Biometrics Enterprise Architecture Systems Engineering Management Plan (BMEA SEMP)

Version 1.0

Prepared by:

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Revision History

Date	Purpose	Revision Level	Responsible Person
11/17/2009	First Draft	1.0	

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1 Introduction

The purpose of the BMEA Systems Engineering Management Plan (PMP) is to define the System Engineering methods and associated management methods for BMEA project, and to provide the management approaches and methodologies designed to successfully achieve the project objectives in support of fulfilling the requirements of Systems 798. The overall objective of the BMEA project, in support of modernizing biometrics operational architecture is to develop an executable architecture and a set of technical and business models highlighting the effectiveness of the architecture.

1.1 Background

Add Background.

1.2 Purpose and Scope

This Systems Engineering Management Plan (SEMP) describes the activities, processes,

and tools that will by used by the Biometric Enterprise Architecture (BMEA) Systems Engineering team to support the analysis and design of BMEA.

The objective of the Systems Engineering effort is to assure successful development of BMEA primarily by ensuring clear and accurate system requirements and verifying compliance of

to those requirements. The BMEA system consists of the means to connect image requestors, suppliers (subjects), reviewers and adjudicators with the BMEA to introduce, search for, validate, enroll and ratify images and biographical information into BMEA for fusion of various image artifacts into a cohesive collective aggregate identity of an individual. The BMEA is set of image and biographical information storage, search and fusion capabilities for supporting the aggregate identity of individuals supporting identification functions within an enterprise.

This SEMP is applicable to all Systems Engineering tasks to be performed in support of the BMEA project. This document will be placed under change control upon its initial release.

1.3 Acronyms

SEMP – Systems Engineering Management Plan
SRR – System Requirements Review
WBS – Work Breakdown Structure

1.1 Applicable Documents

The following documents are applicable to the development of this SEMP.

2 Systems Engineering Process

2.1 Organizational Responsibilities and Relationships

The BMEA team consists of members from the George Mason University's Systems Engineering/Operational Research Department's (SEOR) capstone class, SEOR 798/680 Systems Engineering and Operations Research Applied Project, within the SEOR Master of Science curriculum and is managed by Dr. Thomas H. Speller, Faculty Professor for SEOR 798/680. BMEA team members report to Dr. Speller who mentors SEOR 798/680 Systems Engineering and Operations Research Applied Project Course on behalf of the SEOR department within the Volgenau School of Information Technology and Engineering at George Mason University. The BMEA manages and is responsible for all systems engineering activities. The organizational structure of the BMEA collaboration is shown in Figure X.

Dr. Speller provides technical leadership and mentors Team BMEA's BMEA development through tracking project requirements and project performance. Team BMEA is responsible for assuring BMEA meets overall objectives as specified by stakeholders and subject matter experts.

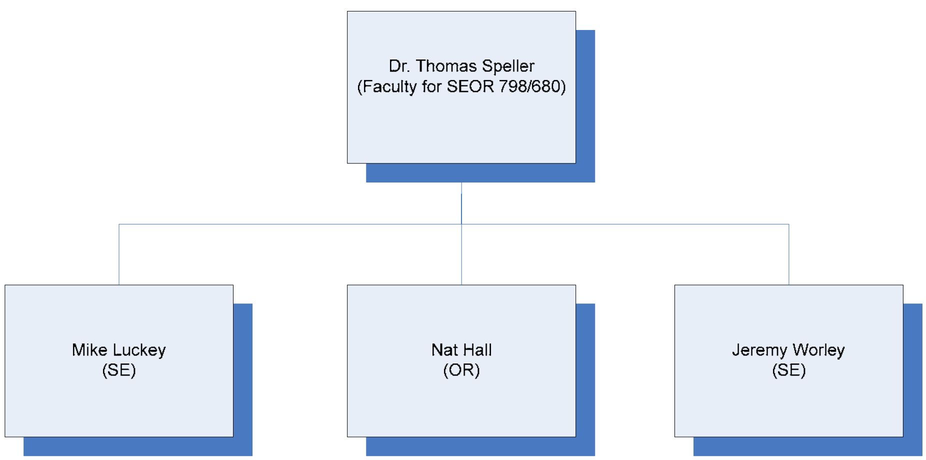

Figure 1 Organization Chart

2.2 Systems Engineering Process Planning

This section describes the key components of the BMEA systems engineering process, including the major systems engineering products, technical objectives, work breakdown structure, requirements verification, and engineering participants.

