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Stockpile Transition Enabling Program (STEP)

Process and Project Requirements

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Abstract

This document provides the participants in the Stockpile Transition Enabling Program (STEP) a common, consistent understanding of the process and requirements. The STEP objectives are presented and the activities are outlined. The STEP project selections are based on the customer needs, product applicability, and maturity of the technology used. A formal project selection process is described and the selection criteria are defined. The concept of "production readiness" is introduced, along with a summary of the project requirements and deliverables to demonstrate production readiness.

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1.0 INTRODUCTION

1.1 Scope of Document

The purpose of this document is to provide all participants in the Stockpile Transition Enabling Program (STEP) a common, consistent understanding of the STEP process and requirements. The document describes the program objectives, project selection criteria and process, project development requirements and deliverables, demonstrating production readiness, and maintaining production readiness of a product. Revision and distribution of this document will be controlled by the STEP Manager.

1.2 Background

STEP is aiming at identifying weapon components suitable for use in more than one weapon and for qualifying components so identified for multiple use. Work includes identifying the means to maintain the manufacturing capability for these items. The STEP concept was formulated during 1990 to develop a strategy that reduces weapon system development risks and enhances product quality. The concept was combined with the Focal Point program, forming a weapon component development process. Focal Point projects are aiming at earlier stages of the component development activities such as demonstrating feasibility and establishing practicality. STEP activities include full-scale development and manufacturing engineering of a component.

STEP started in October of 1991. Together with MAST and PRESS, STEP is a demonstration program. The first project sponsored by STEP was the development of the Laser Diode Ignition (LDI) subsystem.

1.3 Program Objective

The future nuclear weapon stockpile will be smaller, with emphases on system safety, security, and use control. We are in an era of declining resources and consolidation of the nuclear weapon complex. It is our responsibility to maintain nuclear weapon capabilities and remain responsive to future needs. The objectives of STEP are

- 1) to develop subsystems and components that are broadly applicable to different nuclear weapon systems,
- 2) to maintain a selection of weapon components in a production readiness status and to modernize these items using the latest available technology, and
- 3) to provide development projects that exercise and maintain nuclear complex key capabilities in design, system integration, manufacturing, and evaluation.

Using predeveloped, multiapplication subsystems and components, STEP improves the responsiveness and cost-effectiveness of system integration for future weapon and other stockpile improvement and replacement programs.

2.0 THE STEP PROCESS

Major STEP activities include project selection, development engineering, manufacturing engineering, production readiness demonstration, and production readiness maintenance. The process is intended to manage weapon components and subsystems from engineering development through final product.

STEP provides a development environment de-coupled from specific weapon system requirements. The process encourages concurrent engineering and risk sharing between designers, manufacturers, and users. Figure 1 shows the time-line of a STEP project, and Figure 2 summarizes the STEP activities.

2.1 Project Selection

The objective of STEP is to establish production readiness of subsystems and components that have broad applications for nuclear weapon systems. Project selections are based on needs, applicability, and maturity. There are special emphases on projects related to nuclear weapon safety, security, and use control. Projects with dual use potential are encouraged. The components or subsystems to be developed by STEP should be configurable, standardized, or modular, so that they are broadly applicable. The performance requirements, implementation technologies, and manufacturing processes should have adequate maturity for commitment to full-scale engineering and manufacturing.

The candidate projects for STEP are reviewed during Milestone II. (Milestone I is dedicated for Focal Point review.) The STEP Management Review Board has the responsibility of reviewing and approving STEP projects.

2.1.1 Preliminary Proposal

STEP accepts project proposals during the annual call for proposals, or anytime the need for a product is identified. The preliminary proposal is a one- to two-page description of project objectives, proposed implementations, major milestones, and resource requirements.

2.1.2 Proposal Assignment

Each submitted proposal will be assigned to a STEP Project Engineer. It is the responsibility of the STEP Project Engineer to become familiar with the proposal and to facilitate the review process.

