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Revised and Augmented SDCE Model

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Prepared by

R. HADDAD
Computer Science and Technology Subdivision
Computer Systems Division

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SPACE AND MISSILE SYSTEMS CENTER
AIR FORCE MATERIEL COMMAND
2430 E. El Segundo Boulevard
Los Angeles Air Force Base, CA 90245

Engineering and Technology Group

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THE AEROSPACE CORPORATION
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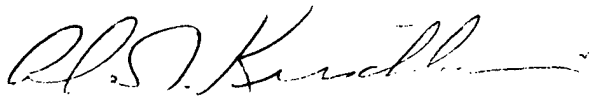

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13. ABSTRACT (*Maximum 200 words*)

This report documents the updated Software Development Capability Evaluation (SDCE) model. SDCE model updates reflect software lessons learned between the last publication of SDCE in 1993, and the present date (1998). The updates include three new Critical Capability Areas (CCA), namely Trusted Systems, Distributed Network Systems, and Object Oriented Developments, and updates to several existing CCAs, such as Reuse, Software Development Planning, and Software Configuration Management. Traceability to the 1993 version of the SDCE model is included int he report.

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Introduction

This document contains an updated version of the Software Development Capability Evaluation (SDCE) model. The updates incorporate feedback and lessons learned from numerous SDCE applications that Aerospace personnel were involved in. This document supplements the Air Force Materiel Command's (AFMC's) SDCE pamphlet [ref 1].

SDCE Background

The SDCE is a methodology for assessing a contractor's capabilities in software and software-related systems engineering disciplines. SDCE is based on the premise that if contractors have defined their software development plans and identifed the software engineering processes, tools, and technologies they will use on a given program and if furthermore they have past experience in the use of the identified processes, tools, and technologies, they present a lower risk to the program than contractors who have not. The methodology was developed for the acquisition of software-intensive systems at AFMC [ref 1].

The SDCE assessment is based on a process whereby the contractors under evaluation provide information about their capabilities in the form of responses to SDCE questions. The responses are then evaluated using predefined evaluation criteria, and validated during a site visit. The SDCE questions and associated criteria are organized into a structure that is referred to as the SDCE model. Thus, SDCE can be thought of as having two components: the process component, which embodies the SDCE methodology, and the model component, which embodies the SDCE scope. This document focuses on the model component of SDCE.

Although SDCE was developed using two predecessor methods as inputs, namely Aeronautical Systems Center's (ASC's) Software Development Capability/Capacity Review (SDCCR) [ref 2] and the Software Engineering Institute's (SEI's) Capability Maturity Model (CMM) [ref 3], it differs from most other software evaluation methods in the following three ways. The first difference is that SDCE looks not only at software processes but also at software tools and technologies, primarily in the System/Software Engineering Environment and the Program Specific Technologies sections, respectively. The second difference is that when SDCE evaluates the contractor's ability to define software engineering processes, it goes beyond the existence of the processes and attempts to evaluate their adequacy with respect to the program at hand. For example, the responses to the SDCE questions that deal with planning are compared to related portions in the management section of the proposal; responses to the SDCE questions that deal with the choice of methodologies and tools are compared to the technical section of the proposal that describes the portion of the system where these methodologies and tools will be used. The third distinguishing feature of SDCE is the tight coupling of the SDCE process to the source selection rules as defined in the Federal Acquisition Regulation (FAR). The SDCE model differs from models associated with other evaluation methodologies in that its scope is broader (it includes tools and technologies), and its questions are more detailed.

When SDCE is applied on a given program, the model is tailored for that program. Tailoring of the SDCE model consists of selecting a subset of the model that corresponds to the risk profile of the program, while keeping the size of the tailored model consistent with the resources available to perform the evaluation.

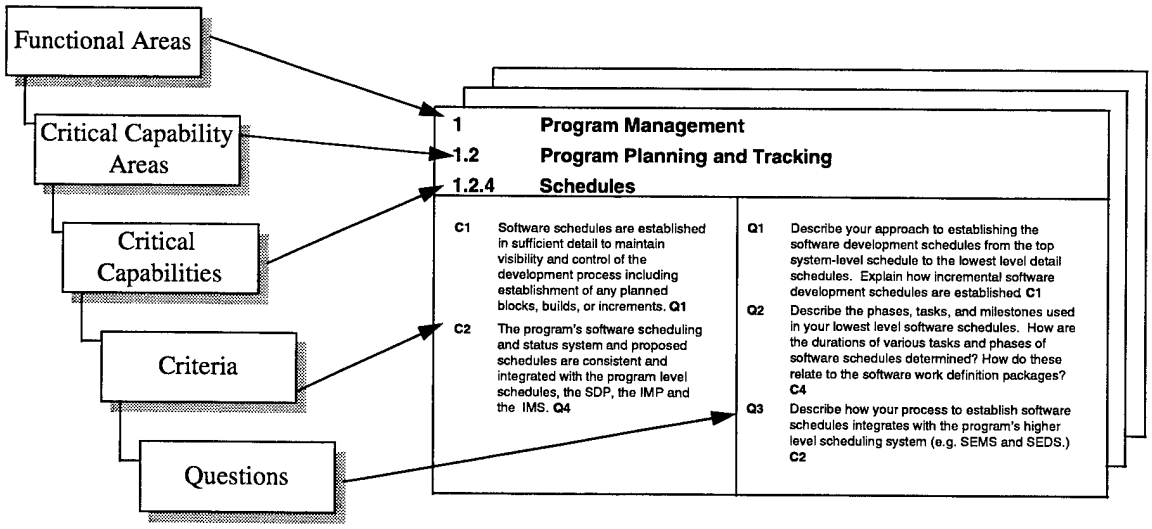

Figure 1. SDCE Model Structure

The SDCE model is structured into five layers. The layering helps the reader navigate through the hundreds of questions included in the SDCE model, and facilitates the tailoring of SDCE to each program. The top layer consists of Functional Areas (FAs). The FAs are further organized into Critical Capability Areas (CCAs) which are groupings of Critical Capabilities (CCs). The two layers below the CCs correspond to the SDCE questions and the associated evaluation criteria (Figure 1).

The SDCE model covers those software and software-related systems engineering disciplines that present high risk for the success of a program, if the performing contractor has inadequate capability in those areas. FA1, Program Management, evaluates the integration of software management with the overall management of the program. FA2, Systems Engineering, evaluates the contrators' software-related system engineering activities. FA3, Software Engineering, focuses on software engineering planning, tracking, and the life cycle functions. FA4, Quality Management and Product Control, evaluates software quality, metrics, configuration management, and documentation. FA5, Organizational Resources and Program Support, evaluates those capabilities that tend to be funded at the corporate level but are a resource to the program, such as training, facilities, Software Engineering Environment, etc. The purpose of FA6, Program Specific Technologies, is to assess the bidder's ability to use technologies that are important to a given program.

Our experience with the large, unprecedented systems that constitute most of the acquisitions for which SDCE has been used is that the use of new technologies often presents high risk for these programs. Therefore, assessing the bidder's capability in applicable technologies is an important element of the risk assessment exercise that SDCE implements. A critical factor in successful use of the SDCE model in general, and of FA6 in particular, is to select evaluators who are knowledgeable and experienced in the selected components of the SDCE model. This recommendation is made in the SDCE pamphlet regarding all areas of the SDCE evaluation; it is particularly applicable to FA6, Program Specific Technologies. Additional information on SDCE experiences and lessons learned can be found in [ref 4].

Rationale for Updates to the SDCE Model

There are three drivers to the model updates included in this document:

- Population of FA6

- Acquisition reform
- Feedback from Space and Missile Systems Center (SMC) programs on which SDCE was used

The SDCE methodology was defined by the SDCE Process Action Team (PAT) sponsored by AFMC. The SDCE PAT completed the definition of SDCE on a tight schedule. The PAT identified the need for FA6 but did not have time to define it. FA6 was defined subsequently through two separate efforts. The first effort was undertaken by ASC, and consisted of incorporating the technology portions of the SDCCR, namely the Safety Critical Systems and the Complex Hardware Development CCAs. The second effort was undertaken by the Aerospace Corporation (Aerospace), and consisted of identifying new technology areas (Artificial Intelligence, Database Management Systems, Trusted Systems, Distributed Systems, and Object Oriented Developments) and defining criteria and questions for them. The SDCE pamphlet was published before the Aerospace effort was completed. As a result, only a subset of FA6 was included in the published pamphlet (the Artificial Intelligence CCA and the Database Management Systems CCA).

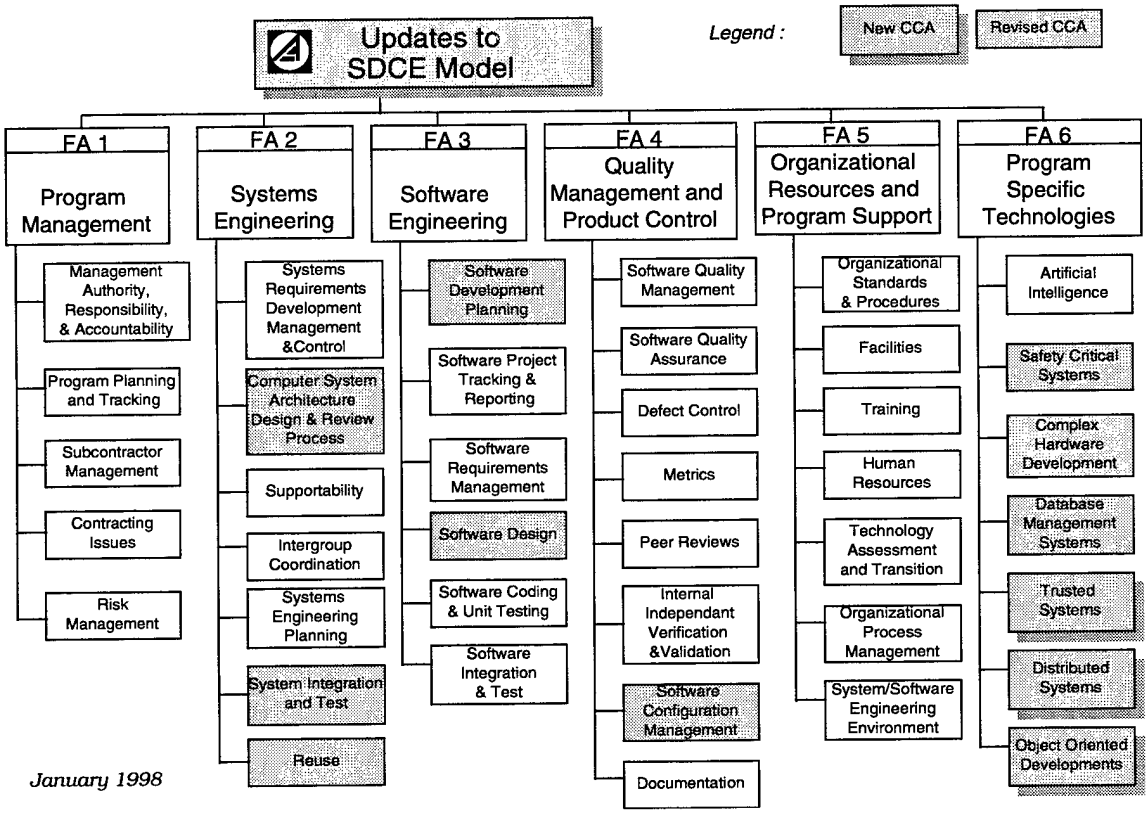

Figure 2. Updates to the June 1994 version of the SDCE Model

Acquisition reform, which began shortly after the SDCE pamphlet was published, brought with it an emphasis on reuse, the use of open system architectures, and a departure from Government-mandated process standards. Questions were added to help evaluate the contractors' capabilities in software reuse, commercial off-the-shelf (COTS) integration, open architectures, etc. The Perry initiative, which came along with acquisition reform, strongly discouraged acquisition agencies from mandating DOD-defined process standards. Instead of the Government defining the process that contractors must follow in developing software, and putting that process on contract, contractors are now free to select or define a software development process of their

choice. As a result, several program offices requested SDCE questions that can help them evaluate the contractor's ability to define their own software development processes, which is why the Software Development Planning CCA was rewritten.

Other criteria and questions were added or modified based on feedback from applications of SDCE to date. In particular, questions were added regarding the contractor's ability to correct the Year 2000 problem, and the whole section on Configuration Management (CCA 4.7) was rewritten to facilitate tailoring. The differences between the SDCE model provided in this document and the SDCE model published in the AFMC pamphlet are illustrated in Figure 2, and summarized in Table 1.

Aerospace's Contributions

Aerospace has been involved with SDCE since its inception. When the AFMC PAT was formed, it was partly in response to a request from the Commander, SMC for AFMC to identify a software evaluation method suitable for SMC. The SMC commander's request was preceded by an Aerospace report that analyzed the existing contractor evaluation methodologies, and recommended development of a new method that should take the best from SEI's CMM and ASC's SDCCR [ref 5]. As a result, Aerospace was invited to participate in the SDCE PAT, and made significant contributions to the initial version of the SDCE model. Subsequently, Aerospace supported all SMC acquisitions that used SDCE, and provided the majority of the evaluators for these SDCEs.

In addition to the SDCE activities funded directly by programs, Aerospace undertook two internally funded efforts aimed at providing cross-program SDCE support and enhancing the method. The first of these efforts, the SDCE Applications Engineering Method (SDCE Applications EM), aimed at promoting the use of SDCE and developing support material for applying it. Much of FA6 [ref 6] was developed under this effort. The second effort, the SDCE Metrics Mission Oriented Investigation and Experimentation (SDCE Metrics MOIE), aimed at collecting and analyzing data from SDCE applications at SMC, and using results of the analysis to develop improvements to the method and guidelines for its use [ref 7]. The Object Oriented Development portion of FA6, along with the updates to FA1 through FA5 were outputs from the SDCE Metrics MOIE.

This document is intended for use in conjunction with the AFMC pamphlet, as a replacement to the SDCE model charts in Chapter 3 "Description of the SDCE Model" and an update to Chapter 5 "Model Criteria and Questions."