2.2.1 Major Systems Engineering Products

2.2.1.1 Integrated Database

Throughout the design phase of the BMEA project, studies and analyses will be conducted to support decisions regarding requirements selection and system design. The collection of these reports and artifacts on the BMEA website effectively documents the process of defining the BMEA and will be archived for future reference. As requirements and specifications are recorded on the BMEA website, they will be cataloged and categorized to the applicable analyses are as described on the website to provide some level of traceability to the rationale for the requirements and for retaining the document on the BMEA website.

2.2.2 BASELINES

Throughout the lifecycle of the project, the BMEA system configuration is defined in a technical baseline, consisting of the approved documentation as posted to the BMEA website and is used to record and define the technical requirements of the BMEA project and further define the overall characteristics of the BMEA system including documentation supporting the different development stages of the project. The technical baseline progresses from high-level requirements (the Functional Baseline) to more detailed requirements, design drawings and specifications (the Allocated Baseline) to complete “as-designed” drawings and specifications (the BMEA Baseline). Specifications, interface control documents, and drawing packages are used to describe the BMEA system and are intended for use in further development and implementation activities. These baseline documents will be organized in a hierarchy that provides design traceability to the lowest level. Once approved, these baseline documents are placed under configuration control, as described in the Configuration Management Plan (CMP).

2.2.2.1 **Specifications**

The planned specification tree, Figure 2, shows intended BMEA requirements specification and their intended relationships within BMEA. These requirements are articulated and specified within the BMEA Systems Requirements Specification. The specification tree also represents the flow of requirements from the top-level mission requirements to increasingly detailed requirements for the associated intended and perspective subsystems.

The specifications developed by Team BMEA include:

The specification and sub-levels associated with the high-level requirement for ENROLLING an Image/ID.

The specification and sub-levels associated with the high-level requirement for VALIDATING an Image/ID.

Changes to these specifications require approval of BMEA stakeholder/subject matter experts

2.2.3 TECHNICAL OBJECTIVES

The technical objectives of the BMEA project are to xxxxx.

The objective of the systems engineering process is to assure that the BMEA capability meets all the requirements that flow down from the mission objectives.

2.2.4 *WORK BREAKDOWN STRUCTURE*

The work breakdown structure (WBS) is a hierarchical tree-like depiction of the system development activities as they relate to analysis and design of the BMEA system architecture. The WBS provides a coordinated and complete view of the BMEA Project and is useful for tracking technical systems engineering and non-technical program management activities. The initial WBS has already been developed for this analysis and design phase of the project. The structure of the WBS and its associated network diagram are shown in Figures X and Y. For a detailed description of the WBS elements down to the *fourth* level, see the BMEA proposal. This

WBS is maintained and updated by the Team BMEA and mentored by Dr. Thomas Speller per the syllabus for SEOR 798/690.

The WBS is used by Systems Engineering to aid in:

- Identifying products, processes, data and documents.
- Organizing risk management analysis and tracking.
- Implementing configuration management and control of subsystem interfaces.
- Organizing technical reviews and audits.

2.2.5 WORK AUTHORIZATION

The WBS defines the limits of individual responsibility for work efforts. The method for authorizing work within the BMEA Project is defined in the Project Management Plan.

