blanket exceptions to using the metric system were not granted to large programs when smaller projects within that program could logically implement the metric system. The additional comments provided by the Chief Engineer on April 16, 2010 (see Enclosure), are responsive to the recommendation. Therefore, the recommendation is resolved and will be closed upon completion and verification of management's proposed actions. Following is a summary of management's comments on Recommendation 2 and our evaluation of those comments.

Recommendation 2

In our draft memorandum, we recommended that the Chief Engineer add clarifying language to NASA Policy Directive (NPD) 8010.2E, "Use of the SI (Metric) System of Measurement in NASA Programs," effective March 4, 2007. In part a of Recommendation 2, we stated that NASA needed to more clearly define the exception criteria "adds unacceptable risk" to avoid differing interpretations of the risks programs can cite when seeking an exception to using the metric system. In part b of Recommendation 2, we requested that NASA require individual projects added to complex or long-term programs that had been granted an exception to periodically re-evaluate their ability to implement the metric system.

The NASA Chief Engineer stated in his March 19, 2010, response to the draft report that on March 16, 2010, NASA cancelled NPD 8010.2E when it was superseded by NPD 7120.4D, “NASA Engineering and Program/ Project Management Policy,” which includes language stating that it was NASA’s policy for all new programs and projects to use the metric system. The Chief Engineer noted that unlike NPD 8010.2E, the new NPD did not include the exception language “adds unacceptable risk.” In addition, the Chief Engineer agreed with part b of our recommendation and said his office would ensure that as programs evolve and additional projects are added, each new project will evaluate its ability to implement the metric system.

However, we did not agree that NPD 7120.4D adequately addressed our concerns to clearly define the exception criteria or ensure that NASA policy complied with the pertinent Federal law and Executive Orders. Therefore, we recommended that the Chief Engineer establish a NASA Procedural Requirements (NPR) document to ensure that NASA program and project managers effectively implement the metric system policy stated in NPD 7120.4D to the fullest extent possible.

In his follow-up comments, the Chief Engineer concurred with our recommendation and stated that he plans to describe the use of the metric system in both space flight policy and requirements documents. Specifically, the Chief Engineer said he would ensure that the more detailed requirement language from NPD 7120.4D is included in the next revision of NPR 7120.5, “NASA Space Flight Program and Project Management Requirements,” to more clearly delineate what a program or project needs to address when requesting an exception to using the metric system. Specifically, the Chief Engineer stated that the revised NPR 7120.5 would require that

- projects identify the units of measure in all product documentation;
- all new projects use the metric system of measure unless formally waived, with special emphasis on using metric measurements in cooperative programs with international partners;
- waivers to using the metric system be submitted and justified on an individual project basis and be documented in the Project Plan;
- the NASA Chief Engineer is the approval authority for waivers related to the use of the metric system;
- waivers include the results of the assessments done to determine the short- and long-term benefit-cost-risk impacts to the project, program, and Agency of not implementing the metric system; and
- when full implementation of the metric system is not practical, hybrid configuration may be used to support maximum practical use of metric units for design, development, and operations.

The Chief Engineer's proposed action to incorporate details of NASA's implementation of the metric policy into the NPR 7120.5 revision is responsive to our recommendation. However, in addition to the above requirements, we anticipate that the Chief Engineer would also ensure that the exception criteria specifically stated in Federal law and Executive Orders are included in the revised NPR and, if NASA develops additional exception criteria such as the previous exception criteria "adds unacceptable risk," that this additional criteria will be clearly defined and included in the NPR. We would also expect that the revised NPR will address the need to periodically review approved exceptions to ensure that they remain applicable and justified.

We will close the recommendation following verification of the corrective action. The Chief Engineer stated that the estimated completion date for revising the NPR is December 31, 2010.

We appreciate the courtesies extended during our audit. If you have any questions, or need additional information, please contact Raymond Tolomeo, Space Operations Acting Director, Office of Audits, at 202-358-7227.

Enclosure

cc: Charles F. Bolden, Jr.
Administrator

Management's Additional Comments

National Aeronautics and Space Administration
Headquarters
Washington, DC 20546-0001



April 16, 2010

Reply to Attn of: Office of the Chief Engineer

TO: Assistant Inspector General for Auditing
FROM: Chief Engineer
SUBJECT: Review Report on the Review of the Constellation Program's Request to Discontinue Using the Metric System of Measurement Report No. IG-10-011, (Assignment No. S-09-010-00)

The following request for additional comments was excerpted from report IG-10-011:

Recommendation 2. *The Chief Engineer should revise NPD 8010.2E to*

- a. adequately define the "Adds Unacceptable Risk" exception criteria and*
- b. require individual projects added to complex or long-term programs to periodically re-evaluate their ability to implement the metric system.*

Management's Response. *The Chief Engineer stated that on March 16, 2010, NASA cancelled NPD 8010.2E when it was superseded by language added to NPD 7120.4D, "NASA Engineering and Program/Project Management Policy." The Chief Engineer said because NPD 7120.4D does not include the language "adds unacceptable risk," he considers the recommendation to define the exception criteria no longer valid. Management concurred with the second part of the recommendation to periodically re-evaluate new projects added to ongoing programs to assess their ability to implement the metric system. The estimated completion date for implementing this latter recommendation is the onset of the next Agency project.*

Evaluation of Management's Response. *Management's proposed actions are not responsive to the intent of the recommendation. We believe that the language concerning metric system implementation in NPD 7120.4D does not adequately meet the intent of Federal Law and Executive Orders. NPD 7120.4D states:*

POLICY (i). Metric System of Measurement. It is NASA policy for all new programs and projects subject to NPR 7120.5 ["NASA Space Flight Program and Project Management Requirements"] to use the International System of Units (commonly known as the Systeme Internationale (SI) or metric system of measurement) for design, development, and operations; in preference to customary U.S. measurement units, for all internal activities, related NASA procurements, grants, and business activities. Exceptions to this policy may be granted by the NASA Chief Engineer based on program/project recommendations by the responsible Mission Directorate Associate Administrator.