Table 1. Traceability Between 1994 and 1998 SDCE Models

CC	Criteria/ Questions	Change Description
2.2.1	C5, Q5	Addition (Architecture)
2.6.1	C5, Q5	Addition (Year 2000)
2.7.2	C3–5, Q4–6	Addition (Reuse)
3.1.3	Section title C1–2, Q1–2 C3, Q3	Modification (rewrite of Software Development Planning CCA) Modification (rewrite of Software Development Planning CCA) Deletion (rewrite of Software Development Planning CCA)
3.1.4	C1–2, Q1–3 C3–8, Q4–8	Modification (rewrite of Software Development Planning CCA) Deletion (rewrite of Software Development Planning CCA)
3.4.1	C8, Q11	Addition (Architecture)
4.7.1	C1–2, Q1–2 C3–4, Q3–6	Modification (rewrite of Software Configuration Management CC) Deletion (rewrite of Software Configuration Management CC)

Table 1. Traceability Between 1994 and 1998 SDCE Models (Cont'd)

CC	Criteria/ Questions	Change Description
4.7.2	C1–3, Q1–3 C4–8, Q4–9	Modification (rewrite of Software Configuration Management CC) Deletion (rewrite of Software Configuration Management CC)
4.7.3	C1, Q1 C2, Q2–3	Modification (rewrite of Software Configuration Management CC) Deletion (rewrite of Software Configuration Management CC)
4.7.4	C1–3, Q1–3 C4–6, Q4–6	Modification (rewrite of Software Configuration Management CC) Deletion (rewrite of Software Configuration Management CC)
4.7.5	C1–2, Q1–2 C3–4, Q3–4	Modification (rewrite of Software Configuration Management CC) Deletion (rewrite of Software Configuration Management CC)
5.7.2	C2, Q4	Modification of software tools question (clarification)
6.2.2 Safety	Q8	The text of this question in the Safety Critical Systems CCA had been inadvertently left out of the AFMC pamphlet
6.3.4 Complex Hardware	All	Additions of VHDL CC
6.4.2 DBMS	All Q6 Q7	The old CC 6.4.2 (Database Tools) was separated into two CCs: 6.4.2 (Database Design) and 6.4.3 (Database Tools), and both were expanded Modification (clarification) Deletion (subsumed by Q6)
6.4.3 DBMS	All C1	The old CC 6.4.2 (Database Tools) was separated into two CCs: 6.4.2 (Database Design) and 6.4.3 (Database Tools), and both were expanded Modification (references to Q6–11 added)
6.4.4 DBMS	Q3–4 Q5 Q6	Modification (CC rewrite) Deletion Modification (becomes Q5)
6.4.5 DBMS	Q6–7	Additional questions for the Database Quality Assurance CC
6.4.6 DBMS	C1 Q5, Q9	Modification (references to Q6–7 added) Modification (CC rewrite)
6.5.1–6.5.3 Trusted Systems	All	New CCA
6.6.1–6.6.4 Distributed Network Systems	All	New CCA
6.7.1–6.7.5 OO Devel.	All	New CCA

Revised SDCE Model

Functional Area 1: Program Management

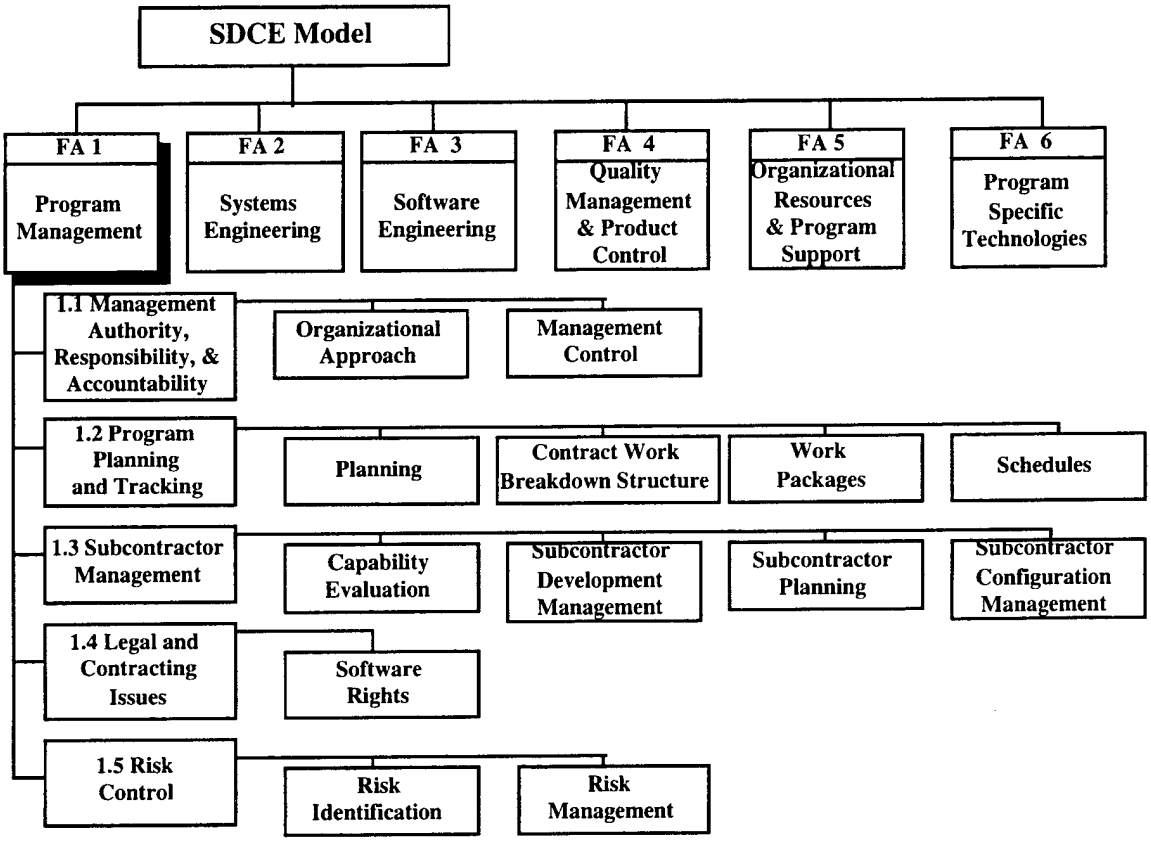

Figure 3. Program Management

1	Program Management
1.1	Management Authority, Responsibility, and Accountability
1.1.1	Organizational Approach

C1	The software development and management functions are organized consistent with the proposed overall system development organizational structure (e.g., straight functional, Integrated Product Teams (IPTs)) and include identified support functions to the system engineering, subcontractor development and other functional development support activities as needed. **Q1 Q3**	**Q1**	Describe the total software development organization, top to bottom, including intermediate organizational supervisory levels. How is this software development function organizationally integrated and consistent with the program's overall system development organizational structure (e.g., straight functional, IPTs, etc.)? Describe the major software subcontractors' organizations to develop software. Describe any formal agreements between team members that define specific responsibilities for development. **C1**
C2	The program organization includes specific elements composed of systems, software and hardware engineering that are responsible for the allocation of requirements and derivation of design from the System Specification to the Software and Hardware Configuration Item (HWCI) specifications. **Q2**	**Q2**	Describe the organizational elements responsible for the allocation of requirements and derivation of design from the System Specification through the various levels of design and requirements to the Software Requirements Specifications, HWCI specifications, Interface Requirements Specification, and top-level design. Include teaming and/or subcontracting elements. **C2**
C3	The software engineering organization is structured such that all program software (including support software) development is assigned to specific organizational elements. **Q4**	**Q3**	How does this structure provide the necessary support functions to related development functions such as systems engineering, subcontractor development management, vendor management and other functional development support activities? **C1 C4**
C4	The total software development organization is defined and responsibilities assigned, including identified elements responsible for the management and control of subcontractor-developed and vendor-delivered software. **Q3**	**Q4**	Describe, within the identified software development organization and structure, the responsibility assignments for all program software including support, integration, and test software. **C3**
C5	The organizational structure integrates special technology-driven resource requirements (e.g., specialists in languages, architectures, methods, tools not assigned full time to the program) into the program organizational working structure. **Q5**	**Q5**	How is the organization structured to meet the program needs for specialized technology skills that are driven by program requirements such as language and architecture specialists who may not be required full time on the program? **C5**

1	**Program Management**
1.1	**Management Authority, Responsibility, and Accountability**
1.1.2	**Management Control**

C1	The chief engineer/system engineer, or equivalent, is organizationally responsible for all technical activities on the program. **Q1 Q2**	**Q1**	Where does the overall technical responsibility for the program development reside? Identify program technical activities that do not report through the lead technical manager. To whom does the lead technical manager (Chief Engineer) report? **C1**
C2	Responsibility for control of all software development resides within the program organization, including subcontracted, simulation, integration, and test software. **Q3 Q4 Q5 Q6**	**Q2**	Where does the program management responsibility reside? Identify any development activity outside the control of the program manager, upon which the program is dependent; e.g., reusable software, tools to be acquired, components being developed by another organization, etc. How does the program manager influence and status these components? **C1**
		Q3	Where does the overall software responsibility reside? Does all software development report through a single software manager? Is all software, including that developed by teaming associates and subcontractors, support, simulation, integration and test software, included in the overall software management responsibility? If not, how is this other software managed, interfaced and integrated with the central software effort? **C2**
		Q4	How is software managed within the Integrated Product Development Team approach to the system development? How is software managed/developed within subsystems and across interrelated subsystems? **C2**
		Q5	Who is responsible to see that the Software Development Plans and Software Development Standards are followed? **C2**
		Q6	Describe the specific management functions applied to control software development. **C2**

1	Program Management
1.2	Program Planning and Tracking
1.2.1	Planning

C1	The program planning accounts for the integration of software development and management with system and hardware management. **Q1**	**Q1**	How is your software development planning integrated with systems management and hardware management? **C1**
C2	The proposed program planning approach includes planning for personnel qualifications, quantities, skill types, need dates, and required training. **Q7**	**Q2**	Describe your planning process used to establish the front-end software related system development activities. Describe your process to status and report these activities including specific criteria and control measures. Who is responsible to perform these front-end management activities? **C3**
C3	The program planning includes the necessary reviews, accountability, status assessment, schedule control and reporting to manage the software related system development activities leading to the definition of the software requirements baseline. **Q2 Q3**	**Q3**	Describe your technical and management reviews used to control the development progress throughout the entire development period. Define these events and corresponding criteria. How are these events incorporated into the Systems Engineering Master Plan, Systems Engineering Master Schedule, Systems Engineering Detailed Schedule, and the Software Development Plan? **C3 C4**
C4	The program planning includes a series of technical and management reviews with associated completion criteria that is used to control the development progress. **Q3**	**Q4**	Describe any special management planning processes used as a result of the selected software development methodologies and programming languages. How do these processes vary from your standard software development management activities? **C5**
C5	Specific management planning processes are defined to account for the proposed software development methodologies and implementation language selected. **Q4**	**Q5**	Identify the software tracking metrics to be used on this program. Describe your process for monitoring critical status metrics or indicators. How do you determine when management action is required? Describe the conditions that would result in management action for each established metric or indicator. **C6**
C6	Variance thresholds are established for critical status metrics (e.g., size, cost effort, progress, and schedule). **Q5 Q6**	**Q6**	Where is this metrics monitoring process documented? **C6**
		Q7	Describe how your program planning includes provisions for personnel qualifications, quantities, skill types, need dates, and required training. **C2**

1	Program Management
1.2	Program Planning and Tracking
1.2.2	Contract Work Breakdown Structure (CWBS)

C1 The proposed CWBS and internal CWBS generation procedures identify software elements to levels that support software management visibility and are compatible with cost reporting and program RFP requirements. **Q1 Q2 Q3 Q4**	**Q1** How and at what level is software structured in the CWBS? Provide examples of your recent CWBSs that include major software development. **C1**
C2 The proposed CWBS and internal CWBS generation procedures identify how the CWBS links with and traces to the work definition system down to and including the software work packages. **Q5**	**Q2** What are the factors and criteria for determining software level within the CWBS? **C1**
C3 The program has a mutually consistent and integrated CWBS, work definition, scheduling, and cost tracking system and is used as the basis for program status and control. **Q6**	**Q3** Identify your internal standards (criteria) for identifying software work within the CWBS. **C1**
	Q4 At what level (of CWBS) is software reported in the cost performance report? **C1**
	Q5 Describe the overall flow of work definition from the CWBS down through detailed work definition including cost accounts and work packages. Explain (illustrate) how the software work package interfaces with and is traceable to the software elements of the CWBS. **C2**
	Q6 Describe how your CWBS procedures integrate with your work definition process, scheduling process, and cost tracking system. Describe how the CWBS is used to support program status and control. **C3**

1	**Program Management**		
1.2	**Program Planning and Tracking**		
1.2.3	**Work Packages**		
C1	A documented process exists for defining software development work packages, including schedules and manpower allocations. This process includes rules and criteria for formulating software work packages. **Q1 Q2 Q3**	**Q1**	Explain your method for defining software work package including schedules and manpower allocations. Identify rules, essential elements and criteria for an acceptable software work package within your system. **C1 C3 C4**
C2	The software work package is used to manage the work and is used as the basis for cost performance reporting. The cost performance reporting system includes all of the software development tasks and activities. **Q4**	**Q2**	Identify the document that fully describes the software work package method. **C1**
C3	The software work packages include planned and actual effort expenditures. **Q1**	**Q3**	Describe how your cost account and work package definition process is integrated with the system and software scheduling system. Explain how the software work package is used to plan the work, i.e., plan, define and assign resources (manpower loading) and responsibility. How are the Contract Work Breakdown Structure (CWBS), cost accounts and work packages used to status and report progress of the program in terms of effort (cost) and schedule? **C1 C5**
C4	The software work packages have completion milestones, with associated criteria scheduled consistent with the program requirements (e.g., cost performance reporting (CPR) and Cost/Schedule Control System Criteria (CSCSC)). **Q1 Q5**	**Q4**	Explain how the software work package is used in CPR. Explain how Earned Value data from software development activities is included in the CPR. How do these differ for varying elements of the CWBS? How is the CPR used to establish a true indication of software cost considering the effects of general or overhead functions such as software management, configuration management, software quality assurance, internal independent verification and validation, etc.? **C2**
C5	The scheduling information contained in the software work packages is consistent with the program scheduling system. **Q3 Q5**	**Q5**	How do the Work Package milestones and completion criteria correlate with Systems Engineering Master Plan/Systems Engineering Master Schedule (SEMP/SEMS) milestones? Is the completion criteria and earned value within the CPR or CSCSC system related to the SEMP/SEMS completion criteria? **C4 C5**
C6	The CWBS and Work Package Definition System provides a correlation to the software structure. **Q6**	**Q6**	Explain how the CWBS, cost accounts and work packages correlate with the software structure. **C6**

1	Program Management
1.2	Program Planning and Tracking
1.2.4	Schedules

C1	Software schedules are established in sufficient detail to maintain visibility and control of the development process including establishment of any planned blocks builds or increments. **Q1 Q5**	**Q1**	Describe your approach to establishing the software development schedules from the top system level schedule to the lowest level detail schedules. Explain how incremental (block, build) software development schedules are established. **C1**
C2	The program's software scheduling and status system and proposed schedules are consistent and integrated with the Software Development Plan (SDP) and the program system level schedules, including the Systems Engineering Master Plan, Systems Engineering Master Schedule, and Systems Engineering Detailed Schedule (SEMP/SEMS/SEDS) as appropriate. **Q3 Q4 Q6**	**Q2**	Define the phases, tasks, and milestones used in your most detailed (lowest level) software schedules. How are the duration of various tasks and phases of software schedules determined? How do these relate to the software work definition packages? **C4**
C3	The proposed schedule duration for software development, software integration, and software/hardware integration is consistent with the effort to be accomplished as estimated with established estimating models and the offeror's historical data. **Q8**	**Q3**	Describe how your process to establish software schedules integrates with the program's higher level scheduling system (e.g., SEMS and SEDS). **C2**
C4	The lowest level software schedules include task, phase, and milestone definitions that are consistent with the software work definition packages. **Q2**	**Q4**	Describe your approach to defining milestones with completion criteria in the SEMS and SEMP. How is this approach correlated with the software scheduling system including use of software milestones and criteria? **C2**
C5	A process is defined to maintain consistent software schedule information across various disciplines including engineering, management, and the Cost Performance Reporting System. **Q7**	**Q5**	Describe your method for monitoring and statusing software development schedules. Who is responsible for this function? How is each level of schedule addressing software used in the management process? Which level is used as the baseline to track and report status? **C1**
		Q6	Describe how software schedules are defined, referenced, used, and updated in the SDP. **C2**
		Q7	Describe your approach to maintaining consistent software schedule information across various disciplines (e.g., management, engineering, and program control (Cost Performance Reporting and Cost/Schedule Control System Criteria)). **C5**

1 Program Management 1.2 Program Planning and Tracking 1.2.4 Schedules (Cont'd)	
	Q8 Describe this program's software development, software integration, and software/hardware integration schedules including time phasing and duration. Also describe scheduling of any planned increments or blocks. How were these schedules derived? Relate proposed schedules to the effort to be accomplished (man months), available personnel resources and your past schedule accomplishments on similar programs. **C3**

1 Program Management 1.3 Subcontractor Management 1.3.1 Capability Evaluation	
C1 As part of the subcontractor selection process, documented procedures exist to evaluate subcontractors' capability and capacity to develop software. **Q1 Q2**	**Q1** How are potential subcontractors' software development capabilities and capacities evaluated prior to selecting a specific subcontractor? **C1** **Q2** Where is this procedure for evaluating subcontractors' software capabilities and capacities documented? **C1**