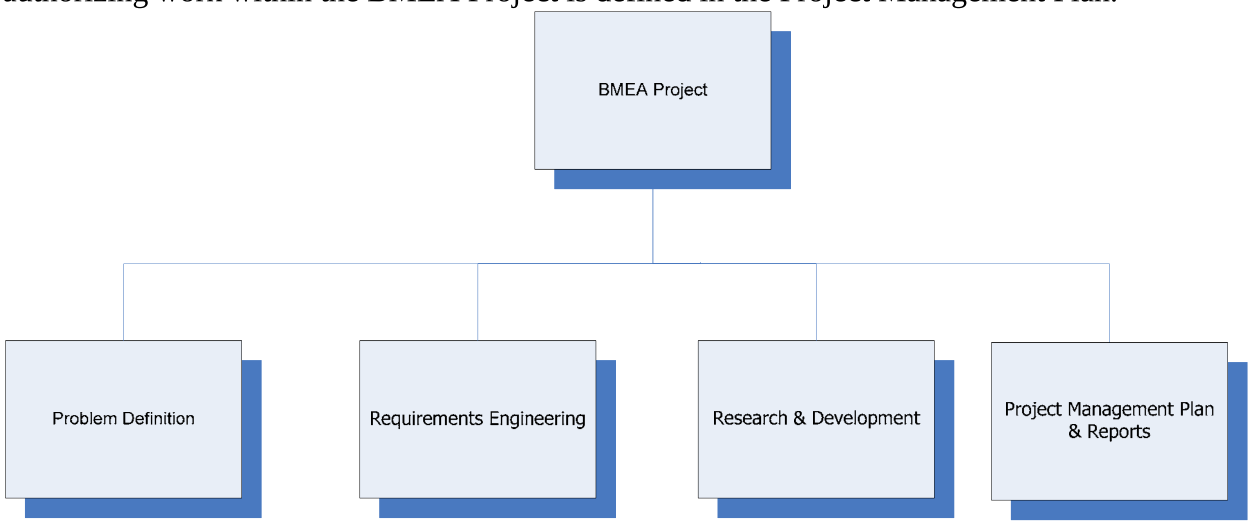

Figure 2 Breakdown Structure

2.2.6 PARTICIPANTS

The systems engineering process will involve coordinating the engineering efforts of Team BMEA as analysis and design into the resulting architecture. The engineering participants in the BMEA project are shown in Table X.

Institution	Responsibility
Team BMEA	Systems Engineering: Requirements Elicitation Requirements Refinement System Analysis System Design Project management
Stakeholder Subject Matter Experts	Requirements Articulation Requirements Validation System Assessment

Institution	Responsibility
SEOR 798/690	Project Review Project Technical Assessment Proposal Review
Dr. T. Speller	Project Mentor Systems Engineering Process Review
GMU Faculty	Solution Assessment Requirements Coverage
Noblis, Inc.	Requirements Articulation Requirements Validation System Assessment

Figure 3 Participating Institutions

2.3 Requirements Analysis

Requirements analysis is the iterative process of transforming the mission objectives into a set of requirements that define the characteristics and functions of the system and specify the environment in which it must perform. The process is iterative because as the design of the system progresses, further system analyses result in better understanding of the system and should prompt a reconsideration of the system requirements

2.3.1 *FLOWDOWN*

The requirements analysis process involves transforming the mission objectives into high level requirements and then further refining those requirements into lower-level requirements and design specifications. The BMEA system requirements flow down from the mission and objectives articulated by both the BMEA stakeholders and subject matter experts. The primary sources of BMEA requirements are:

- BMEA Requirements Document
- BMEA Derived Requirements

The high-level BMEA mission requirements are transformed into functional specifications for the BMEA capability set. These specifications are captured in the BMEA functional models, namely, the BMEA Requirements Traceability Diagram. This diagram and associated artifacts undergo extensive review by the Team BMEA and are put under configuration management early in the Formulation Phase, primarily in the Core® modeling tool and posted to the Team BMEA website.

The sub-level performance and design requirements flow down from these requirements specifications and are added to the model as needed. The flow down of requirements is documented and tracked using a requirements management software tool. The BMEA requirements database in Core® provides requirements traceability from the highest to lowest levels.