Figure 1 - STEP Project Time Line

2.1.3 Preliminary Proposal Evaluation

The STEP Project Engineer will perform the preliminary evaluation, with the proposal owner, to determine if the proposal reasonably satisfies the following criteria:

1. What are the needs for the product?

Examples of need are applications for stockpile improvements and other committed or expected weapon programs, and maintaining core capabilities, key design, or manufacturing processes.

2. Does the product have broad applications for weapon systems?

A STEP component should be modular, standardized, or have a flexible configuration so that it can satisfy the requirements of various nuclear weapon systems.

3. Do the performance requirements, implementation technologies, and manufacturing processes have adequate maturity for the commitments of full-scale engineering and manufacturing?

Some of the consideration factors are design experiences, product or prototype performances, analysis data, and industrial supports.

4. Does the product have a significant and credible dual use potential?

"Dual use" has the following general meaning: required by the nuclear weapons program and having the potential to impact the economic welfare of the US. One way to demonstrate the potential is to identify outside contacts to establish the "significance and credibility" of the dual use nature of the project.

2.1.4 Peer Review

Peer participation in proposal evaluation is optional but highly recommended. A project evaluation matrix has been developed for this purpose (see Appendix A). The evaluation criteria are designed to encourage discussion. The STEP Project Engineer has the responsibility to facilitate the review process, provide information, and encourage a consensus decision.

2.1.5 Milestone II Review Document

The STEP Project Engineer will assist the proposal owner to develop the review document. The format and content of the Milestone II review document have been generated (see Appendix B) as a guideline. The document will be submitted to the Management Review Board for review and approval.

2.1.6 Milestone II Review

The Management Review Board will convene when there is a need for Milestone II review, determined by the SNL DP Sector Director. The review procedure is flexible. The assessment criteria for Milestone II have been developed as general review guidelines (see Appendix C). The proposal owner will be informed as soon as a decision has been reached by the Management Review Board after the review.

2.1.7 STEP Management Review Board

The STEP Management Review Board consists of Directors and managers from the project implementation organizations, weapon systems organizations, manufacturing engineering organizations, DOE/AL, and production agencies. The SNL DP Sector Director will chair the board to review candidate projects during the Milestone II review. The board also convenes annually to review all projects currently sponsored by STEP.

2.2 Product Development

Once a project is selected, STEP provides a development environment de-coupled from specific weapon system application. STEP also provides the system focus and user interface for multiapplication components. Continuing support of project is based on the needs, merits, and progress of the project. The STEP Management Review Board will review active projects annually.

STEP product development activities are similar to the traditional Phase 3 and Phase 4 efforts. They include detailed design, worse-case analysis, process development, product testing, and so on. The component or subsystem will be fully designed, tested, and evaluated. The manufacturing processes and procedures will also be established. At the end of product development, the project is reviewed by the STEP Management Review Board at the Milestone III review. Mark quality units will be produced to demonstrate production readiness (see Section 3.0).

2.2.1 Project Management

A Product Manager, who has the responsibility of the product from cradle to grave, will be assigned to each STEP project. In the early stages of development, the Product Manager evaluates the potential applications of the product, establishes product performance requirements, and provides general guidance for design and manufacturing trade-offs. During production, the Product Manager ensures that application requirements are satisfied, establishes new applications, improves manufacturing processes, interfaces with users, maintains the product in a readiness status, and recommends product upgrades.

A product realization team will be formed once a project is selected. The project team consists of a team leader and other team members who are actively involved in design,

testing, manufacturing, and qualification of a product. Concurrent engineering will be emphasized using the team concept.

Traditional project management tools such as Work Breakdown Structure, and Work Packages are used. Project/task responsibilities and accountability are assigned at the appropriate levels.

2.2.2 Project Annual Review

All projects sponsored by STEP will be reviewed annually by the Management Review Board. This is not a design review. The presentation should be focused on demonstrating the latest applications, presenting accomplishments, reporting status, and discussing issues. The basis of support for a project depends on its continuing needs and satisfactory progress. The Milestone II review format (see Appendix B) can be used as a guideline.