1	Program Management
1.3	Subcontractor Management
1.3.2	Subcontractor Development Management

C1	The proposed subcontractor management process is integral to the system program management process and provides integrated reporting and control of the subcontractor software development activities consistent with the program's management control system. **Q1**	**Q1**	Fully describe your process for subcontractor management including reporting and control of the subcontractor software development activities. How does this process relate to and integrate with your overall system program management approach? Describe how the subcontractor management and review activities are reflected in the program level Systems Engineering Master Plan, Systems Engineering Master Schedule, and Systems Engineering Detailed Schedule (SEMP/SEMS/SEDS). **C1 C3**
C2	The system-level engineering management controls including SEMP/SEMS/SEDS are levied on subcontractors. **Q2**	**Q2**	Using this approach, how are the SEMP, SEDS, SEMS, and the Software Development Plan (SDP) flowed down to the subcontractors? **C2**
C3	Periodic management and technical reviews to address subcontractor development progress are conducted and are reflected in the program's SDP/SEMP/SEMS/SEDS. **Q1**	**Q3**	How do you specify and control the subcontracted software technical/performance requirements, interfaces, deliverables, and product testing (test requirements and criteria)? **C4**
C4	A process is defined to specify and control the subcontractor's performance requirements, interfaces, deliverables and product testing. **Q3**	**Q4**	Describe your process for establishing and conducting periodic management and technical reviews and interchanges with your subcontractors. **C5**
C5	A documented process exists which requires reviewing and assessing the technical content of subcontractor generated design information and documentation. **Q4 Q5 Q6 Q7 Q8**	**Q5**	Describe your process to integrate subcontractor design information and documentation into the system documentation. Identify the technical products and the set of software documentation you require as deliverables from your subcontractors. **C5**
C6	The software test and verification process includes subcontractor developed software and incorporates the subcontractor software test and verification management and results into the overall hierarchical test process. **Q9**	**Q6**	What role does software documentation play in statusing the subcontractor's development activities? Describe how documentation is reflected in the SEMP/SEMS events and criteria. **C5**
C7	The subcontractor's defined software cost status and reporting system is compatible with the program cost status and reporting requirements. **Q10 Q11**	**Q7**	How is this information reviewed and evaluated for adequacy? What are the criteria for complete documentation regarding both individual documents and the set as a whole? **C5**

1 Program Management 1.3 Subcontractor Management 1.3.2 Subcontractor Development Management (Cont'd)	
C8 The software size control program established for the program is applied to the subcontractor effort and monitored throughout the development. **Q12**	**Q8** Who within your organization is responsible to review and approve subcontractor software documentation? **C5** **Q9** What technical completion criteria for software are identified in the subcontract? Describe your test criteria and procedures for accepting subcontracted software. How is subcontracted software incorporated into your software integration and test process? **C6** **Q10** How is management visibility into the subcontracted development efforts established and maintained? Specifically, how do you assess a subcontractor's software development status? What is the basis for this assessment? How are Work Packages used in this assessment? What metrics/indicators are required from the subcontractor? How often is this information submitted and in what format? **C7** **Q11** What formal reporting do you require of your subcontractor relative to software? How is this reporting tied to the subcontractor's Contract Work Breakdown Structure (CWBS) and in turn to your CWBS? To what level do you require the subcontractor's software to be identified and reported in his cost performance report? **C7** **Q12** How is software size control established and applied to subcontracted software development? **C8**

1	**Program Management**
1.3	**Subcontractor Management**
1.3.3	**Subcontractor Planning**

C1	The software development planning process includes subcontracted software development. **Q1**	**Q1**	How does your Software Development Plan (SDP) incorporate the planning for subcontracted software development? Describe specific planning coverage areas required to manage subcontracted software development. Is this planning based on a written organizational policy for managing software subcontractors? **C1**
C2	Program-level SDP requirements and process requirements are levied on subcontractors. Subcontractor SDPs are consistent with the prime contractor's software development planning. **Q2**	**Q2**	Describe how the program's SDP and process requirements including documentation requirements are flowed down to subcontractors developing software. How do you ensure that subcontractor SDPs are consistent with your software development planning? **C2 C5**
C3	Subcontractor SDPs are reviewed and approved by the prime contractor. **Q3**	**Q3**	Are subcontractor SDPs reviewed and approved? How are these plans incorporated into your subcontractor development monitoring and tracking activity? **C3 C4**
C4	Procedures ensure that the program's development standards and procedures are applied to subcontractor development efforts or a process is in place to ensure that subcontractor standards and procedures are used which are compatible with the program's development processes. **Q3 Q4**	**Q4**	Do you apply your software standards to your subcontractor(s)? If not, what standards are required? How do you ensure that standards are followed and are compatible with the program's development processes? **C4**
C5	The program's software documentation requirements and documentation approach are levied on subcontractors developing software. **Q2**	**Q5**	Describe your approach to establishing award fees and incentives for subcontractor-developed software. Are predefined criteria established? Describe the nature of these criteria. Do you plan to use award fees or incentives on this contract? **C6**
C6	If award fees or incentives are established for subcontractor-developed software, measurable award fee or incentive criteria are established. **Q5**		

1 Program Management 1.3 Subcontractor Management 1.3.4 Subcontractor Configuration Management	
C1 The subcontractors' software configuration management system is documented and is compatible and consistent with and supports the overall program software configuration management needs. **Q1**	**Q1** Describe how your subcontractor software configuration management system integrates with the overall program software configuration management system. Describe how they are mutually compatible and consistent. **C1**
C2 The subcontractors' software configuration management system is reviewed and verified by the prime contractor to be totally compliant with program requirements and needs early in the development phase (i.e., prior to Preliminary Design Review). **Q2**	**Q2** How do you review your subcontractors' internal software configuration management system compliance to the program-level configuration management requirements? How early in the development is this compliance verified? **C2**

1	Program Management
1.4	Legal and Contracting Issues
1.4.1	Software Rights

C1	The software rights required for follow-on support and system maintenance including development System/Software Engineering Environments (S/SEEs) and tools are identified, including subcontracted and vendor software. **Q1 Q2**	**Q1**	Identify any proprietary or restricted rights software including reused software intended to be incorporated into the delivered system or in tools to be used to develop or support the delivered system. Provide in tabular form, the software identification, developer or vendor, and description of the associated restrictions. **C1 C2 C4**
C2	The identified restrictions on the use of the delivered software are compatible with the intended system operation and support concept. **Q1 Q2**	**Q2**	Identify any restricted rights that would impact the ability to organically support the system and software or to competitively procure system and software support over the life cycle. Describe how your software development process accommodates these restrictions. **C1 C2 C3**
C3	The software development process is compatible with the limitations imposed by restricted rights and licensing restrictions for software. **Q2**	**Q3**	What contractual provisions have you instituted with your subcontractors to obtain rights sufficient for program life cycle support and maintenance? Describe how these contractual provisions meet your contractual obligations with the acquisition organization. **C5**
C4	The identified rights to reused software, either previously developed or concurrently developed across development teams, including subcontracted and vendor software on this program, are consistent with the program's life cycle support and maintenance needs. **Q1**	**Q4**	Where licensing agreements are required (e.g., on software tools), are they being negotiated for the total system program life cycle? **C5**
C5	The contractual terms proposed for use in acquiring subcontracted and vendor software includes provisions for the necessary rights to software and are compatible with the prime contractor's contractual obligations to the acquisition organization. **Q3 Q4**	**Q5**	Provide for each proprietary or restricted rights software component a complete justification as to why this software is proprietary or restricted. **C6**
C6	All delivered subcontracted and vendor software that is proposed as proprietary or restricted is fully justified in accordance with governing acquisition regulations; e.g., Federal Acquisition Regulation (FAR), and DOD FAR Supplement. **Q5**		

1	**Program Management**
1.5	**Risk Control**
1.5.1	**Risk Identification**

C1	Shortfalls and risks associated with the proposed development activities are identified. **Q1 Q2 Q3**	**Q1**	Describe your process to identify and reduce technical risks associated with the system and software development. **C1**
C2	Critical paths and tasks in the software development and associated schedules are identified and monitored. **Q4 Q5**	**Q2**	Identify the projected risks and shortfalls associated with this program as a result of applying this process. **C1**
		Q3	What specific risks do you see in developing the subject program software with the selected design methodologies and implementation languages? **C1**
		Q4	Identify the critical tasks and paths associated with the proposed development plan. Describe your process to monitor these critical elements. **C2**
		Q5	Explain how you apply critical path and risk management techniques in managing software schedules. **C2**

1	**Program Management**
1.5	**Risk Control**
1.5.2	**Risk Management**

C1	Risk management strategies required to identify and reduce risk are identified consistent with the program's cost, schedule, and performance baselines. **Q1**	**Q1**	Describe your risk management process. What role will prototypes and demonstrations play in risk management? **C1**
C2	Identified risks areas are tracked and managed throughout the program development. **Q2**	**Q2**	Describe how identified risk areas are analyzed, tracked, and monitored throughout the program development. **C2**
C3	Specific criteria are identified in the risk management planning applicable to each risk reduction activity. These criteria define for each activity the condition under which each risk reduction activity is exercised. **Q3**	**Q3**	How does your process support determining when to exercise the appropriate risk reduction activities? Are specific criteria established for each risk reduction activity? Are variance thresholds established for each risk area? **C3**
C4	Metrics exist for management tracking of specific program risk reduction actions. **Q4**	**Q4**	Identify and describe the metrics to be used to track specific program risk reduction activities. **C4**

Functional Area 2: Systems Engineering

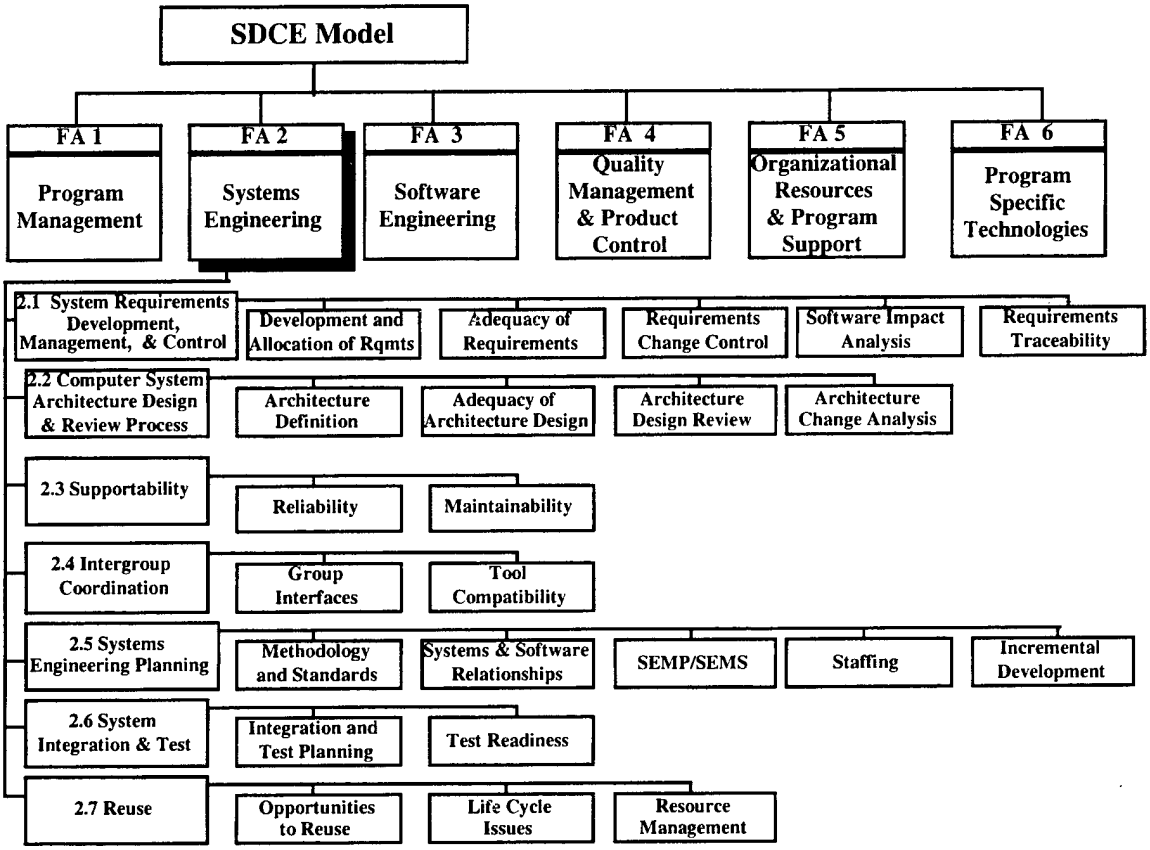

Figure 4. Systems Engineering

2	**Systems Engineering**
2.1	**System Requirements Development, Management and Control**
2.1.1	**Development and Allocation of Requirements**

C1	A systems analysis and allocation process is used to verify that performance and verification requirements are correct and complete at each level prior to further allocation and decomposition, and to verify them as to feasibility and top-level design concept prior to allocation to software. **Q1**	**Q1**	How are system and subsystem requirements defined and allocated? How are these requirements verified at each level prior to further allocation and decomposition? How are those requirements that imply digital processing and software verified as to feasibility and top-level design concept prior to allocation to software? **C1**
C2	The selected systems analysis and allocation methodology is compatible with other methodologies adopted on the program. **Q2**	**Q2**	Describe how the systems analysis and allocation methodology is compatible with the systems design methodology, and with the software analysis methodology. **C2**
C3	System requirements (including test and verification requirements) are analyzed, refined, and decomposed to ensure complete functional allocation to hardware and software. **Q3**	**Q3**	Describe the process by which system requirements are analyzed, refined, and decomposed to develop a functional allocation to hardware, software, and other implementation technologies. Describe the process and specific trade studies and analyses performed to aid in deciding which requirements to allocate to hardware and which to software. **C3**
C4	When a system-level requirement is allocated to more than one configuration item (CI), a process is used to ensure that the lower-level requirements taken together satisfy the system-level requirement. **Q4**	**Q4**	Describe the process ensures that when a system-level requirement is allocated to more than one CI, the combination of the lower-level requirements meets the system-level requirement. **C4**
C5	A defined process is used to generate the initial versions of the Software Requirements Specifications (SRS) and the Interface Requirements Specifications (IRS). A process to develop and review verification requirements for each performance requirement is in place. **Q5**	**Q5**	Describe the process used to generate the SRS and IRS. Describe the process to define verification requirements for each performance requirement as part of the requirements and definition (specification preparation) process. **C5**
C6	A process exists to identify all design documents, requirements specifications, and interface specifications across the development team, including subcontractors. **Q6**	**Q6**	Provide a tree diagram illustrating the hierarchical relationship among the various levels of system, subsystem, critical item, and prime item requirements specifications and design documents down to and including the software. This tree of design documents and specifications should include flowdown to subcontracted efforts. **C6**

2 Systems Engineering 2.1 System Requirements Development, Management and Control 2.1.2 Adequacy of Requirements	
C1 System requirements are analyzed and refined to ensure that they are consistent, clear, valid, feasible, compatible, complete, and testable, and they do not include inappropriate levels of design information. **Q1 Q2**	**Q1** Describe the process used to ensure that system requirements are consistent, clear, valid, feasible, compatible, and complete. How do you ensure that inappropriate levels of design information are not contained in the requirements documents? **C1 C2**
C2 Software Requirements Specifications (SRS) and Interface Requirements Specifications (IRS) are analyzed and refined to assure that all requirements allocated to software are adequately addressed, and that they do not include inappropriate levels of design information. They are reviewed by all affected parties. **Q1 Q3**	**Q2** Describe the process used to ensure that system requirements have complete verification (test) coverage. **C1**
C3 If incremental development is planned, a process is used to establish functional, performance, and verification requirements for each incremental system or software block/build. This process ensures that all requirements are allocated to planned increments prior to design and development of the increment. **Q4**	**Q3** Describe the process by which the SRS and IRS are analyzed and refined to ensure that all requirements allocated to software are adequately addressed. **C2**
	Q4 If incremental development is planned, describe the process used to establish functional, performance, and test requirements for each incremental system or software block/build. Explain how these allocations to all planned blocks are reviewed and baselined prior to initiating design and development of the first increment. **C3**