2.3.2 ENGINEERING CONSIDERATIONS

Reliability, maintainability and supportability requirements of the system as well as other human factors are considered when developing and analyzing BMEA requirements. This ensures the BMEA system will meet its requirements over its lifetime and in its operating environment and that it can be logistically supported, operated, and maintained at the intended level of skill and training.

2.3.3 ALLOCATED REQUIREMENTS

Some system capabilities such as management, and operational systems management capabilities and physical interfaces may be determined to be distributed among the system components in order to meet the overall system requirements. The allocation of these capabilities is assigned based on component distribution amongst the operating capabilities and is determined through BMEA systems and analysis and design and will be allocated to components after functions are determined. The functions, as determined from requirements, are allocated to components through transition from function analysis to component analysis based on those functions. The requirements analysis process and resulting traceability will verify that requirements are correctly allocated to the subsystems.

2.3.4 REVIEW PROCESS

All requirements documents will be subject to review by the appropriate Team BMEA members prior to initial release. The reviewers are responsible for verifying that the higher-level requirements are satisfied. The reviewers should also verify that the requirements have the following attributes:

- ***Achievable*** – the requirement must be technically achievable within the allotted schedule and budget constraints.
- ***Verifiable*** – the requirement must be expressed in a way that is verifiable by an objective test or analysis.
- ***Unambiguous*** – the requirement must have only one possible meaning.
- ***Complete*** – the set of requirements must contain all the information necessary to successfully meet the mission objectives, including mission profiles, environments (including enrollment and verification), operational and maintenance concepts and interface constraints.
- ***Consistent*** – each requirement must not conflict with another requirement.

2.4 System Analysis

System analysis is the process of evaluating the system and documenting data and decisions. System analysis activities support all steps of the systems engineering process and provide a quantitative basis for selecting performance, functional, and design requirements. All BMEA system analyses will be documented and archived.

2.4.1 *Trade Studies (Analysis of Alternatives)*

System analysis uses trade studies to support decisions about requirements selections and design alternatives. These trade studies target performance drivers and constraints from the limited resources, such as distribution of functions to components based on architecture based on physical system constraints. Certain trade studies may also address increased margins in algorithm choice and reliability as well as capability flexibility and need for higher or lower resolution image assessment capabilities.

2.4.2 *Cost Effectiveness Analyses*

Cost effectiveness analyses are used to provide economic balance to the systems engineering decision-making process. Cost effectiveness analyses weigh the total cost of design alternatives against their effectiveness in order to determine the relative value of solutions. These analyses attempt to capture all short-term and long-term costs associated with an item. The potential costs and effectiveness parameters to be considered in the analyses are listed in Table 2.

Life-Cycle Costs	System Effectiveness Parameters
Research, design, and development cost	System performance
Construction cost	Availability, reliability,supportability
Production cost	Producability
System operation cost	System quality
Maintenance and support cost	Disposability
Retirement and disposal cost	Other technical factors

Figure 4 Cost Effectiveness Parameters

2.5 System Control

System control is the collection of methods used to manage the project configuration, risk and external interfaces, as well as to track both the BMEA system performance and the progress of the system development.

2.5.1 *Risk Management*

Risk management will be included as part of the system control process to accomplish the following objectives:

- Identify the potential sources of risk and identify risk drivers.
- Quantify risks and assess their impacts on cost, schedule and performance.
- Determine the sensitivity of these risks to program, product and process assumptions, and the degree of correlation among the risks.
- Determine and evaluate alternative approaches to mitigate moderate and high risks.
- Take actions to avoid, control, assume or transfer each risk, and
- Ensure that risk is factored into decisions on selection of specification requirements and solution alternatives.

The risk management process for the BMEA project is described in detail in the BMEA Risk Management Plan.