2.2.3 Milestone III Review

Milestone III review is held at the end of the Product Development phase of a project. It is a formal review before the project enters the Production Readiness Maintenance phase. The deliverables of the Product Development activities (see Section 3.10) must be completed prior to Milestone III. A Milestone III review document, similar to the one in Milestone II, will be submitted by the project team to the Management Review Board for approval. Milestone III assessment criteria (see Appendix D) have been developed as general review guidelines.

2.3 Production Readiness Maintenance

The predeveloped components and subsystems will be maintained in a production readiness status. The Product Management Plan generated during the Product Development phase will be the main guidance document for production readiness maintenance. This is a continuing effort aimed at ensuring product quality and performance, establishing new applications, improving manufacturing processes, interfacing with users, and continuing product upgrades. Limited quantity of Mark Quality unit (see Section 3.0) will be produced to maintain manufacturing capability and to satisfy system integration requirements. The components become available off the shelf. Continuing need and progress of the project will be reviewed annually by the Management Review Board during the Production Readiness Maintenance phase.

3.0 DEMONSTRATION OF PRODUCTION READINESS

STEP is a technology demonstration program. The mission is to develop, upgrade, and maintain subsystems and components to support weapon system integration. This section describes STEP requirements to demonstrate production readiness of a component in an environment that is similar to, but different from, traditional Phase 3 projects.

3.1 Definition of Terms

Production Readiness

Ready to deliver War Reserve (WR) hardware to support weapon system integration activities using predeveloped, multiapplication Mark Quality subsystems and components.

Ready

Prepared to configure, test, qualify, and produce a predeveloped mark quality subsystem or component for a specified application within twelve months following STEP Milestone III. (See Figure 1, STEP Project Time Line.)

Weapon System Integration Activities

MAST, PRESS, SIPs, Phase 3, and the like.

Mark Quality

Material that meets all applicable design agency requirements and all applicable drawings and specifications and known design intent. (Source: DOE/AL Quality Assurance Procedure 10.0; EP401100, Qualification of Processes and Production Under Demonstration Programs.)

3.2 Design Development

Successful development of a multiapplication component can be accomplished only with a robust design directed toward a long-term solution. Considerations of user requirements, cost, reliability, testability, qualification requirements, manufacturing capabilities, maintenance, product dismantlement, and so on, should begin early in the design stage of development. Concurrent engineering is essential. The following are some suggestions on design approach:

- Avoid potential "sunset technologies."
- Minimize specialized technologies, parts, equipment, and processes developed solely for nuclear weapon applications.

- Encourage the use of technologies with industrial support and broad application potentials.
- Design in quality as opposed to testing and inspecting for it.
- Use designs that are compatible with agile manufacturing techniques, standard processes, and available manufacturing capabilities.
- Design for testability by using self-test, boundary scan, health status, and so on.
- Encourage the use of simple, generic, "dumb" test equipment.

The requirements related to design development to demonstrate production readiness are as follows:

1. Design completed.

The design must be reviewed and drawings released. There are several design reviews and document releases defined: Conceptual Design Review (CDR), Baseline Design Review (BDR), Final Design Review (FDR), Complete Engineering Release (CER), and Qualification Engineering Release (QER) (see Section 3.8 and Section 3.9).

2. CD and SB requirements satisfied.

Performance versus requirements must be demonstrated using the final design definition and manufacturing processes (using the expected production version). The demonstration will involve both development testing and analysis.

3. Performance margin of critical parameters determined.

Critical performance parameters should be identified, and performance margins determined. The objectives are to demonstrate the capability of the design, establish the performance distribution, and identify limits.

3.3 Manufacturing Development

The major challenge for manufacturing development is the uncertainty of future production environments. There are no fixed production schedules defined, and the anticipated production quantity is small. The following should be considered as guidelines for manufacturing development to satisfy the demonstration of production readiness.

1. Production process developed and documented.

Part lists, assembly procedures, acceptance testing, record of assembly, and so on, must be thoroughly described, verified, and documented.