5. **RESPONSIBILITY (j).** *Managers and engineers responsible for the realization of a program, project, service, or activity shall:*

...(9) If subject to NPR 7120.5, identify method for implementing the SI system of measurement prior to completion of the Systems Requirements Review or equivalent milestone during new Program/Project Formulation. Document approved deviations and waivers.

(10) Document determinations on where and how the SI system of measurement is to be used in the Program or Project Plan, including use of SI units in related mission support and institutional projects.

The intent of the first part of our recommendation was to have NASA more clearly define the parameters for an exception to Federal Law and Executive Orders to implement the metric system. NPD 7120.4D does not identify criteria for granting exceptions to using the metric system. The intent of part b of the recommendation was to ensure that blanket exceptions were not granted to large programs when smaller projects within that Program could logically implement the metric system. Although NPD 7120.4D states that exceptions should be documented, it does not state where, how, or who keeps the record, or for how long the exception lasts. NASA officials stated in both their response to the NIST Deputy Director (Appendix D) and in their response to the draft IG report (Appendix E) that the metric system will be implemented on vehicle projects that have lunar content since these are the projects in which international participation will most probably be involved. Moreover, NPD 8010.2E stated that “[s]pecial emphasis shall be placed on maximum use of SI [metric] units in cooperative programs with international partners.” However, this language does not appear in the recently approved version of NPD 7120.4D. Thus, with NPD 8010.2E cancelled, the requirement to apply special emphasis to implement the metric system in programs with international participation no longer appears in any NASA policy documents.

Consequently, we recommend that the Chief Engineer create an NPR based on the relevant language in NPD 8010.2E and the recommendations contained in this report. While NPDs are policy statements that describe what is required by NASA management to achieve its vision, mission, and external mandates and who is responsible for carrying out those requirements, NPRs provide Agency requirements to implement NASA policy as delineated in an associated NPD. We request that the Chief Engineer provide additional comments on Recommendation 2 in response to this final report by April 16, 2010.

Additional Chief Engineer Comments to Recommendation 2:

The Chief Engineer concurs with the OIG’s recommendation to reflect the use of the International System of Units (commonly known as the Systeme Internationale (SI) or metric system of measurement) in both Space Flight policy and requirements. We agree to flow down the more detailed requirement language from NPD 7120.4 into NPR 7120.5 and to more clearly delineate what needs to be addressed when a project requests an exception. These documents are the primary source for space flight programmatic policy and procedural requirements and therefore serve as the optimal location for institutionalizing SI requirements.

NPD 7120.4 states: "It is NASA policy for all new programs and projects subject to NPR 7120.5 ["NASA Space Flight Program and Project Management Requirements"] to use the International System of Units (commonly known as the Systeme Internationale (SI) or metric system of measurement) for design, development, and operations; in preference to customary U.S. measurement units, for all internal activities, related NASA procurements, grants, and business activities. Exceptions to this policy may be granted by the NASA Chief Engineer based on program/project recommendations by the responsible Mission Directorate Associate Administrator".

NPR 7120.5 (NASA Space Flight Program and Project Management Requirements) establishes the requirements by which NASA formulates and implements space flight programs and projects. Revision E, currently in development, will include the implementation flow down of the requirements related to the application of metric system measurements. Specifically, the Rev. E will capture the following points:

- Projects are to identify the units of measure in all product documentation.
- The Metric System of Measurement is to be used for all new space flight projects unless formally waived. Special emphasis will be provided on the maximum use of the metric system in cooperative programs with international partners.
- Waivers of metric system of measurement requirements are to be submitted and justified on an individual project basis. (This is an approved exception to the submission of groups of waivers as permitted by 3.6.4.1). |
- The NASA Chief Engineer is the approval authority for waivers related to the use of the metric system of measurement.
- In addition to the minimum attributes required for all requests for requirement relief (3.6.3), waivers related to the metric system of measurement are to include the results of the assessment done to determine the short and long-term benefit-cost-risk impact to the project, program, and Agency of not implementing the metric system. This includes an evaluation of programmatic, technical, cost, schedule, and supply chain risks.
- Where full implementation of the SI system of measurement is not practical, as determined per Section 1.b above, hybrid configurations (i.e., a controlled mix of SI/non-SI system elements) may be used to support maximum practical use of SI units for design, development and operations. Where hybrid configurations are used, specific requirements shall be established to control interfaces between elements using different measurement systems. [Source NPR 8010.2E- canceled]
- Waivers related to the use of SI units are documented (or referenced) in the Project Plan.

Expected Completion Date

OCE will modify NPR 7120.5E to incorporate additional language proposed above by December 31, 2010.

If you have any questions about this response, please feel free to contact me.



Michael G. Ryschkewitsch