2.5.2 *Configuration Management*

Systems engineering will exercise control of the BMEA system analysis and design through configuration management. The objective of configuration management is to ensure that:

- Baselines are defined and documented
- Documentation is identified, released and controlled
- The Configuration Manage (CM) is established and functions according to CM guidelines
- Changes to the baseline are evaluated and controlled
- Approved configuration changes are implemented and tracked
- Configuration status accounting is accomplished

Configuration management is the responsibility of the designated Team BMEA team member. From week to week the CM is dependent on the activities for that week and the primary contributor for that week. The CM is arbitrated from week-to-week. All products CM is coordinated by a particular week's primary Systems Engineer. The configuration management process is described in detail in the BMEA Configuration Management Plan.

2.5.3 *Interface Management*

The interfaces between BMEA functions and components will be defined in the BMEA set of systems models from within the Core® system analysis tool in the BMEA project model. The models in this tool impose the interface requirements of the systems functions and components. Changes to the model must be approved by the CM for that week.

The BMEA external interfaces are controlled by the stakeholders and subject matter experts and are specified and articulated in the requirements documents provided by that group. BMEA external interface requirements cannot be changed unless approval is obtained from the stakeholder and subject matter expert group.

2.5.4 *Technical Performance Metrics (TPMs)*

Team BMEA will establish a set of TPMs to track critical performance parameters throughout the analysis and design of BMEA. These TPMs are parameters that will impact the technical, schedule or cost if they exceed critical values. These parameters, which are either directly measurable or derivable from modeling of the BMEA, will be tracked as part of the systems engineering process to ensure that mission objectives are met. The technical performance metrics will be monitored and reported at project status and technical reviews. The report will include the current value and the threshold or "trigger point" for the point in time of analysis and design. The "trigger point" is the value which, if exceeded, triggers an automatic review of the entire system by the SEOR 79-/690 mentor to assess impacts and corrective actions. The system-level metrics are flowed down and budgeted to the subsystems by Team BMEA:

- Image Resolution Validation Time
- Adjudication Time

- Requestor Enrollment Time
- Subject Image Production/Initiation Time
- Image/Biographical Fusion Time
- Others (TBD)

2.5.5 *TECHNICAL REVIEWS*

The systems engineering process will utilize technical reviews to promote communication and guidance within the Team BMEA and to provide status to and obtain feedback from the SEOR 79-/690 mentor. Additional technical reviews include Team BMEA internal peer reviews. The time order of these reviews is depicted in Figure X. The suggested content of these reviews is given in Appendix X.