2	Systems Engineering		
2.1	System Requirements Development, Management and Control		
2.1.3	Requirements Change Control		
C1	Requirements are baselined early in the program and are maintained under configuration control. **Q1**	**Q1**	Describe the requirements configuration management process. **C1**
C2	All changes to requirements, including those generated by the customer, are managed by means of a defined change process. **Q2**	**Q2**	Describe the requirements change control process, with reference to both internally and externally generated changes. **C2**
C3	Allocation of new and additional requirements between hardware and software is managed by a structured change process; reallocation of existing requirements between hardware and software is managed by a structured change process. **Q3**	**Q3**	What process is used to control allocation of changed (new or existing) requirements between hardware and software? **C3**

2 Systems Engineering 2.1 System Requirements Development, Management and Control 2.1.4 Software Impact Analysis	
C1 The structured change process for requirements ensures that the software impact for each proposed change is addressed. **Q1**	**Q1** How is the software impact for proposed changes to system requirements addressed? **C1**
C2 All trade-off studies include an assessment of the software impact of each alternative. Trade study results are documented and maintained for the life of the program. **Q2 Q3**	**Q2** What process is used to include the software impacts of each alternative within system-level trade-off studies? **C2**
C3 Software is addressed in all systems engineering reviews. **Q4**	**Q3** How are trade-off study results documented? How are they maintained? **C2**
C4 Areas of the system with volatile requirements are monitored, and requirements specifications are reviewed for ambiguities that could result in software sizing and timing instability and other program impacts. **Q5**	**Q4** What provisions exist to include software issues in systems engineering reviews? **C3**
	Q5 How are areas of the system with volatile requirements monitored? Within those areas, how is the impact of potential requirements changes to the program (including software) identified and managed? **C4**

2 Systems Engineering 2.1 System Requirements Development, Management and Control 2.1.5 Requirements Traceability	
C1 Two-way requirements traceability is maintained from system specifications to hardware and software configuration item specifications. **Q1**	**Q1** Describe the process used to provide two-way requirements traceability. At what point is requirements traceability established and documented? What provisions exist to maintain traceability? **C1**

2	Systems Engineering
2.2	Computer System Architecture Design and Review Process
2.2.1	Architecture Definition

C1	A process exists for establishing and maintaining the computer system architecture (hardware and software), for determining the nature and number of the Computer Software Configuration Item (CSCI), and for maintaining traceability of the architecture to system requirements. **Q1**	**Q1**	What process is used to establish and maintain the computer system architecture (hardware and software)? Describe how the nature and number of CSCIs is defined. Describe how the architecture is traced to system requirements. **C1**
C2	A process is used to define, maintain, and document interfaces (internal and external) within the architecture. **Q2**	**Q2**	Describe the process used to define, maintain, and document interfaces (internal and external) within the architecture. **C2**
C3	A process is used to establish and show relationships between the hardware and software components within the computer system architecture, including the system-level component hierarchy and control structure. **Q3**	**Q3**	What process is used to establish and show relationships between the hardware and software components within the computer system architecture, including the system-level component hierarchy and control structure? **C3**
C4	A process is used to establish and show relationships between the computer system architecture (hardware and software) and the operational (human) interface. **Q4**	**Q4**	What process is used to establish and show relationships between the computer system architecture (hardware and software) and the operational (human) interface? **C4**
C5	The contractor has demonstrated a commitment to applying open system architecture concepts in their development. **Q5**	**Q5**	Describe your process for identifying, defining and/or selecting interfaces and protocols that will be used between the different software and hardware components of the system. Will any of these interfaces be proprietary? **C5**

2	Systems Engineering	
2.2	Computer System Architecture Design and Review Process	
2.2.2	Adequacy of Architecture Design	
C1	A process exists to evaluate suitability of the computer system architecture for implementing all system functional and performance requirements, as well as how design constraints are satisfied. **Q1 Q2 Q6**	**Q1** Describe who participates in evaluating adequacy of the computer system architecture design. **C1**
C2	A process exists to evaluate the design based on use of risk reduction techniques, such as the creation of models and prototypes (proofs, benchmarks). **Q4**	**Q2** What process is used to evaluate suitability of the computer system architecture for implementing all system functional and performance requirements? Within that process, how are estimates made and budgeting performed regarding the use of computer system resources? **C1**
C3	A process exists to periodically reassess the adequacy of the computer system architecture over the development cycle. **Q3 Q5**	**Q3** What process is used to evaluate suitability of the computer system architecture for meeting user needs? **C3**
		Q4 Describe any plans for using risk reduction techniques such as creation of models and prototypes (proofs, benchmarks). **C2**
		Q5 What is the process for reassessing adequacy of the architecture as the development of the system progresses? What criteria are used to either stay with the original design or change it? **C3**
		Q6 How is performance of the architecture measured? How is adequacy of the computational resources, memory, processor capacity, and bus bandwidth established? **C1**

2	Systems Engineering	
2.2	Computer System Architecture Design and Review Process	
2.2.3	Architecture Design Review	
C1	Whenever system requirements change, there is a review of, and (as necessary) an update to, the computer system architecture design. **Q1**	**Q1** Describe the review process for computer system architecture design. **C1**
C2	The computer system architecture design is reviewed for flexibility to adapt to new system requirements. **Q2**	**Q2** Explain the extent to which design-for-change considerations and flexibility to adapt to new system requirements are reviewed on the program, relative to the computer system architecture design. **C2**

2	Systems Engineering
2.2	Computer System Architecture Design and Review Process
2.2.4	Architecture Change Analysis

C1	There is a review of all architectural changes and their impact on design margins (such as memory, throughput, bus loading, and data latency) and cost and schedule baselines. **Q1 Q2**	**Q1**	Describe the process used to review the impact of all architectural changes on design margins (such as memory, throughput, bus loading, and data latency). **C1**
		Q2	Describe the process used to review the impact of all architectural changes on cost and schedule baselines. **C1**

2	Systems Engineering
2.3	Supportability
2.3.1	Reliability

C1	Reliability requirements are included in system requirements, and are allocated to hardware and software. **Q1**	**Q1**	Describe the process by which the system reliability requirements are allocated to hardware and software. **C1**
C2	Reliability is defined, measured, controlled, and reported in all life-cycle phases. A process is used to institute corrective actions when necessary. **Q2**	**Q2**	How is reliability in all life-cycle phases defined, measured, controlled, and reported? **C2**

2 Systems Engineering 2.3 Supportability 2.3.2 Maintainability	
C1 Maintainability is defined, measured, controlled, and reported. A process is used to institute corrective actions when necessary. **Q1 Q2 Q4**	**Q1** How is maintainability defined, measured, controlled, and reported? **C1**
C2 Support systems needed for any required operational self-sufficiency are developed, with an understanding between the customer and the developer regarding the effort, cost, and equipment required to support the system. **Q3**	**Q2** How is maintainability built into the design? **C1**
	Q3 Describe the process used to evaluate the effort, cost, and equipment needed to support the system. **C2**
	Q4 Describe the process to manage corrective actions. **C1**

2	Systems Engineering	
2.4	Intergroup Coordination	
2.4.1	Group Interfaces	
C1	Throughout the development life-cycle there is periodic coordination among developers, acquisition organizations, users, maintainers, and testers regarding user needs, acquisition organization resources, technology status, and system requirements. Requirements changes resulting from interaction with users, maintainers, and testers are managed with acquisition organization approval. **Q1 Q2 Q3 Q4**	**Q1** Describe the processes to be followed to have users' and maintainers' needs and viewpoints adequately reflected in system requirements throughout development. **C1**
C2	There is a systems engineering process which (as appropriate) emphasizes an integrated product development approach and defines systems engineering interfaces with other engineering disciplines and development activities, as well as interfaces between system and subsystem developers. **Q5 Q6 Q7**	**Q2** Describe the processes to be followed to keep system requirements in balance with acquisition organization resources throughout development. **C1**
C3	A process exists to manage, provide an escalation path for, and resolve conflicts regarding intergroup issues, including system-level issues that arise internally or with subcontractors. **Q8 Q9**	**Q3** Describe the processes to be followed to have system testers adequately involved in the requirements definition process throughout development. **C1**
C4	Critical dependencies between development groups are identified and tracked. **Q10 Q11 Q12**	**Q4** Describe the processes to be followed to ensure that all requirements changes take place with customer approval. **C1**
		Q5 To what extent is an integrated product development approach to be followed? **C2**
		Q6 How will systems engineering interface with the other engineering disciplines and development activities? **C2**
		Q7 How will interfaces between the various system and subsystem developers be managed? **C2**
		Q8 Describe the processes for conflict resolution to be used internally between development groups. **C3**
		Q9 Describe the processes for conflict resolution to be used between prime contractors and subcontractors, and between subcontractors. Describe the processes used to identify and resolve intergroup product interface issues. **C3**

2 2.4 2.4.1	**Systems Engineering** **Intergroup Coordination** **Group Interfaces (Cont'd)**
	Q10 What critical dependencies exist between development groups? **C4** **Q11** Describe the processes for identifying new critical dependencies during development. **C4** **Q12** How are critical dependencies between development groups tracked? **C4**

2 Systems Engineering 2.4 Intergroup Coordination 2.4.2 Tool Compatibility	
C1 Support tools used by the different engineering groups enable effective communication and coordination. **Q1**	**Q1** Where different development groups have an interface, what support tools will be used to communicate and share data? Describe any areas of potential difficulty. **C1**

2 Systems Engineering 2.5 Systems Engineering Planning 2.5.1 Methodology and Standards	
C1 Detailed systems engineering policies, practices, and procedures are defined, consistent with systems engineering contractual standards such as MIL-STD-499B. **Q1**	**Q1** Describe how the program's systems engineering policies, practices, and procedures are defined and documented. **C1**
C2 The systems engineering process makes provisions for documenting the rationale of all major systems engineering decisions. **Q2**	**Q2** Describe the provisions that have been made for documenting the rationale of all major systems engineering decisions. **C2**
C3 A process is used to arbitrate contention across trade-off studies for utilization of system-level resources and reserves. **Q3**	**Q3** What policies, practices, and procedures govern system-level trade-off studies? When there is contention across trade-off studies for utilization of system-level resources, how are competing claims resolved? **C3**

2	Systems Engineering		
2.5	Systems Engineering Planning		
2.5.2	Systems and Software Relationship		
C1	Software engineering coordinates with systems engineering on all items that flow down to software engineering; for example, system architecture, information models, and identification, definition, and allocation of software requirements. **Q1**	**Q1**	Describe the role of software engineering on items that flow down from systems engineering to software engineering, such as system architecture, information models, and identification, definition, and allocation of software requirements. **C1**
C2	A process is used to ensure that a staff with software skills conducts system-level trade-off studies for all issues affecting hardware and software and that they fully consider and account for software issues, including sizing, cost, schedule, memory, throughput, reuse, and other architectural considerations. **Q2**	**Q2**	How are software issues addressed in system-level trade-off studies? How does software engineering participate in those studies? How do you ensure that the staff performing system level trade-off studies has adequate software skills? How do you ensure that system level trade-off studies account for software issues including sizing, cost, schedule, memory, throughput, reuse, and other architectural considerations? **C2**

2	Systems Engineering		
2.5	Systems Engineering Planning		
2.5.3	Systems Engineering Master Plan (SEMP), Master Schedule (SEMS), and Detailed Schedule (SEDS)		
C1	Systems engineering milestones (including formal reviews) are defined and implemented with clear completion criteria in the SEMP/SEMS. **Q1**	**Q1**	Describe the intended use of SEMP/SEMS/SEDS on the program. Are all major software milestones addressed in the SEMP, SEDS and SEMS? Are completion criteria specified with all events? **C1**
C2	The Software Development Plan (SDP) is coordinated with and, as appropriate, incorporated into the SEMP/SEMS; all software milestones are accounted for. **Q2**	**Q2**	Describe the relationship of the SDP to the SEMP/SEMS/SEDS. **C2**

2 Systems Engineering 2.5 Systems Engineering Planning 2.5.4 Staffing	
C1 Within systems engineering, a staffing plan defines personnel requirements, including numbers, skill level, experience, and staffing profile. The systems engineering staffing plan identifies the personnel with required software skills and experience. **Q1**	**Q1** Is there a staffing plan for systems engineering on the program? Have required software skills and experience been identified? **C1**

2	Systems Engineering	
2.5	Systems Engineeering Planning	
2.5.5	Incremental Development	
C1	Incremental software development, integration, and test (with a series of builds), if used, is consistently integrated into plans for system incremental development. **Q1**	**Q1** If there are plans for incremental software development, integration, and test, describe how those plans are coordinated with any system incremental development plans. **C1**

2	Systems Engineering		
2.6	System Integration and Test		
2.6.1	Integration and Test Planning		
C1	System integration planning begins in the early development stages of the program with identification of the person responsible, and includes having that person participate in architecture and design reviews. **Q1**	**Q1**	When will the person responsible for system integration planning be identified? Does that person participate in architecture and design reviews? **C1**
C2	Test planning for each system build includes the multiple levels of system integration and test (from units to Computer Software Configuration Items (CSCIs) to subsystem to system-level test). **Q2**	**Q2**	If system builds are planned, describe how test planning for each system build includes the multiple levels of system integration and test (from units to CSCIs to subsystem to system-level test). **C2**
C3	Any incremental software development is incorporated into system integration and test planning. **Q3**	**Q3**	If incremental software development is planned, describe how it is incorporated into system integration and test planning. **C3**
C4	Any use of commercial-off-the-shelf (COTS) software or other reuse software is incorporated into system integration and test planning. **Q4**	**Q4**	Describe any special integration and test plans developed for COTS software or other reuse software. **C4**
C5	System integration and test planning includes verification of year 2000 compliance of hardware and software. These processes are adequately documented. **Q5**	**Q5**	Describe any integration and test plans developed to ensure year 2000 compliance of developed software, COTS software, other reuse software, and hardware. Where are these processes documented? **C5**

2 Systems Engineering 2.6 System Integration and Test 2.6.2 Test Readiness	
C1 Readiness criteria are clearly identified for formal subsystem and system test. **Q1**	**Q1** Describe the process to be used to ensure that readiness criteria are clearly identified for formal subsystem and system test. **C1**
C2 Readiness and completion criteria are clearly identified for informal subsystem and system test. **Q2**	**Q2** Describe the process to be used to ensure that readiness and completion criteria are clearly identified for informal subsystem and system test. **C2**
C3 The readiness criteria for both formal and informal test are incorporated into the Systems Engineering Master Plan, Systems Engineering Master Schedule, and Systems Engineering Detailed Schedule SEMP/SEMS/SEDS milestones. **Q3**	**Q3** How are these readiness criteria reflected in the SEMP/SEDS/SEMS? **C3**

2 Systems Engineering 2.7 Reuse 2.7.1 Opportunities to Reuse	
C1 Opportunities to utilize previously developed system and software components (including architectures, designs, code, and documentation) are identified and subject to trade-off studies. **Q1 Q2**	**Q1** What previously developed system-level components are candidates for reuse or adaptation on this development? What previously developed software components are candidates for reuse or adaptation on this development? For each, indicate: source; whether NDI, COTS, or GFE; rights issues; availability; security issues; reliability level; likelihood of use; and projected percent of modification needed. **C1 C2**
C2 Opportunities to utilize nondevelopmental item (NDI), commercial off-the-shelf (COTS), and Government furnished equipment (GFE) system and software components (including architectures, designs, code, and documentation) are identified and subject to trade-off studies. **Q1 Q2**	**Q2** What trade-off studies have been done or are planned to evaluate the costs, benefits, and risks of the opportunities to reuse existing system and software components? **C1, C2**
C3 Opportunities for prime contractors and subcontractors to utilize common system and software components in different parts (subsystems) of development are identified and subject to trade-off studies. **Q3**	**Q3** Describe any plans to identify and develop common system-level components for shared use across development groups or across configuration items (CIs). Describe any plans to identify and develop common software components for shared use across development groups or across CIs. Include both intercompany and intracompany planning. **C3**