2. Process flow defined, critical processes identified, and databases developed.

With a limited number of development and production units, producibility cannot be established by the actual yield of the product. Component producibility will be established by defining the manufacturing process flow and identifying the processes that are critical to the yield of the product. Examples of the critical process are precision machining, casting, soldering, and potting. These processes should have adequate databases to establish their capability. A metric plan should be available to continuously monitor and improve critical processes. The goal is to achieve a capability index greater than 1.6 ($Cpk > 1.60$).

3. Material availability determined.

A Material Acquisition Plan should be developed and maintained to ensure the availability of all required materials. Long-term acquisition strategies are needed for specialized materials or parts that require special handling, inspections, testing, or vendor development. Successful implementation of this plan requires a robust design that avoids sunset technologies and minimizes specialized parts.

4. Tooling and testers available.

Tooling and testers will be required to support low-quantity production. In most cases, open bench setup, soft tooling, and generic test equipment are adequate. Hard tooling and dedicated testers designed for large-quantity production should be used only when the need is justified. Test procedures must be carefully written so that test results are accurate and repeatable, and tester variance is eliminated.

5. Production facility and personnel ready.

Dedicated facility and assembly line setup might not be compatible with designs that limit production quantity. Products should be designed to be compatible with agile manufacturing techniques so that specialized equipment can be minimized. Production personnel should be cross-trained for several tasks.

3.4 Qualification

DOE/AL QC-1, QC-2, and engineering procedure EP401100, "Qualification of Processes and Products Under Demonstration Programs" will apply. EP401100 defines a qualification process to satisfy Sandia's current nuclear weapon development and production environments. It requires that products be qualified in stages. The Product Realization Team (PRT) will determine the details of the qualification requirement. It

is the responsibility of the PRT to determine what is a "qualified" product. Traditional qualification requirements such as source inspections, tool-made samples (TMS), vendor qualifications, and so on might not be compatible with the new production environment, and are not necessarily a part of the qualification process.

3.5 Reliability

It is neither practical nor feasible to statistically demonstrate the reliability of a product or process when the quantity of production is limited. The reliability numbers will be a "prediction" of the reliability based on past and current data, and should be consistent with the reliability requirement. The "prediction" should be continuously updated by available test data. Corrective action must be taken immediately if test data do not support the reliability "prediction."

3.6 ES&H

Materials and manufacturing processes used by the product must comply with ES&H regulations. Handling procedures and disposal of hazardous materials must be documented (see Section 3.9).

3.7 Production Capability Assurance Program (PCAP) Supports

The Production Capability Assurance Program (PCAP) is responsible for implementing DOE requirements for the acquisition and maintenance of a viable technology base that is responsive to weapon production requirements. The activities of development and demonstration production capability for components, subassemblies, and assemblies at the Production Agencies (PA) are within the scope of the PCAP program. The STEP program will coordinate with the PCAP activities in the following manner:

1. STEP will provide input to DOE/AL for the Advance Planning Document (APD). This document gives a general description of the STEP program and the active STEP projects. It is used by PAs for the advanced planning of production capability requirements. STEP will update the input to APD when a new project starts or an existing project terminates.
2. STEP will prepare the Technology Demonstration Definition Document (TDDD). This document defines the quantity and the description (breadboard, prototype, mockup, flight qualified, Mark Quality and so on) of the development units and their delivery schedule. It also identifies the expected funding sources to support these activities, either from PCAP or from the Design Agency ICOs. The TDDD will be generated by Sandia, with the concurrence of the PA, to maximize the benefits for both STEP and PCAP programs.
3. To supplement TDDD information, the STEP project team may place a "no cost" Integrated Contractor Order (ICO) to the PAs. It contains detailed information on PCAP activities defined in the TDDD, such as task definitions, schedule, and

deliverables. The "no cost" ICO has the same format as a regular ICO except that there will be no budget commitment from Sandia to the PA. The purpose of this document is to encourage concurrent engineering and provide traceability of responsibilities. It will be generated by Sandia, with the concurrence of the PA.