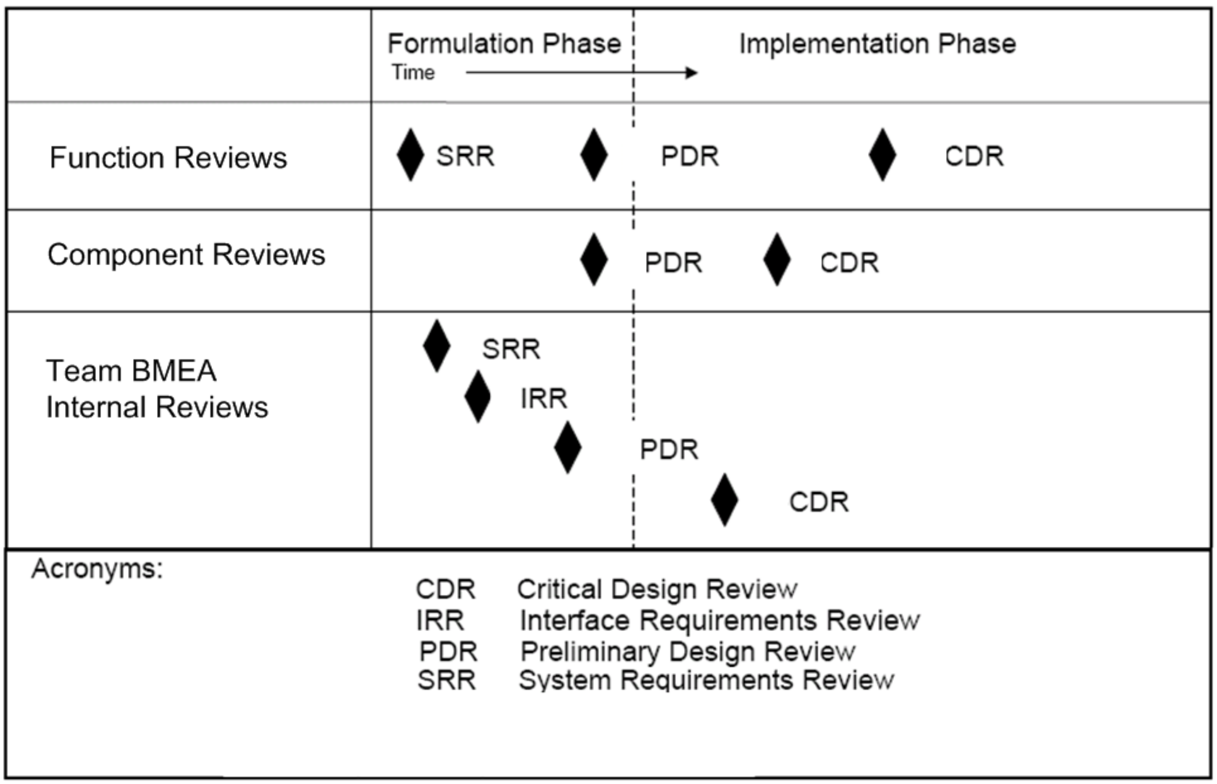

Figure 5 Technical Review Timeline

The SEOR 798/680 mentor will support the function and component reviews with status reporting on the function, component and programmatic progress. The review team will develop and present specific recommendations, actions, and concerns to concerning the Project. These actions will be tracked to resolution by Team BMEA to ensure closure, and then present resolved actions at the next review. The Team BMEA internal peer reviews will be convened and managed by Team BMEA. For these reviews, technical experts (the Team BMEA team) review plans, analysis and designs. Informal notes and action items will be taken at these peer reviews and will be documented on the Team BMEA website. These peer reviews will occur at weekly meetings and at key development stages, such as requirements analysis, preliminary design,

design analysis and design completion

2.5.6 *Requirements Traceability*

Requirements traceability is maintained in the Core® systems engineering and modeling software package and will be used to facilitate requirements traceability. This software will allow the Team BMEA to convert requirements documents into requirements databases, with each requirement receiving a unique identifier. Each requirement in the Core® database can then be assigned a link to a higher-level requirement. As lower-level requirements are developed, imported into the database, and linked to the higher-level requirements, a structure evolves which allows the flow down of requirements to be traced from the highest-level mission objectives to the lowest-level component specifications. The requirements database will include the following information about each requirement:

- Higher-level requirement satisfied
- Related documents (trade studies, system analyses, etc.)
- Requirement owner
- Requirement change history
- Verification method

2.6 Implementation

2.6.1 *Integration of Systems Engineering Effort*

Through all phases of the BMEA project, the systems engineering effort is managed by the SEOR 79-/690 mentor. The systems engineering team will consist of engineering representatives from SEOR 79-/690 class (Hall, Luckey, and Worley). When engineering support is needed the SEOR 79-/690 mentor will obtain engineering support from the SEOR 79-/690 class and from other organizations as needed. As the final phase (event) of the project, Team BMEA will present the project; a final report and presentation to faculty representatives from the SEOR Department within the Volgenau School of Information Technology, George Mason University.

2.6.2 *Problem Resolution*

Problems or failures occurring during model execution or simulation will be identified, documented, assessed, tracked and corrected according to the local procedures developed by Team BMEA The process to assure closure of all such incidents is the

Problem/Issue tracking established and documented on the Team BMEA website. Systems Engineering is generally responsible for identifying the troubleshooting steps and other analyses required to assess the problem and to determine the resolution and corrective action. Team BMEA established final corrective actions and are open and closed by the team.

2.6.3 *Systems Engineering Plans and Specifications*

The systems engineering processes will be implemented upon release of the defining documents. The planned release of systems engineering documents is shown in Figure X.