2	Systems Engineering
2.7	Reuse
2.7.2	Life-Cycle Issues

C1	Future reuse potential of newly developed system and software components is maximized within the constraints of system cost, schedule, and performance baselines. **Q1 Q2**	**Q1**	Describe plans to make newly developed system and software components reusable (generic, adaptable). Include any efforts to perform domain engineering tasks. Describe the impact of these efforts on the system and software baselines. **C1**
C2	Life-cycle cost impact of reuse-related decisions is assessed, including: choice of computer languages, processors, architectures, and environments; development of reusable assets; and maintenance of reuse repositories. **Q3**	**Q2**	Describe the impact of reuse plans on processes used to perform systems and software engineering tasks (such as requirements analysis, design, implementation, integration, and test). **C1**
C3	The contractor has a process in place for evaluating the applicability of reuse code to the program's requirements and ensuring that no code is executed for a function that does not apply to the program at hand. **Q4**	**Q3**	Describe how the choice of computer platform, software architecture, and development environment relates to plans to create and maintain reusable system or software components. **C2**
C4	The contractor has a process in place for monitoring the evolution of reuse code and ensuring that the solution is consistent with the needs of the program at hand. **Q5**	**Q4**	Describe your process for evaluating applicability of all components of reuse software to the program at hand and ensuring that no extraneous code is executed on the program. **C3**
C5	The contractor has a process in place for ensuring the quality of reuse code. **Q6**	**Q5**	Describe your process for ensuring that upgrades to reuse code meet the needs of the program in terms of requirements and schedule. **C4**
		Q6	Describe your process for ensuring that the quality of the reused code meets the needs of the program. **C5**

2	Systems Engineering	
2.7	Reuse	
2.7.3	Resource Management	
C1	Processes, procedures, and tools exist to document, manage, and control reusable components. **Q1 Q2 Q3 Q4**	**Q1** Explain whether reusable components are documented differently from the rest of the system. **C1** **Q2** Explain whether reusable components are managed and controlled differently from the rest of the system. **C1** **Q3** Explain whether any special tools are needed to manage reusable components. **C1** **Q4** Explain whether any special processes or procedures are needed to manage reusable components. **C1**

Functional Area 3: Software Engineering

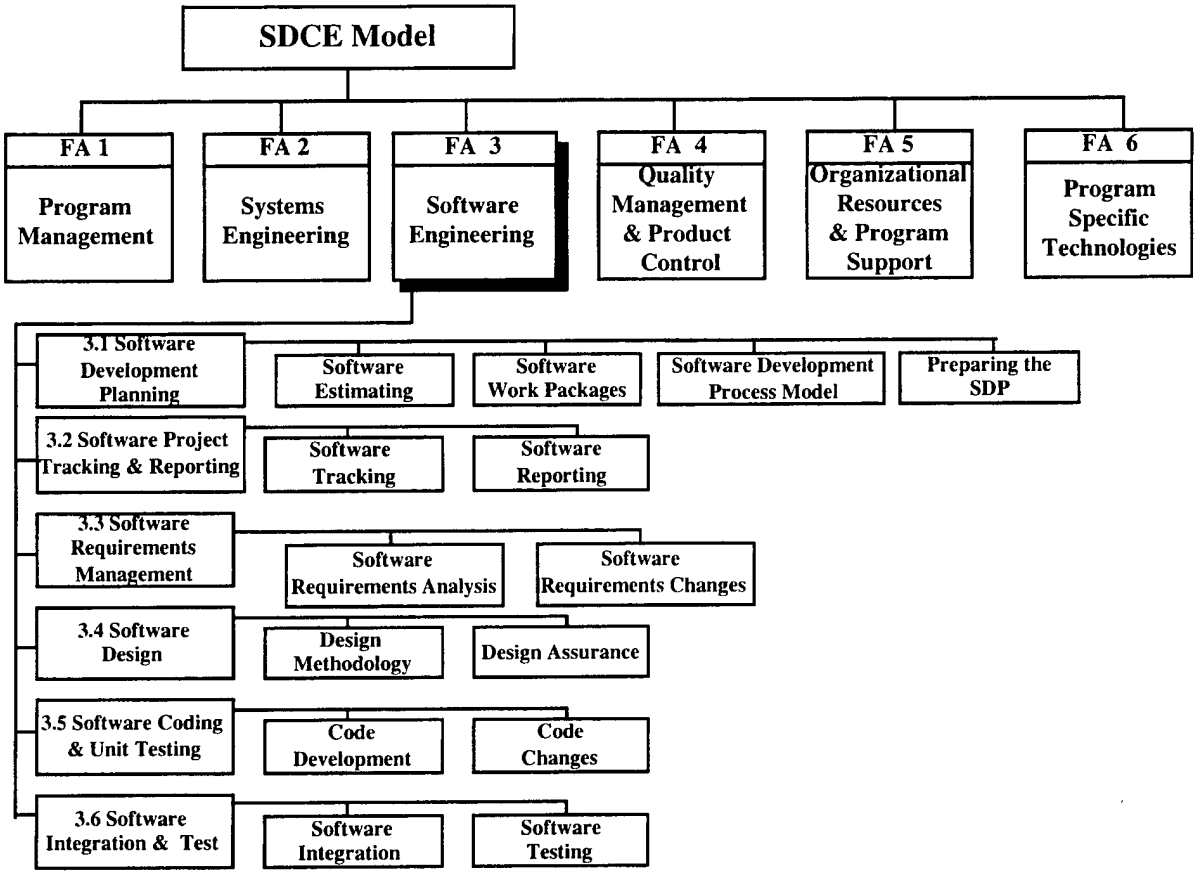

Figure 5. Software Engineering

3	Software Engineering		
3.1	Software Development Planning		
3.1.1	Software Estimating		
C1	Estimates for size, effort, cost, and schedule of each software component are generated according to a documented procedure. Estimates for incrementally developed software are generated consistently with published methods and company experience. **Q1**	**Q1**	How are estimates for the size, effort, cost, and schedule of each software component generated? Which published estimating methods and models are used? Describe how estimates are developed for any planned incremental development or release. Describe your experience with this method relative to actual size, effort, cost, and schedule of completed projects. **C1**
C2	Estimates for manpower profiles required for completion of estimated schedules of each software product are generated according to a documented procedure. Estimated profiles are consistent with past actual company experience. **Q2**	**Q2**	How are effort profiles estimated for software components? What process ensures that each task required for the software development (i.e., requirements, definition, analysis, design, code, integration, and test) are included in the estimates? How are the cost and effort of related software engineering tasks (such as configuration management, quality assurance, and test and integration) included in estimates for the program? **C2 C6**
C3	Estimates for required critical computer resources needed by each software component are generated according to a documented procedure. **Q3**	**Q3**	How are estimates generated for required critical computer resources needed by each software component? How are computer resources estimated and balanced across the program to ensure that critical needs are met? **C3**
C4	As software system definition progresses, estimates are performed for each lowest-level software component, and previous estimates are revised. **Q4**	**Q4**	Describe how estimates are revised as software system definition progresses. What process ensures that estimates remain consistent with the current state of the overall program? What is the approach to revising estimates as lowest-level software components are comprehensively defined? By what program milestone are these revised estimates baselined? **C4**
C5	Environmental parameters and calibration factors applied in estimating manpower requirements, and the resulting productivity factors, are consistent with past actual productivity rates for similar applications. **Q5**	**Q5**	How are the various environmental parameters and calibration factors derived? What is the source of productivity factors applied in estimating manpower requirements? Are they consistent with past actual productivity rates? Are environmental parameters and calibration factors for use in estimating under configuration management? **C5**

3	Software Engineering	
3.1	Software Development Planning	
3.1.1	Software Estimating (Cont'd)	
C6	The estimating methods account for all tasks and steps associated with the software development process to be used. **Q2**	**Q6** How is the data required to repeat the above estimates for each software component recorded and maintained? Is the data configuration controlled and available to all who need it? Are occasional audits done to verify that the required data is accurate and available? **C7**
C7	All data required to repeat the above estimates for each software component are recorded and maintained. **Q6 Q7**	**Q7** Who is responsible for development and storage of the above estimates? Who ensures that estimates are performed according to procedure, and that the data is recorded and maintained? **C7**
C8	The estimating process ensures consistency among estimates for size, workload effort, distribution of manpower, schedule, and cost. **Q8**	**Q8** Describe the methodology for correlating and ensuring consistency among estimates of size, workload effort, distribution of manpower, schedule, and cost. **C8**
C9	Software estimates are periodically compared to actual results to calibrate the estimating models and procedures. **Q9**	**Q9** How is accuracy of software estimates ensured? Is there a formal process for periodically calibrating software estimating procedures with actual performance data? **C9**

3 Software Engineering 3.1 Software Development Planning 3.1.2 Software Work Packages	
C1 Software components and work packages of manageable size and development effort are defined to enable management of the entire software system. **Q1**	**Q1** How is the overall software effort organized into manageable software components? What factors are considered in determining the appropriate size and development effort for each component? How is the software organization documented? **C1**
C2 The defined set of software work packages is used to manage the work tasks associated with software development. **Q2**	**Q2** How are software work packages planned and defined? Describe the criteria for acceptable software work packages. Explain how the software work package is used to manage the work (i.e., plan, define, assign resources and responsibility, and status and report progress). **C2**
C3 Manpower is allocated to individual work packages consistent with their individual development schedules. In addition, software development manpower is allocated consistent with the total software development needs of the program. **Q3**	**Q3** Describe your method for allocating manpower to individual software work packages as well as across the total software development effort. How does this allocation method apply to incremental (block, build) software development? How does the method provide realistic manpower profiles, based on experience, to support total program needs? **C3**

3	Software Engineering		
3.1	Software Development Planning		
3.1.3	Software Development Process Model		
C1	A well-defined Software Development Process Model has been selected for use on the program at hand. **Q1**	**Q1**	Describe the Software Development Process Model selected for the program: what activities it comprises, how activities are sequenced and iterated, what are the entrance and exit criteria from one activity to the next, and from one iteration to the next. **C1**
C2	The criteria used to select and/or define the Software Development Process Model are sound and consistent with the needs of the program at hand. **Q2**	**Q2**	Provide the rationale for selecting the Software Development Process Model and its associated risks. **C2**

3	Software Engineering	
3.1	Software Development Planning	
3.1.4	Preparing the Software Development Plan (SDP)	
C1	The SDPs are developed and maintained using a sound and complete process. **Q1**	**Q1** Describe the process used to generate the SDPs for the project, who participates in the effort, where results are recorded, and how plans are maintained. Describe the software development planning that will be performed; what software development life-cycle activities will be covered in SDPs; how the plan accounts for processes, schedules, and manpower needed to develop the software to be delivered. **C1**
C2	A process exists for coordinating SDPs across team members and ensuring integrity and supportability of the program's software. **Q2 Q3**	**Q2** Explain how you will ensure that the software subcontractors' SDPs are compatible with the prime contractor's SDPs. How will software integrity and supportability across software developed by the prime contractor and subcontractors be ensured? **C2** **Q3** Which components of the software development organizations (across the prime contractor and subcontractors) coordinate on the final contents of the SDPs and how do they do that? How are terms, dependencies, and responsibilities negotiated and communicated internal to the prime contractor, between the prime contractor and subcontractors, and among subcontractors? **C2**

3 Software Engineering 3.2 Software Project Tracking and Reporting 3.2.1 Software Tracking	
C1 The size, effort, cost, and schedule status of each software work package is periodically measured and reviewed by engineering management and corrective actions are taken when pre-established variance thresholds are exceeded. **Q1**	**Q1** How often will engineering and program management measure and review the size, effort, cost, and schedule status of each software component? What criteria and conditions will trigger corrective actions? How will success of corrective actions be measured? What provisions exist for event-driven engineering management reviews? **C1**
C2 The critical computer resources required by and allocated to each software work package are periodically measured and reviewed by management, and corrective actions taken when pre-established variance thresholds are exceeded. **Q2**	**Q2** How often will critical computer resources required by each of the software components be measured and reviewed by engineering and program management? When will it be deemed necessary to take corrective action? Who is responsible for setting variance thresholds? **C2**

3	Software Engineering		
3.2	Software Project Tracking and Reporting		
3.2.2	Software Reporting		
C1	The status of each software work package is reported to all involved levels of engineering and program management through periodic reporting up the chain of command. **Q1**	**Q1**	How is the status of each software work package reported up the chain of command? What specific elements of software status (e.g., units, components, configuration items, subsystem, system) are reported to each management level from first-level supervisor through program manager? What situation, condition, or threshold would trigger a status report to a higher level of management than normally would be necessary for a work package? **C1**
C2	Development process/performance and product quality measurements are recorded, analyzed, and used for improving process and product quality on the program. These data are recorded and maintained for organizational process and product quality improvements. **Q2**	**Q2**	What actual measurements of development performance and product quality will be recorded during software development? How will these measurements be analyzed and used for changing and improving products and processes? How will metrics be recorded and maintained? Who is responsible for collection, storage, and analysis of metrics? **C2**

3	Software Engineering	
3.3	Software Requirements Management	
3.3.1	Software Requirements Analysis	
C1	Software requirements are analyzed for completeness, correctness, clarity, feasibility, and verifiability. **Q2 Q3**	**Q1** Describe the software analysis process to be applied. Identify specific methodologies and tools to be used to support the analysis process. What organizational element is responsible to perform the analysis? Identify the input to and output product from the analysis. **C3**
C2	Requirements derived from the Software Requirements Specification are documented and maintained. **Q4**	**Q2** How are the software requirements analyzed for completeness, correctness, etc.? How do you determine that the software requirements are complete, adequate, and verifiable? **C1**
C3	The selected requirements analysis methodology is compatible with other methodologies applied on the program. The analysis methodology is supported with necessary tools. **Q1 Q5**	**Q3** How are the total sets of software requirements analyzed as a whole, including interfaces? **C1**
		Q4 If additional requirements are derived from the baselined requirements, where are they documented? How are they maintained? How is their impact on cost and schedule determined? **C2**
		Q5 Describe the methodology used to analyze requirements. Is it compatible with the requirements traceability methodology? Is it compatible with the design methodology? Is it compatible with the development language? **C3**

3	Software Engineering	
3.3	Software Requirements Management	
3.3.2	Software Requirement Changes	
C1	Software development artifacts (requirements, design, code and documentation) are revised as changes to the requirements are incorporated. **Q1**	**Q1** Describe the software development activities resulting from a change in or addition to requirements. When are they performed? How do you ensure that they are performed? **C1**
C2	As changes and additions to requirements are incorporated, Software Development Plans (SDPs) and program baselines (cost and schedule) are reviewed and modified if necessary. **Q2**	**Q2** Describe the software planning activities resulting from a change in requirements. When are they performed? How do you ensure that they are performed? **C2**
C3	Two-way traceability between software and system requirements is established and maintained. **Q3**	**Q3** How do you ensure that two-way traceability between system requirements and software requirements is maintained? **C3**