4. When PA supports are needed for development activities beyond the scope of PCAP program, additional ICOs will be used in the traditional manner.

3.8 Design Reviews

Design reviews are formal evaluations to ensure the design is technically adequate and will meet requirements for performance, cost, and schedule (see EP401063, Design Reviews). The objectives of the design review are different from the management reviews such as Milestone II, Milestone III, and Annual Project Reviews. The following design reviews are required during product development:

1. Performance Requirements Review: a review held early in development to verify, validate, and prioritize component performance and cost requirements. No documentation release are required for this review.
2. Conceptual Design Review: a review of design concepts and early examination of producibility and ES&H issues. The review should be held soon after a draft Compatibility Drawing (CD) is received from the STEP system representative. Stage I of the Qualification Evaluation Release (QER) should be completed prior to the Conceptual Design Review. (See EP401100, "Qualification of Processes and Product Under Demonstration Programs" for a detailed description of qualification requirements.)
3. Baseline Design Review: an assessment of the component's ability to meet system requirements. This review should be held when the detailed baseline design and the qualification plan (QER Stage II) has been established.
4. Final Design Review: a review, held prior to Complete Engineering Release (CER), of the final design, documentation, performance requirements, environments, ES&H considerations, and producibility. QER Stage III should be completed before the Final Design Review.

Note: Stage IV (the final stage) of the QER is completed when the first Mark Quality unit is built, tested, and qualified. There is no design review associated with the QER Stage IV. (See Figure 1, STEP Project Time Line.)

3.9 Documentation

Development information such as requirements, design approaches, test results, analyses, and product definition, must be thoroughly documented before any product

can be considered production ready. The following are the documents required by STEP:

1. System Compatibility

A system compatibility control drawing will be generated by the STEP system engineer to envelop the potential application requirements. Refer to Engineering Procedure EP401528, "Interface Definition and Control/Component Request," for a detailed description.

2. Qualification Plan

The qualification plan contains detailed requirements for the qualification process developed by the Product Realization Team. Refer to Engineering Procedure EP401100, "Qualification of Product and Processes Under Demonstration Projects," for details.

3. Product Definition Drawing

The Product Definition Drawing documents the definitions of design and manufacturing processes. As a minimum, the document should include the following information:

- Design definitions: schematic, drawings, parts list, and so on.
- Process definitions: soldering, PCB fabrication, and so on.
- Manufacturing definitions: assembly procedures, acceptance tests, and so on.
- Materials: material list, handling procedure, dismantlement instructions, and so on.

4. Material Acquisition Plan

The Material Acquisition Plan ensures the availability of all required materials. It contains long-term acquisition strategies for specialized materials or parts that require special handling, inspections, testing, or vendor development.

5. Characteristics and Development Report

The content and format of the Characteristics and Development Report are specified in Engineering Procedure EP401518, "Component Engineering Reports." The document describes development results such as the following:

- Requirement/Performance summary
- Design margin assessment: test data, worse-case analysis, and so on.
- Producibility assessment: yield, Cpk, and so on.
- Reliability assessment: failure rate, life, and so on.
- Material compatibility studies

6. Product Characteristic Drawing

The Product Characteristic Drawing describes user information such as performance capabilities and interface characteristics. It contains all of the information about how to use the product, similar to a user's manual. This document will be widely distributed to potential users.

7. Product Management Plan

The Product Management Plan describes the planning and requirements to maintain the product in a production readiness status. The document includes a statement of need, production quantity in order to maintain capability, schedule, resource requirements, continued improvement strategy, and other management information.

8. Dismantlement Plan

The Dismantlement Plan documents hazardous materials used in the product, defines the handling procedure, and provides dismantlement instructions.