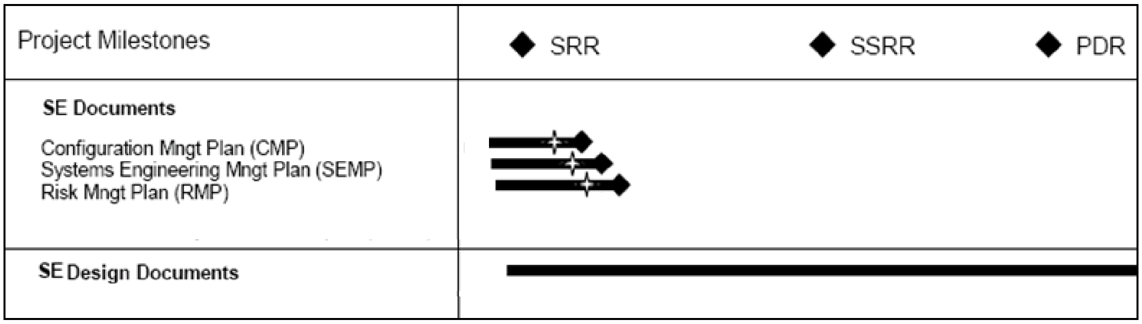

Figure 6 Systems Engineering Documentation Plan

2.7 Other Systems Engineering Activities

2.7.1 *REQUIREMENTS MANAGEMENT SOFTWARE*

In order to facilitate requirements tracking, a requirements software tool encapsulated within the Core Systems and Software Modeling Tool is implemented to maintain BMEA's requirements.

2.7.2 *DATABASE SOFTWARE*

Databases may be implemented and used to maintain various systems engineering artifacts including an action item database and configuration management and risk management databases. If needed, these databases will be implemented using simple database software, such as Microsoft Access otherwise, issues, configuration management and risk management items will be logged, resolved and tracked using the Team BMEA website.

APPENDIX A

Technical Review Definitions and Checklists

System Requirements Review (SRR)

The SRR occurs early in the Formulation Phase and is used to reach mutual agreement between all parties to the development of system requirements. In this review, the draft system requirements should be reviewed for completeness and necessity. The draft system specification should be complete with all TBR items clearly identified with planned closure responsibility and dates. The draft system architecture and external interfaces should also be reviewed.

Preliminary Design Review (PDR)

The Preliminary Design Review occurs at the end of the Formulation Phase and is used to determine if the project is ready to authorize the detailed design work involving a considerable increase in manpower and cost. All system and subsystem requirements must be complete as well as credible design concepts that are responsive to those requirements. The PDR should address the following items:

- Subsystem block and functional diagrams
- Equipment layouts and preliminary drawings
- Environmental controls
- Support system requirements and design approach
- Preliminary Development Specifications
- Physics parameter modeling, test, and simulation data
- Software Development Plan
- Software requirements specifications (Preliminary Design)
- Interface control documents
- Design standardization and logistic considerations
- Trade and design studies
- Preliminary reliability, maintainability, and availability studies
- Transportation, packaging, and handling considerations
- Environmental, Health, and Safety analyses
- Quality Control Planning
- Test methodology
- Schedules
- Problems and Concerns

Critical Design Review (CDR)

The CDR occurs after the design is approximately 90% completed and is used to determine if the project is ready to proceed to implementation including hardware and software acquisition. The following items should be addressed to the extent possible:

- Subsystem block and functional diagrams
- Final Development Specifications

- Design analysis and engineering test data
- Detailed software design, database design, interface design, firmware support, and computer resources integrated support documents
- Logistic support considerations:
- Transportation, packaging, and handling
- Standardization
- Support equipment requirements
- Spares requirements
- Calibration requirements
- Risk: cost, schedule, and technical
- Integration and Test Plans
- Software Test Plans
- Design reliability and maintainability
- System safety
- Quality control plans
- Schedules
- Problems and concerns