3 Software Engineering 3.4 Software Design 3.4.1 Design Methodology	
C1 A methodology is used to develop, document, and maintain top-level and detailed software design. **Q1**	**Q1** Describe the process and specific methodologies used to develop the top-level and detailed software design. Is the same methodology used to maintain the design through development and life cycle support? What tools are used to support the methodology? **C1**
C2 The design description includes the (static) structure and the (dynamic) behavior of the software. **Q2 Q3 Q4**	**Q2** What mechanism and format are used to describe the components of the design? **C2**
C3 The design description includes all software interfaces. **Q5**	**Q3** What mechanism and format are used to describe the execution priorities of the different components, and the execution control? **C2**
C4 The estimated use of the target computer resources is refined and included in the design documentation. **Q6 Q7**	**Q4** How is the data flow described? **C2**
C5 Plans and mechanisms exist to document the design decisions including trade-off studies. **Q8**	**Q5** How does the design methodology describe the interfaces internal to the software components? How does it describe the interfaces between the software components? How does it describe the interfaces between the software and other components of the system? **C3**
C6 The selected design methodology is compatible with other methodologies adopted on the program. **Q9 Q10**	**Q6** Describe the timelines generated to represent CPU usage of the target computer(s). How are these timelines maintained with the design documentation? **C4**
C7 The taxonomy used to represent design, code, and test entities are either common across entities or are compatible and mapped. **Q7 Q10**	**Q7** Describe the memory maps (or other representations of memory utilization) generated to represent the memory usage of the target computer(s). How are they maintained with the design documentation? **C4 C7**
C8 The contractor has demonstrated a commitment to basing their implementation on a sound software architecture. **Q11**	**Q8** How are the design decisions documented and communicated? How are the trade-off results analyzed? How is this process enforced? **C5**
	Q9 Is the design methodology compatible with the requirements analysis methodology? Is it compatible with the development language? **C6**

3 Software Engineering 3.4 Software Design 3.4.1 Design Methodology (Cont'd)	
	Q10 Is the same taxonomy (Computer Software Components, units, packages, files, etc.) used to represent the design entities, the code entities, the test entities and the configuration management entities? If not, how is the mapping between them defined? **C6 C7** **Q11** Describe the phase of your development that deals with software architecture, the resources allocated, the processes and tools that will be used and the architecture outputs that will be generated. **C8**

3 Software Engineering 3.4 Software Design 3.4.2 Design Assurance	
C1 Mechanisms exist to ensure the modularity, cohesiveness, feasibility, and coupling of the design. **Q1 Q2 Q3**	**Q1** Describe the exit criteria for baselining the top-level design. Do they include adherence to the design methodology? What are the criteria for completeness of the design documentation? How are the development standards required for the program reflected in the exit criteria? How are they enforced? **C1**
C2 Exit criteria are used to ensure completeness and quality of the design before it is baselined. **Q4**	**Q2** Describe the exit criteria for baselining the detailed design. Do they include adherence to the design methodology? What are the criteria for completeness of the detail design documentation? How are the development standards required on the program reflected in the exit criteria? How are they enforced? **C1**
C3 Two-way traceability between design and requirements is established and maintained. **Q5**	**Q3** How is the correctness, completeness, and feasibility of the design ensured? Who has that responsibility? What tools are used? Is it part of the exit criteria described above? Identify the design quality attributes included in the exit criteria. **C1**
	Q4 How are the modularity, cohesiveness, and coupling of the design ensured? Who has that responsibility? What tools are used? Is it part of the exit criteria described above? Identify the design characteristics included in the exit criteria. **C2**
	Q5 How is traceability established from the requirements to the design, and from the design to the requirements? At what point in the design is it done, and by whom? How is it documented? How is it maintained? What tools are used? Is this traceability part of the exit criteria described above? **C3**

3	Software Engineering
3.5	Software Coding and Unit Testing
3.5.1	Code Development

C1	The program software coding standards contain guidelines regarding internal documentation, style, complexity, and use of language features. **Q1 Q2 Q3 Q4**	**Q1**	Describe the process for ensuring that coders use a common coding style and that the code is sufficiently and uniformly documented. **C1**
C2	Use of the target computer's resources is measured and compared to budgeted values. Corrective action is taken as required. **Q5 Q6**	**Q2**	Explain how complexity of code is minimized. What guidelines are followed? What tools are used? **C1**
C3	The developed software is unit tested. Realistic resources and schedules are allocated to this level of testing. Units are tested in all increments of development. **Q7 Q8**	**Q3**	Identify any guidelines for use of special features of the development language. How are they communicated? **C1**
C4	The software is reviewed against the design, and 2-way traceability between software code and design is established and maintained. **Q9**	**Q4**	Describe any plans to use code generation technology for this development. What are the potential benefits, risks, and life-cycle trade-offs? **C1**
C5	Exit criteria exist for establishing that each lowest-level software unit has been implemented correctly, is performance tested, and conforms with the coding standards. **Q10**	**Q5**	How are timing measurements made? At what component level? How often? Who has that responsibility? How are the results used ? **C2**
		Q6	How are memory usage measurements taken? At what component level? How often? Who has that responsibility? How are the results used ? **C2**
		Q7	What processes and procedures are used to ensure that the design is implemented completely and correctly? At what component level? Who has that responsibility? **C3**
		Q8	How do you ensure that each lowest-level software component (unit) is unit tested? How do you ensure that adequate resources are allocated and adequate schedule (duration) is planned to support this level of testing? What tools are used? Who has that responsibility? **C3**
		Q9	How is traceability from the software code to the design and from the design to the code established and maintained? When is it done? How is it documented and maintained? What tools are used? Who has that responsibility? **C4**

3 3.5 3.5.1	**Software Engineering** **Software Coding and Unit Testing** **Code Development (Cont'd)**	
		Q10 What exit criteria exist for establishing that each lowest-level software unit is ready for integration? Do they include compliance with coding standards? Do they include peer reviews? Do they include unit testing? Do they include conformance to the design? How are they enforced? **C5**

3 Software Engineering 3.5 Software Coding and Unit Testing 3.5.2 Code Changes	
C1 Code changes are unit tested before they are incorporated. **Q1** **C2** Code changes are reviewed for correctness, and to avoid undesired impact on other software and system variables and components. **Q2 Q3**	**Q1** Describe your process for ensuring that all code changes are unit tested. **C1** **Q2** Describe your process for estimating the effect of code changes on other parts of the system, including variables and other software components. What tools are used? Who is involved in the process? **C2** **Q3** Describe your process for reviewing code changes after the code has been baselined. Are they reviewed for correctness and compliance with the standards? What if there are urgent changes? How is the review process enforced? Who has that responsibility? **C2**

3 Software Engineering 3.6 Software Integration and Test 3.6.1 Software Integration	
C1 The software integration planning takes into account the interdependencies between the different software components and the criticality of each component. **Q1 Q2 Q3**	**Q1** Describe your process for planning software integration. How many components do you integrate at once? How do you determine the order for integrating the components? Describe how your integration process accommodates all levels of software integration. **C1 C2 C4**
C2 The software integration planning takes into account the availability of other components of the system. **Q1 Q4**	**Q2** How are the dependencies between software components determined? At what level? How does it affect integration planning? **C1**
C3 For planned incremental software development, software integration is planned, scheduled, and resources are allocated to support each increment of software development. **Q5**	**Q3** How is the criticality of each component determined? What role does it play in integration planning? **C1**
C4 The software integration planning and process accommodate software integration starting with the lowest-level elements (i.e., units through all levels, including Computer Software Configuration Items (CSCIs) and CSCI/ Hardware Configuration Items (HWCIs). **Q1**	**Q4** How does your integration planning handle situations where a needed software or hardware component is not available on time? **C2**
	Q5 How does your integration planning cover integration with all planned software increments (blocks, builds)? **C3**

3	Software Engineering
3.6	Software Integration and Test
3.6.2	Software Testing

C1	The software test process includes development of test plans, procedures, and test cases. **Q1**	**Q1**	How are test plans, procedures and cases developed? When ? By whom? Where are they documented? How are they reviewed? How are they controlled? **C1**
C2	A process exists to ensure that software testing is adequately planned with sufficient test resources. **Q2**	**Q2**	What tools will be used for testing? When will they be available? Will they require any special inputs? Will their outputs require any special processing? What is your process to ensure that all required test resources have been planned and allocated? **C2**
C3	An approach is used that plans for all levels of testing to ensure thorough testing of the software. **Q3 Q4**	**Q3**	Does your software test and verification process define specific levels of software test? What are they? How do they relate to the structure of your software design? **C3**
C4	A process exists for incorporating changes resulting from software testing. **Q5 Q6**	**Q4**	What are the completion criteria for each level of testing? Do you generate test plans and procedures for each level? If so, how are they coordinated across levels? **C3**
C5	A regression test methodology ensures that system performance is maintained after revisions are made to the software components. **Q7 Q8**	**Q5**	Describe your process for incorporating changes resulting from errors uncovered during testing. Where is it documented? How is it enforced? **C4**
C6	Software testing is planned with adequate schedules and resources for all planned software development increments (blocks, builds). **Q9**	**Q6**	Does your change process ensure that changes are incorporated into the right baseline version? Are there provisions for priority changes requiring quick turnaround? **C4**
		Q7	What is your process for regression testing? Are there guidelines for when and how regression tests should be run? Is regression testing factored into the schedules? **C5**
		Q8	Is there a library of regression tests? If so, describe how it is generated. Are any regression testing tools used? **C5**
		Q9	How is the software test process and discipline applied to each planned increment (block, build) of software developed? **C6**

Functional Area 4: Quality Management and Product Control

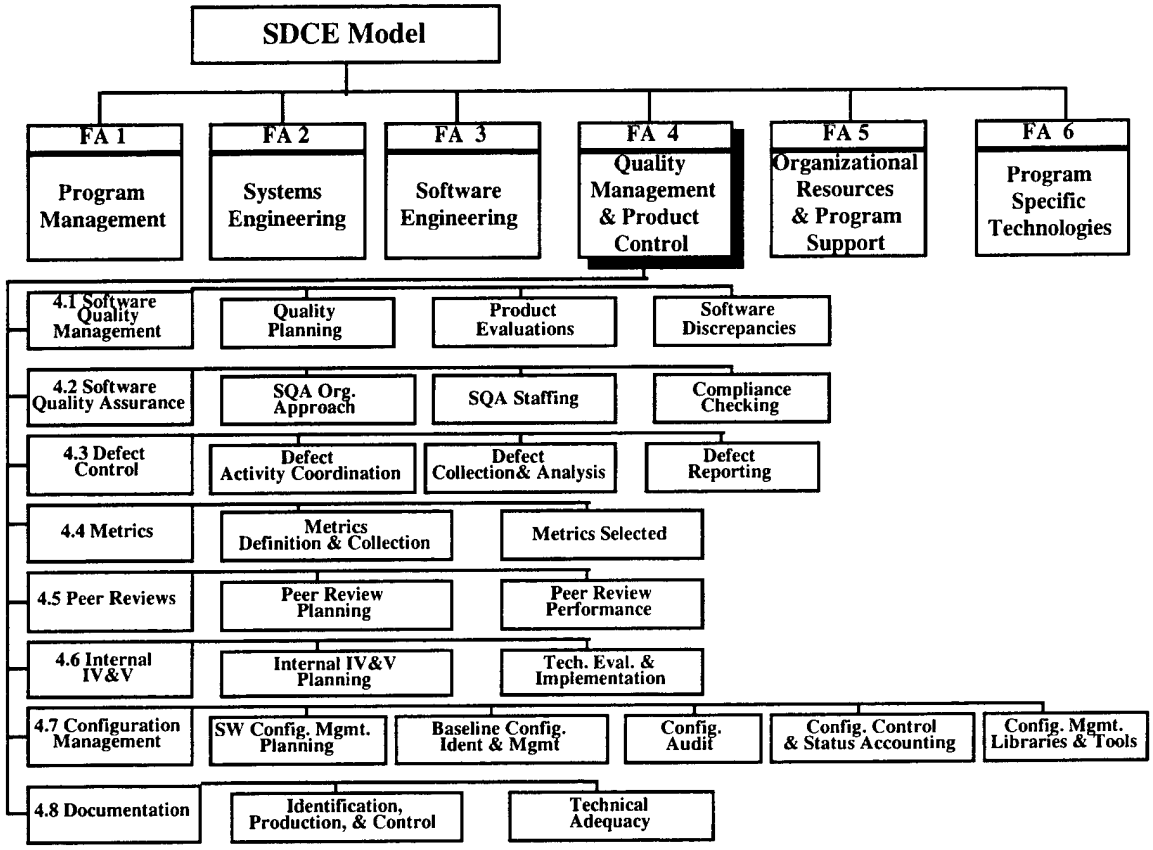

Figure 6. Quality Management and Product Control

4	Quality Management and Product Control	
4.1	Software Quality Management	
4.1.1	Quality Planning	
C1	The program's software quality plan is the basis for its activities for software quality management. **Q1 Q2 Q4**	**Q1** Describe your process for developing a quality plan for the program. **C1**
C2	The program's software quality plan contains provisions to ensure that quality is built into the software. **Q3**	**Q2** How are the activities described in the program quality plan reflected in proposed work packages? **C1**
C3	The program's quality goals and their priorities for the software products are defined, monitored, and revised throughout the software life cycle. **Q5**	**Q3** What provisions does the quality plan have to ensure that quality is built into the software? **C2**
C4	The plan identifies points in the process where software quality is measured. **Q6**	**Q4** Is quality training planned for the development organizations? Is it mandatory? What does it consist of? **C1 C7**
C5	The plan identifies methods for analyzing the program's quality measurements, for evaluating whether they meet the customer's needs, and for determining necessary corrective actions. **Q7**	**Q5** Does the quality plan define specific quality goals for each software product? Does it describe how these goals are prioritized? Does it describe how these goals are monitored and kept consistent with the customer's needs? **C3**
C6	The software program's quality goals for the products are allocated appropriately to the subcontractors delivering software products to the program. **Q8**	**Q6** Are there checkpoints for measuring software quality identified in the quality plan? **C4**
C7	Plans exist for members of development organizations to receive required training in software quality. **Q4**	**Q7** Does the quality plan describe how the quality data is analyzed and how it is used? **C5**
		Q8 Have the program's quality goals been incorporated into subcontracts where appropriate? **C6**

4. Quality Management and Product Control 4.1 Software Quality Management 4.1.2 Product Evaluations	
C1 Independent product evaluations are performed for all software work products before they are baselined. **Q1 Q2 Q3 Q4 Q5** **C2** Responsibility for each product evaluation is clearly defined. **Q5**	**Q1** Do you have evaluation procedures for all the software products to be developed on the program? Do they describe the evaluation criteria in sufficient detail? **C1** **Q2** When are the software products evaluated? **C1** **Q3** Are adequate resources (cost and schedule) provided for them? **C1** **Q4** What are the evaluator's qualifications? Do they receive any special training? **C1** **Q5** Is responsibility for each product evaluation defined? At what level? **C1 C2**

4	Quality Management and Product Control	
4.1	Software Quality Management	
4.1.3	Software Discrepancies	
C1	Specific procedures exist to resolve software versus hardware discrepancies and to identify, document, track, and resolve software discrepancies. **Q1 Q2 Q3 Q4**	**Q1** How are software discrepancies managed? **C1** **Q2** Identify and describe specific procedures to identify, document, report, track, and resolve software discrepancies. **C1** **Q3** Describe your method for resolving software versus hardware discrepancies in your problem reporting systems. **C1** **Q4** Describe tools used, and any automation, to address discrepancy collections, tracking, and reporting. **C1**

4	Quality Management and Product Control	
4.2	Software Quality Assurance (SQA)	
4.2.1	SQA Organizational Approach	
C1	An organization is assigned the responsibility to monitor the software development process and the software products. **Q1**	**Q1** Describe the responsibilities of the SQA organization and how it interfaces with other organizations. **C1 C2**
C2	The responsibilities, mission, and interface(s) of SQA with the engineering, configuration management, and test functions are defined and documented. **Q1 Q2 Q3**	**Q2** Does the the SQA organization communicate the results of SQA activities to the engineering organization? **C2**
C3	The SQA group is empowered to effect changes to the program when quality goals are not followed. **Q4 Q5**	**Q3** How does the SQA function interface with engineering, configuration management, and test functions? **C2**
		Q4 What can the SQA organization do if the software development process and procedures are not being followed? **C3**
		Q5 What mechanisms and channels exist for SQA to surface quality problems and elevate them in the management chain until they are resolved? **C3**