3.10 Deliverables

At the end of product development, the component should be designed, tested, and fully evaluated. The manufacturing processes and procedures should also be established. Before a STEP project enters the Production Readiness Maintenance phase, a STEP Milestone III review will be held. The following is a list of deliverables required for the review:

- Milestone III review document
- A qualified Mark Quality Unit
- System Compatibility Drawing
- Qualification Plan
- Product Definition Drawing
- Material Acquisition Plan
- Characteristics and Development Report
- Product Characteristic Drawing
- Product Management Plan
- Dismantlement Plan

The hardware deliverables to support testing, evaluations, system integration, and so on depend on individual project needs and are specified by each project.

APPENDIX A

PROJECT EVALUATION MATRIX

The project evaluation matrix is developed to be used in a peer review. The STEP project engineer is responsible for facilitating the review process, providing information, and encouraging a consensus decision.

The matrix is a hierarchical list of criteria that are deemed important to the weapon program as a whole. Before using the evaluation matrix, a benchmark should be selected, which represents the current implementation of the function provided by the proposed product. The evaluation is done by entering a score at the lowest hierarchical level of the criteria list, comparing the proposed product with the benchmark. There are two entries for each criterion: an optimistic score and a pessimistic score. The score ranges from minus 2 to plus 2 based on the following rules:

- +2: the proposed product has significant improvement w.r.t. the benchmark
- +1: the proposed product has modest improvement w.r.t. the benchmark
- 0: no change
- 1: the proposed product has minor degradation w.r.t. the benchmark
- 2: the proposed product has major degradation w.r.t. the benchmark
- N/A: not applicable

It is very important to recognize that the matrix is designed to cover a broad range of subjects for discussion purpose only. The scores are not intended to be totaled at the end of the evaluation. The project evaluation matrix follows.

Table A-1

Project Evaluation Matrix

Criteria	Score (-2 to +2)		Benchmark	Explanation
	Optim.	Press.		
1 Weapon Function/Performance				
1.1 Military Effectiveness				
1.1.1 Reliability				
1.1.2 Delivery Options				
1.1.3 Output Options				
1.2 Warhead Packaging				
1.2.1 Yield To Weight Ratio				
1.2.2 Warhead-Carrier Communication				
1.2.3 Packaging Flexibility				
1.3 Operational Impact				
1.3.1 Operational Simplicity				
1.3.2 Deployment Ease				
1.4 Logistical Impact				
1.4.1 Maintainability				
1.4.2 Repairability				
1.4.3 Movement/Storage Ease				
2 Weapon Surety				
2.1 Inadvertent Nuclear Detonation (IND) Safety				
2.1.1 Normal Environment				
2.1.2 Abnormal Environment				
2.2 Special Nuclear Material (SNM) Scattering				
2.2.1 Probability				
2.2.2 Consequence				
2.3 Weapon Use Control/Command & Control				
2.3.1 Allows Timely Authorized Use				
2.3.2 Prevents Unauthorized Use				
2.3.3 Support Hardware Impacts				
2.4 Security				
2.4.1 Allows authorized Access				
2.4.2 Deters Unauthorized Access				
2.4.3 Minimizes Weapon Exposure				

Table A-1

**Project Evaluation Matrix
(Continue)**

Criteria	Score (-2 to +2)		Benchmark	Explanation
	Optim.	Press.		
3 Broad Applicability				
3.1 Weapon System Applications				
3.1.1 Bomb				
3.1.1.1 SIPs				
3.1.1.2 New				
3.1.2 Missile				
3.1.2.1 SIPs				
3.1.2.2 New				
3.1.3 R/V				
3.1.3.1 SIPs				
3.1.3.2 New				
3.1.4 Specialty Weapons				
3.2 Strategic Thrusts				
3.2.1 Complex-21 / Reconfiguration				
3.2.2 Cross Cuts				
3.2.3 Dual Use				
4. Product Life Cycle Impacts				
4.1 System Integration Flexibility				
4.1.1 Packaging				
4.1.2 Other Components/Subsystems				
4.1.3 Functionality				
4.2 ES&H				
4.2.1 Manufacturing Process				
4.2.2 Product				
4.2.3 Dismantlement & Disposal				
4.3 Production Cost				
4.3.1 Material				
4.3.2 Production Engineering				
4.3.3 Inventory				
4.3.4 Manufacturability				
4.3.5 Infrastructure				
4.3.6 Distribution				
4.4 Schedule				
4.4.1 Weaponization				
4.4.2 Manufacturability				
4.4.3 Infrastructure				

APPENDIX B

MILESTONE II REVIEW DOCUMENT

The Milestone II review document should be focused on the justifications of the project, cost and benefit trade-offs, and risk assessments. Quantitative data instead of qualitative statements to support the cost/benefit study, producibility assessment, and so on are highly desirable. Technical discussions should be limited to providing understanding of project objectives. The following is a recommended outline.

Product Development Milestone II Review Stockpile Transition Enabling Program (STEP)

Project

Project title.

Responsible Organizations

A list of all responsible organizations.

Objectives

The statement of objectives should be specific and unambiguous.

Statement of Need

The statement of need should address the principle reason(s) why this development activity is required to support the weapon program. The justification might be based on a specific program need or supported by a broad spectrum of weapon applications. Some examples: to support stockpile improvement or replacement, to enhance surety, to maintain capability, to reduce cost, or to improve yield. The justification should be backed up by fact and data if possible.

Project Description

This section describes the project in detail. It should discuss what the product is, how it works, how the product fits in different weapon systems, what are the improvements and contributions, and so on. Block diagrams and drawings might be included.

A significant portion of this section should address the maturity level of this project, which includes discussions of technologies used, critical manufacturing processes, and understanding of the requirements. Supporting information such as past development

efforts and results, prototype performance, related activities, current status, and yield estimates are highly desirable.

Assessment Criteria

The purpose of this section is to provide a summary discussion of assessment criteria. The information might be repeat statements from other sections of this document. (See Appendix C for a detailed description of Milestone II Assessment Criteria.)

Approaches

This section outlines approaches to achieve the project objectives. The following are some of the subjects that should be included in this section.

- Summary of requirements
- Design approaches for producibility, testability, quality, etc. (standardized, configurable, modular, self-test, and so on)
- Performance, cost, and schedule trade-offs
- Interface consideration with system and other components
- Test and characterization planning
- Manufacturing considerations
- ES&H considerations
- Quality assurance planning

Deliverables

At the end of product development, the component should be designed, tested, and fully evaluated. The manufacturing processes and procedures should also be established. Before a STEP project enters the Production Readiness Maintenance phase, a STEP Milestone III review will be held. The following is a list of deliverables required for the review:

- Milestone III review document
- A qualified Mark Quality Unit
- System Compatibility Drawing
- Qualification Plan
- Product Definition Drawing
- Material Acquisition Plan
- Characteristics and Development Report
- Product Characteristic Drawing
- Product Management Plan
- Dismantlement Plan

Resources

Milestones

APPENDIX C

MILESTONE II ASSESSMENT CRITERIA

STEP is a program to demonstrate and maintain component production readiness. The mission is to develop, upgrade, and maintain subsystems and components that have broad application to support weapon system integration. Project selections are based on needs, applications, and maturity. There are special emphases on projects related to nuclear weapon safety, security, and use control. Projects with dual use potential are encouraged. Components or subsystems to be developed by STEP should be configurable, standardized, or modular, so that they are broadly applicable to various weapon systems. Performance requirements, implementation technologies, and manufacturing processes should have adequate maturity for commitment to full-scale engineering and manufacturing development.

Milestone II Assessment Criteria have been developed as a guideline for STEP project selection. They are not intended to be used as requirements.

1. *Needs* What are the needs for the product? How does the product satisfy these needs?

The Milestone II review document should include a statement of need. Examples of need are applications for stockpile improvements and other committed or expected weapon programs, and maintaining key capabilities, designs, or manufacturing processes.

2. *Applications* Does the product have broad application? How well does it fit into a weapon system? How useful are the product attributes?

STEP supports the development of subsystems, components, and processes that have broad applications for nuclear weapon systems. Products should include attributes such as standardization, configurability, modularity, and flexibility.