4	Quality Management and Product Control		
4.2	Software Quality Assurance (SQA)		
4.2.2	SQA Staffing		
C1	Sufficient SQA personnel are staffed to the program to accomplish assigned responsibilities and functions as proposed for this program. **Q1**	**Q1**	How many SQA personnel are normally assigned to a major program? What percentage of the software budget is expended on SQA activities? **C1**
C2	Qualified SQA personnel are assigned. **Q2**	**Q2**	What are the required qualifications of SQA personnel? Do they receive training in software development processes? Do they receive any program-specific training? **C2**

4	Quality Management and Product Control	
4.2	Software Quality Assurance (SQA)	
4.2.3	Compliance Checking	
C1	The program follows a written SQA plan for measuring and monitoring the performance of the program's defined software process. **Q1**	**Q1** Where are SQA activities defined for the program? **C1**
C2	Adherence to defined software development and management processes is verified. **Q2**	**Q2** Describe how SQA ensures compliance of software development activities with defined processes. Which processes are audited? How often? **C2**
C3	SQA audits designated software work products to verify compliance with quality goals and adherence to the applicable standards and requirements. **Q3 Q4**	**Q3** Describe how SQA ensures compliance of software management activities with planned processes. Which processes are audited? How often? **C3**
		Q4 Describe how SQA verifies that the software products adhere to the program's requirements, standards, and quality goals. **C3**

4	Quality Management and Product Control		
4.3	Defect Control		
4.3.1	Defect Activity Coordination		
C1	The program develops and maintains a plan for its defect prevention activities. **Q1**	**Q1**	Describe your program plan for preventing software defects. **C1**
C2	Revisions to the standard software process resulting from defect prevention actions are incorporated. **Q2**	**Q2**	Are defect causes assessed for potential process improvement and incorporation into program and organizational development processes? **C2**

4	Quality Management and Product Control		
4.3	Defect Control		
4.3.2	Defect Collection and Analysis		
C1	Common causes of defects are identified, prioritized, and systematically eliminated. **Q1 Q2 Q3**	**Q1**	Describe your approach to collection and analysis of defects. **C1 C2**
C2	Causal analysis meetings are conducted. **Q1 Q4**	**Q2**	Does your program have a process for identifying common causes of defects? **C1**
C3	Data on defects identified in peer reviews, document review, and testing are collected and analyzed. **Q5**	**Q3**	Are known common causes of defects prioritized for correction? **C1**
		Q4	Are causal analysis meetings conducted? Define your procedures for conducting causal analysis meetings. **C2**
		Q5	Identify your approach to collecting defects resulting from peer reviews, testing, and design reviews. Is this approach contained in the quality plan? **C3**

4 Quality Management and Product Control 4.3 Defect Control 4.3.3 Defect Reporting	
C1 Defect prevention data are documented and tracked across the teams that are coordinating defect prevention activities. **Q1** **C2** Members of the software engineering group and software-related groups receive feedback on status and results of the organization's and program's defect prevention activities on a periodic basis. **Q1**	**Q1** Is defect prevention data documented and communicated across all teams participating in defect prevention activities? Does this information include feedback on status and results of defect prevention activity? What is the frequency of this communication? **C1 C2**

4	Quality Management And Product Control	
4.4	Metrics	
4.4.1	Metrics Collection And Definition Process	
C1	The metrics selected and the strategy for the data collection and the analyses to be performed are determined based on the program's defined software process. **Q1 Q2 Q3**	**Q1** Describe your process for defining the metrics that will be used on this program and determining their use. **C1**
C2	The specific measusrement data to be collected, their precise definitions, the intended use and analysis of each measurement, and the process control points at which they will be collected, reported, and fed back are defined. **Q2 Q3**	**Q2** Describe (for each collected metric) how it will be collected, the points at which it will be collected, how it will be analyzed, how it will be reported, and to which organizations it will be reported. **C1 C2**
C3	The established metrics process includes the requirement to define variance thresholds, which when broken, require corrective action. **Q4**	**Q3** Describe the processes and tools used for data collection and analyses. **C1 C2**
		Q4 Describe your use of variance thresholds. Describe how these thresholds are established and used in development management. **C3**

4	Quality Management and Product Control
4.4	Metrics
4.4.2	Metrics Selected for the Program

C1	The metrics selected for the program address the system and software products, the process used to generate the products, and the progress of the development effort. **Q1**	**Q1**	Identify the metrics you plan to collect on this program, which system or software product they apply to, which process they apply to, and/or what progress they measure. **C1**
C2	The measurement program is integrated with the program's development process across the life-cycle and teaming arrangements. **Q2 Q3 Q4**	**Q2**	Describe (for each collected metric) what life-cycle phase it applies to. **C2**
		Q3	Describe the various organizations that will be involved in the measurement program, what their role will be, and how they will interface. **C2**
		Q4	How are these measurements defined and integrated with your program's defined software process? **C2**

4	Quality Management and Product Control		
4.5	Peer Reviews		
4.5.1	Peer Review Planning		
C1	Internal documents exist that: identify required participants in the reviews, provide specific criteria for successful completion, and describe documentation required for the review and how follow-on actions are documented, tracked, and controlled. **Q1**	**Q1**	Describe the documented internal peer review procedures and requirements including definition of required participants, completion criteria and review content, and follow-on action item resolution. **C1**
C2	Peer reviews are planned consistent with the peer review internal standards and procedures. **Q2**	**Q2**	Describe how peer reviews are planned and scheduled. Describe how the peer review schedule is consistent with other program schedules (e.g., SEMP/SEMS). **C2 C3 C4**
C3	Peer review plans specify the schedule of peer reviews. **Q2**		
C4	The peer review schedule is consistent with the Systems Engineering Master Plan and Systems Engineering Master Schedule (SEMP/SEMS). **Q2**		

4	Quality Management and Product Control	
4.5	Peer Reviews	
4.5.2	Peer Review Performance	
C1	Peer reviews are performed according to the peer review plan. **Q1**	**Q1** Describe how peer reviews are performed according to the peer review plan. **C1**
C2	Reviews are documented (i.e., review process, requirements, conduct, and results). **Q2**	**Q2** Describe how peer review results are documented and to whom results are distributed. **C2 C3**
C3	Review results are reported to appropriate managers. **Q2**	

4	Quality Management and Product Control	
4.6	Internal Independent Verification and Validation (IIV&V)	
4.6.1	IIV&V Planning	
C1	A well-defined systematic approach to IIV&V is documented in accordance with contract requirement. **Q1**	**Q1** Describe your process for planning and conducting IIV&V. **C1**
C2	The planning process for IIV&V includes criteria to select elements of the software for which the IIV&V process is applicable. **Q2**	**Q2** Do you have a procedure for determining which software should undergo IIV&V? Has this procedure been applied to identification of software for IIV&V for this program? **C2 C3 C4**
C3	Elements of the software to which the IIV&V process will be applied are selected. **Q2**	
C4	Required resources and tools are identified in IIV&V planning. **Q2**	

4	Quality Management and Product Control		
4.6	Internal Independent Verification and Validation (IIV&V)		
4.6.2	Technical Evaluation and Implementation Process		
C1	The IIV&V function is independent of the software development function. **Q1**	**Q1**	What is the organizational responsibility and reporting chain for the program IIV&V? **C1**
C2	Sufficient resources and required tools are available to accomplish the IIV&V process. **Q2**	**Q2**	Describe the resources and tools available to accomplish the IIV&V process. **C2**

4	Quality Management and Product Control	
4.7	Software Configuration Management (SCM)	
4.7.1	Planning	
C1	A sound process is in place for planning the program's SCM, as well as for disseminating and implementing the plans (draft). **Q1**	**Q1** Describe SCM planning for this project. What guidance exists for development, maintenance, and distribution of this SCM planning and the procedures to implement the plan? Who reviews the plan and procedures? **C1**
C2	The SCM is integrated with other configuration management plans used on the program (draft). **Q2**	**Q2** Explain how SCM is integrated with system configuration management, engineering management, and other development disciplines. **C2**

4	Quality Management and Product Control	
4.7	Software Configuration Management (SCM)	
4.7.2	Baseline/Configuration Identification and Management	
C1	The SCM process includes identifying and controlling master copies of the products of the software development process, including baselines and test configurations, for each block or build. The mechanism and media for storing the master copies, such as libraries and other tools, is appropriate for maintaining required configuration control. The process also controls the release, and re-release after revision, of the master copies. **Q1**	**Q1** Explain how products of the software development process, including baselines and test configurations, are controlled, released, revised, and rereleased for each block or build. **C1**
C2	The software work products to be placed under SCM are identified, including baselines and test configurations for each block and/or build called for by the developer's software development process model. **Q2**	**Q2** Which products of the software development process will be placed under configuration control? **C2**
C3	Procedures are specified for the unique identification (by name and number) of each product placed under configuration control. This uniqueness is applied across all software development processes invoked across all functional disciplines and prime and subcontractors involved in the project. **Q3**	**Q3** How will consistent software identification across the program's functional disciplines and the prime and subcontractors be maintained? How will revisions be identified for each release? **C3**

4	Quality Management and Product Control	
4.7	Software Configuration Management (SCM)	
4.7.3	Configuration Audits	
C1	The appropriate level of management is designated with the responsibility to approve a software configuration audit. The criteria include such issues as the need to establish that master copies of the products of the software development process that are supposed to be under configuration control are properly identified and accounted for. Procedures exist that, when followed, will accomplish the results to be obtained from such an audit. **Q1**	**Q1** Who is responsible for approving a software configuration audit, what are the criteria for initiating such an audit, and what procedures are followed? **C1**

4	Quality Management and Product Control	
4.7	Software Configuration Management (SCM)	
4.7.4	Configuration Control and Status Accounting	
C1	Change control procedures, which include the equivalent of configuration control boards for software, are defined and integrated into the program change management process. **Q1**	**Q1** Describe the change control procedures to be followed for changes requested to products of the software development process under configuration control. **C1**
C2	The software development process is used to manage and control the use of object code patches at all levels and ensure that software patches are a rare exception and are always resolved with permanent changes. The use of patches is approved and documented by the configuration control board. **Q2**	**Q2** If you anticipate the use of object code patches, describe how it will be managed and controlled, including when a patch will be incorporated into a baseline and when it will be deleted. **C2**
C3	Change requests and problem reports for all products of the software development process under configuration control are recorded, reviewed, approved, and tracked. Libraries and other tools are incorporated into the configuration management and control function support status accounting. **C3**	**Q3** Explain how configuration status accounting will be accomplished on this project. **C3**

4	Quality Management and Product Control		
4.7	Software Configuration Management (SCM)		
4.7.5	Configuration Management Library and Tools		
C1	SCM tools are adequate, proven, and available for use on the project and for transition to the post-deployment support environment. Included in the tools is the equivalent of a controlled access library system which is in use and has procedures for software and documentation releases and for promotions to other libraries. **Q1**	**Q1**	Describe the SCM and control tools to be used on this project, your experience with them, and your plans to transition them to the post-deployment environment. **C1**
C2	For efficiency and reliability of SCM and control, the SCM and control process and tools are integrated with the tools used to create the products of the software development process. **Q2**	**Q2**	Describe how SCM and control process and tools are integrated with software development process activities and the software engineering environment. **C2**

4	Quality Management and Product Control	
4.8	Documentation	
4.8.1	Documentation Identification, Production, and Control	
C1	A periodic update based on reviews is held with the acquisition organization, user, and support organizations regarding the design information to be delivered. **Q1**	**Q1** Describe your process to define the detailed information to be included in the design documentation. How are the needs of acquisition organizations, users, and supporters accommodated in this process? **C1**
C2	All internal and deliverable documentation products are clearly identified, including draft documentation. **Q2**	**Q2** Describe the process by which the necessary deliverable documentation is identified. How does incremental development affect documentation development? **C2**
C3	The documentation used to operate and maintain the software is developed and maintained consistent with the current software baseline. **Q3**	**Q3** How is documentation developed and maintained? What process(es) ensure accuracy and completeness? **C3**
C4	Documentation is integrated into the engineering development process and the system, subsystem, and hardware documentation. **Q4**	**Q4** How is software documentation integrated into your software engineering development process? Describe the role of documentation in support of engineering activities. **C4**
C5	Requirements for subcontracted software documentation are tied to the Systems Engineering Master Schedule (SEMS) and Systems Engineering Master Plan (SEMP). **Q5**	**Q5** Describe your requirements for subcontracted software documentation. Are these requirements tied to the SEMS and SEMP? **C5**
C6	Software documentation is integrated into the software development process and is supported by the System/Software Engineering Environment (S/SEE). **Q6**	**Q6** Is the key software documentation accessible from the S/SEE? **C6**
C7	Automated tools support documentation generation. **Q7**	**Q7** Identify any automated tools that support the generation of software documentation. Is the software technical requirements and development information accessible from the S/SEE? **C7**
C8	The documentation is accessible from the S/SEE. **Q8**	**Q8** Does the key software documentation exist in the S/SEE? What procedure ensures that the S/SEE contains the current documentation baseline? **C8**

4	Quality Management and Product Control	
4.8	Documentation	
4.8.2	Technical Adequacy	
C1	Systems engineering decisions, development rationale, and test information are captured and retained in the documentation. **Q1**	**Q1** Does the program have a process for capturing engineering decisions? Describe your approach for documenting design decisions, development rationale, and test information. **C1**
C2	Standards exist for documenting test requirements for the software. **Q2**	**Q2** What standards do you use in documenting test requirements documents? **C2**
C3	Internal standards or requirements for software documentation that are integrated with system, subsystem and hardware documentation are consistent with the requirements of the contract. **Q3**	**Q3** Is the documentation approach integrated with engineering activities? How does your software documentation integrate with system, subsystem, and hardware documentation? **C3**
C4	Documentation completion is a integral part of internal reviews to ascertain software development status and progress. Documentation requirements are part of the completion criteria for the Systems Engineering Master Plan and Systems Engineering Master Schedule. **Q4**	**Q4** What role does documentation play in your internal reviews to ascertain software development status and progress? Do completion criteria for formal and informal reviews include appropriate documentation? **C4**
C5	Consistency and currency is maintained across software work products including software plans, process descriptions, allocated requirements, software requirements, software design, code, test plans, and test procedures. **Q5**	**Q5** Is consistency maintained across software products from requirements through acceptance testing (i.e., traceability across software requirements, software plans, design, code, and test)? What ensures that this is accomplished? **C5**