3. *Dual Use* Does the product have a significant and credible dual use potential?

"Dual use" has the following general meaning: required by the nuclear weapons program and having the potential to impact the economic welfare of the US. One way to demonstrate the potential is to identify outside contacts to establish the "significance and credibility" of the dual use nature of the project.

4. *Cost/Benefit* Examples of cost: development time, resource requirements, impacts on other components, next assembly, and overall weapon system.

Examples of benefit: lower production cost, more manufacturable, less lead time, better performance, higher reliability, and better quality.

- 5. Risks** Are there any potential showstoppers, technical and programmatic? What are the high-risk areas? How can these risks be reduced or eliminated?
- The development and manufacturing risks should be clearly identified. Plans should be included to lower or eliminate these risks.
- 6. Planning** Are resources, schedules, and activities for reaching production readiness (Milestone III) realistic and consistent?
- The approaches, resources, schedules, and activities for reaching production readiness should be outlined. They will be expanded to become the Project Plan after Milestone II.
- 7. Requirements** Are system requirements understood? Are product requirements adequately defined?
- Product requirements describe the functions and capabilities needed to satisfy anticipated applications. They should be adequately defined, and consistent with the statement of need. The requirements will be expanded to become the Compatibility Drawing (CD) after Milestone II.
- 8. Process** Has manufacturing feasibility been demonstrated? What are the key processes?
- Key manufacturing processes should be identified. Attempts should be made to estimate the product yield and process capability (Cpk). The estimates might be based on past process capability, the yield of a similar product, analysis, or other available data.
- 9. Performance** Is product performance understood and robust?
- Characteristics and performance should be consistent with product requirements. Predictions of characteristics need to be supported by prototype evaluation results, product performance of similar designs, industrial supports, design experiences, or other available data.
- 10. Longevity** How long will the product remain viable? What is the upgrading path?

APPENDIX D

MILESTONE III ASSESSMENT CRITERIA

Milestone III is a formal review at the end of STEP product development, before the project enters the Production Readiness Maintenance phase. The component or subsystem should be designed, tested, and fully evaluated. Manufacturing processes and procedures must also be established. The production commitment of a Mark Quality unit is based on the needs of weapon system integration, maintaining manufacturing capabilities, and evaluation/feedback for product improvements.

The Milestone III Assessment Criteria are developed as a guideline. They are not intended to be used as requirements.

1. *Needs* What are the needs for the product? Did the needs change since Milestone II?

The Product Management Plan should include a statement of need. Examples of need are applications for stockpile improvements and other committed/expected weapon programs; maintaining core capabilities, key design, or manufacturing processes; and evaluation and feedback for product improvements.
2. *Cost/Benefit* Examples of cost: facility, equipment, and other resource requirements; impacts on other components, next assembly, and overall weapon system.

Examples of benefit: lower production cost, more manufacturable, less lead time, better performance, higher reliability, and better quality.
3. *Risks* What are the production risks? How can these risks be reduced or eliminated?

During production, there should be minimum or no risk. The project should remain in the development phase as long as there are significant risks involved.
4. *Planning* Are resources, schedules, and production quantities realistic and consistent?

The Product Management Plan should be complete, detailing resource requirements, schedules, production quantities, and so on.
5. *Qualification* Has the Mark Quality unit been qualified according to QC-1, QC-2, and EP401100?

Engineering Procedure EP401100, "Qualification of Product and Processes Under Demonstration Projects," will apply.

6. *Product Def.* Is the Product Definition Drawing complete?

The Product Definition Drawing describes design, manufacturing processes, assembly procedures, testing requirements, and so on. It should be completed during the development phase.

7. *Process* Are the key processes characterized? Stable?

Key manufacturing processes should be identified and characterized during the development phase of the project. The results should be summarized in the Characteristics and Development Report (C&DE).

8. *Functionality* Has the product performed satisfactorily in testing and met all product requirements?

9. *Longevity* How long will the product remain viable? What is the upgrading path?

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