Functional Area 5: Organizational Resources and Program Support

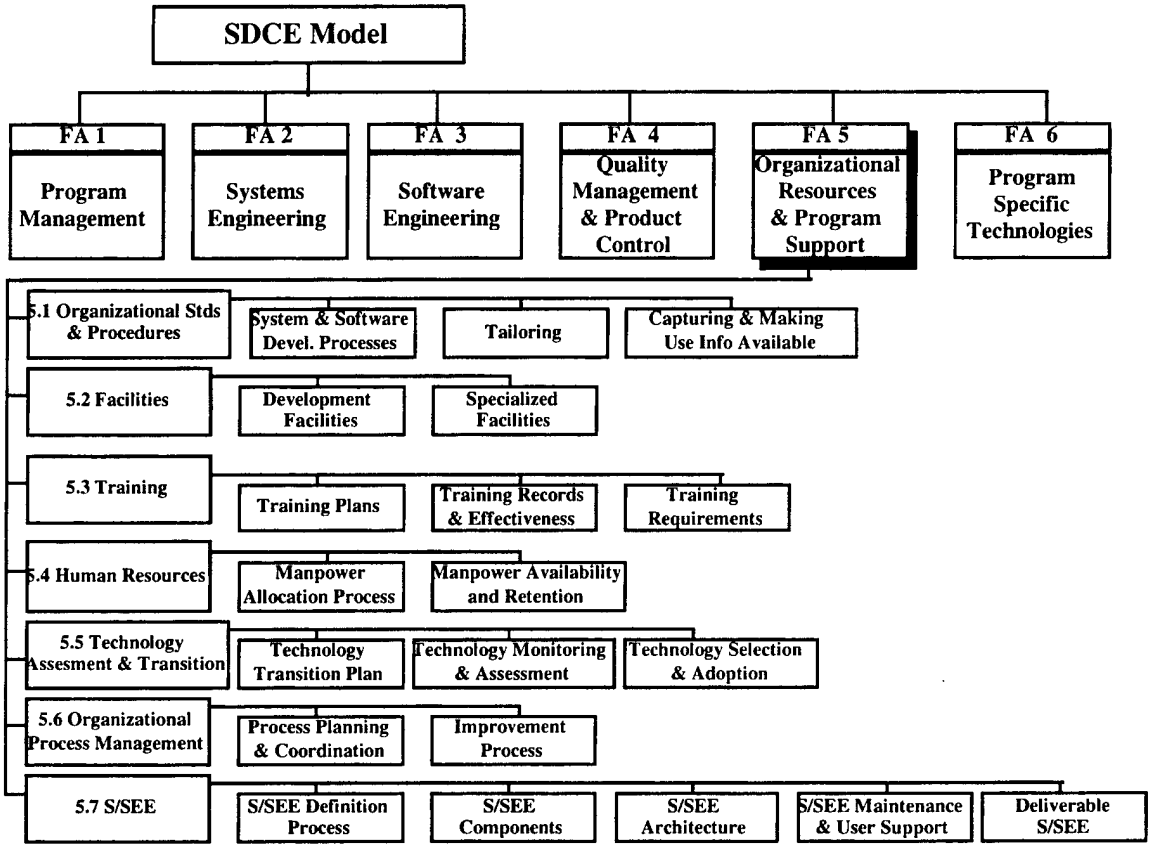

Figure 7. Organizational Resources and Program Support

5	Organizational Resources and Program Support
5.1	Organizational Standards and Procedures
5.1.1	System and Software Development Processes

C1	The organization's systems and software development standards comprehensively describe the system and software development, their interfaces, and interdependencies. The standards also document the interfaces within and among the various system software and other disciplines. **Q1 Q2**	**Q1**	In your organization's system development and software development process(es) standards, how are activities and events described (e.g., inputs, outputs, readiness and completion criteria)? How are the relationships (sequencing, interfaces, and interdependencies) of the activities described? **C1**
C2	The organizational standards provide a set of system and software engineering development models (e.g., waterfall, event-driven) for selection and use by the program. The descriptions of these models are compatible with the organization's standard system and software development process(es). **Q3**	**Q2**	What is covered in the descriptions of the interfaces within and between the various systems development and software development and other engineering development disciplines? For which disciplines are interfaces described? **C1**
C3	The organization's system development and software development process(es) standards, where applied on the program, comply with applicable standards required by the Request for Proposal (RFP), for example: • Systems Engineering, MIL-STD-499B • Defense System Software Development Standard, DOD-STD-2167A • Software Development Integrity Program Standard, MIL-STD-1803 **Q4**	**Q3**	Identify the system development and software development models (e.g., waterfall, event-driven) and explain how they are defined in your standards. How is compatibility between the organization's standard system development and software development process maintained and ensured? **C2**
C4	The organization's system development and software development process(es) standards are placed under configuration control. **Q5** **[If there is more than one standard process, answer the questions for each standard applicable to the program.]**	**Q4**	Which of your organizational development standards are compatible and compliant with the standards required by the program RFP. What is your approach for determining consistency? For those applicable standards required by the RFP for which your standard process is not consistent, what is your approach for ensuring and supporting development processes that comply with program requirements? **C3**

5 Organizational Resources and Program Support 5.1 Organizational Standards and Procedures 5.1.1 System and Software Development Processes (Cont'd)	
	Q5 Describe your approach for version control and controlling changes to the organization's standard system development and software development process(es). How do you know which version of the organization's standard is in use at a given time? How are changes to the standard assessed, incorporated within the standard, and incorporated by the program? **C4**

5 Organizational Resources and Program Support 5.1 Organizational Standards and Procedures 5.1.2 Tailoring	
C1 A waiver procedure and tailoring guidelines and criteria are available to facilitate tailoring the organization's standard systems development software development process(es) to meet specific program requirements and needs. **Q1 Q2**	**Q1** Describe any documented guidelines provided for tailoring organizational standards to specific program requirements. What specific program needs require tailoring on this program? How was the specific system development and software development model for this program selected? Given the systems and software development model for this program, how are the organization's system and software development processes and procedures tailored to be compatible with and support the development model? **C1**
C2 When organizational standards are applied directly to programs, a process exists to verify compliance with these standards. **Q3** **[If there is more than one standard process, answer the questions for each standard applicable to the program.]**	**Q2** Describe the procedure for waiving compliance with the organization's standard system development and software development process(es). How does it support application of the tailoring guidelines? Describe how the procedure provides flexibility for those cases where particular program needs require extensive tailoring. **C1** **Q3** How is compliance by program with the applicable organization's standard process verified? How is compliance by program with the activity descriptions within the standard ensured or verified, taking into account approved deviations? How is proper function of the interfaces within and between the various systems and software disciplines ensured or verified, taking into account approved deviations? **C2**

5	Organizational Resources and Program Support	
5.1	Organizational Standards and Procedures	
5.1.3	Capturing and Making Available Use Information	
C1	Past use data for standard organizational and program processes is collected. This data includes estimates and actuals, quality measurements, peer review/test coverage and efficiency, number and severity of defects found. This experience-based data is made available to programs for planning and managing new programs. **Q1**	**Q1** Explain how data from use of the organization's and programs' development processes and resulting products is collected and made accessible to the program for use in planning and managing its effort. In addition to actual measurement data, what related information is maintained to help the program understand and interpret the measurement data and assess it for reasonableness and applicability? **C1**
C2	A library of process-related documentation (e.g., program standards, measurement plans, process training materials) is maintained and made available to the program to support reuse of proven processes and interpretation of usage data. **Q2** **[If there is more than one standard process, answer the questions for each standard applicable to the program.]**	**Q2** For the program, what process-related documentation is maintained and made available to support reuse of proven processes and interpretation of usage data? How are these documentation items catalogued for easy access? **C2**

5	Organizational Resources and Program Support
5.2	Facilities
5.2.1	Development Facilities

C1	A plan for establishing and maintaining the required system and software development facilities exists, and is consistent with the program's requirements, needs, usage estimates, and schedule. **Q1 Q2 Q3 Q4**	**Q1**	Describe the software development facilities (host development computers, workstations, networks, memory systems, etc.) intended for the program in terms of quantity, location, availability date, capacity and response time. Describe the level of integration of the system/software development facilities (environments). **C1**
C2	Where required, integrated systems/software development environments are planned and acquired or developed to be in place to meet program need dates. **Q5**	**Q2**	Describe the basis for determining that the facilities will satisfy the program's requirements and needs (capabilities and capacities). **C1**
C3	Planning for system and software development facilities includes support of all planned incremental development (blocks, builds), including regression testing. **Q6**	**Q3**	Describe when each facility will be available. What is your plan to ensure that the facilities will be available to meet the program's need dates? What is your fallback position if any of these facilities are not available in time for the program? **C1**
C4	For team developments (including primes, associates, and subcontractors) common and compatible development facilities are planned to ensure continuity, integrity, and supportability of developed systems and software. **Q7**	**Q4**	Describe how the development facilities will be maintained for the program. **C1**
		Q5	For integrated software environments, describe which systems and software functions are integrated and how these integrated facilities will be planned and acquired or developed to meet program needs. **C2**
		Q6	Describe how the software development facilities are planned and acquired to support incremental software development (blocks, builds). **C3**
		Q7	For team developments (e.g., primes, associates, and subcontractors) describe how compatible development facilities are planned to ensure continuity, integrity, and supportability of the developed systems and software. **C4**

5	Organizational Resources and Program Support	
5.2	Facilities	
5.2.2	Specialized Facilities	
C1	The specialized facilities needed for the program, such as special test stations and simulation laboratories, have been identified and meet the program's needs. A systematic process is used to ensure that all required facilities are identified, planned, and acquired or developed to be in place to meet program need dates. **Q1**	**Q1** Describe the specialized testing facilities, simulation laboratories, and any other specialized facilities that will be used on the program. How do you ensure that all required facilities are identified, planned, and acquired or developed to be in place to meet program need dates? **C1**
C2	Availability of specialized facilities is consistent with the program's requirements, needs, usage estimates, and schedule. **Q2 Q3 Q5**	**Q2** Describe your plans for acquiring or developing specialized facilities, if they are not already in place. What is your fallback position if any of these facilities are not available in time for the program? **C2**
C3	A plan to support these specialized facilities during the life-cycle of the program exists and is consistent with the program's resources and schedule. **Q4 Q6**	**Q3** Describe the process for scheduling the use of these facilities and the number of shifts per day scheduled for each. How do you ensure that their availability will meet program needs in terms of number of users and development schedule? **C2**
C4	Where required, integrated systems/software specialized facilities are planned and acquired/developed to be in place to meet program need dates. **Q7**	**Q4** Describe how each specialized facility will be supported during the life-cycle of the program, in terms of user support and maintenance. Where is this support included in the program's allocated personnel and cost baselines? **C3**
C5	Planning for system/software specialized facilities includes support of all planned incremental development (blocks, builds), including regression testing. **Q6**	**Q5** For integrated specialized facilities, describe which systems and software functions are integrated and how these integrated facilities will be planned and acquired or developed to meet program needs. **C2**
C6	For team developments (including primes, associates) and subcontractors, compatible specialized facilities are planned to ensure continuity, integrity, and supportability of developed systems and software. **Q7**	**Q6** Describe how the system and specialized software facilities are planned and acquired to support incremental software development (blocks, builds). **C5**
		Q7 For team developments (e.g., primes, associates, and subcontractors) describe how compatible specialized facilities are planned to ensure continuity, integrity, and supportability of developed systems and software. **C4 C6**

5 Organizational Resources and Program Support 5.3 Training 5.3.1 Training Plans	
C1 A program training plan exists that identifies: • the program's current and future technical, management, and skill needs • how these needed skills will be developed (informal vehicles, formal courses that need to be developed or procured from outside sources) • the resources (e.g., trainers, materials, funding, time) needed to develop these skills • the schedule for required training **Q1**	**Q1** How are the program's software development training needs planned and implemented? Identify the skill needs that must be addressed. What training vehicles will be used to impart those skills? What resources are planned to develop those skills? Which training vehicles are provided by the program and which are provided by the organization? Does the schedule for required training meet program need dates for skilled personnel? **C1**
C2 If the program's training plan relies on the organization, an organizational training plan exists that identifies: • how organizational training needs are addressed (formal courses, etc.) • the resources needed • the schedule for conducting training • relationship of organizational training to program training needs **Q2**	**Q2** Do the program's planned training needs rely on the organization for implementation? If so, describe what the organization's training plan covers. What organizational training needs are addressed? Which skill needs of the program are addressed? How does the training schedule reflect when those skills are needed by the program? What training vehicles will be used to impart those skills? What resources are planned to develop those skills? **C2**

5 Organizational Resources and Program Support 5.3 Training 5.3.2 Training Records and Effectiveness	
C1 A procedure is established and used to determine whether individuals have the knowledge and skills required to perform in their designated roles and to document training courses taken by individuals in their records. **Q1**	**Q1** Describe the process to determine whether individuals have the software development knowledge and skills required to perform in their designated roles. Where skills are required to meet program needs, how are these skills developed? **C1**
C2 Course effectiveness is evaluated to help ensure that the training courses provide the required training. **Q2**	**Q2** Describe how the effectiveness of courses are evaluated. How are the results of the evaluations used to revise the training to better meet the specific needs they were intended to address? **C2**
C3 The organization provides software training and motivation and incentives for personnel to take the training. **Q3**	**Q3** What courses are provided by the organization and how are personnel encouraged to take the courses? **C3**

5 Organizational Resources and Program Support 5.3 Training 5.3.3 Training Requirements	
C1 Technical and management skills training is provided for software development, including: • software engineering development • the programming languages (e.g., Ada) • software engineering development environments; e.g., System/Software Engineering Environment (S/SEE) • methods and tools • software project management	**Q1** Identify the skills training courses typically provided for software development, in particular, software engineering development, programming languages, and software project management development environments (e.g., S/SEE), methods and tools, and software project management. What program skill needs are addressed? Does the program depend on the organization to provide any of this training? **C1**
C2 All new software development team members receive training in the program's software processes. **Q2**	**Q2** Is training provided in the program's system development and software development process and tools (e.g., S/SEE)? If such training is to be provided, what topics are covered? **C2**
C3 All new software project managers and program managers receive training or orientation, as appropriate, in such areas as software project management, program management, and system engineering. **Q3**	**Q3** What training and orientation is provided to new software engineers, project managers, and program managers? Does the program depend on the organization to provide any of this training? **C3**

5	Organizational Resources and Program Support
5.4	Human Resources
5.4.1	Manpower Allocation Process

C1	A process exists for sizing the software development manpower requirement and for realistically allocating and distributing this manpower over the development phases. This process covers both technical and management manpower, is based on a documented model, and is calibrated on the basis of actual experience. The estimating and allocation process covers incremental software development. **Q1**	**Q1**	Describe the manpower profile used to allocate the software development personnel over the total program development period, from requirements definition to subsystem/system testing, and explain the basis for this profile. **C1**
C2	The educational and training background of the proposed software development personnel is consistent with the program's skill needs. **Q2**	**Q2**	Describe the academic requirements and standards for software development engineers. **C2 C3**
C3	The staff assigned to the subject program have the qualifications, technical skills, and experience in the application domains relevant to this program. **Q2 Q3 Q4 Q5 Q6 Q7**	**Q3**	What percentage of your software development personnel have science, engineering, mathematics, or computer science degrees? What percentage of the people assigned to the subject program will have this educational background? **C3**
C4	The lead software development engineers and managers assigned to the subject program have successfully demonstrated technical leadership and management skills on similar programs. **Q8 Q9**	**Q4**	Discuss the experience base and numbers of personnel required to accomplish the software development and related systems engineering and testing on this program. **C3**
		Q5	Identify the average number of years of relevant software development experience among your total software development staff. **C3**
		Q6	What percentage of this experience was acquired while with the current employer? **C3**
		Q7	Describe the software development experience of your staff in terms of applications (domains) relevant to the subject program. **C3**
		Q8	Describe the software management experience of your software management staff in terms of applications (domains) relevant to the subject program. **C4**
		Q9	Describe instances from similar efforts where lead software development engineers and managers assigned to this program have successfully demonstrated technical leadership and management skills. **C4**

5	Organizational Resources and Program Support		
5.4	Human Resources		
5.4.2	Manpower Availability and Retention		
C1	The organization's resources and assets are sufficient to accomplish the program's system/software development effort in parallel with its other ongoing and planned software development contracts and activities. Alternatively, management has a viable specific plan to acquire qualified personnel on a schedule consistent with the program's development plan. **Q1 Q2 Q3 Q4 Q5**	**Q1**	Identify all ongoing and planned contracts which include software development, and their magnitude, status, and schedule. **C1**
C2	A plan exists for ensuring continued availability of qualified software development personnel throughout the life-cycle of the program. **Q6 Q7**	**Q2**	Identify a composite organization profile of software personnel working on all ongoing and planned contracts. **C1**
		Q3	Categorize these personnel by skills and experience and years of experience, including years with the organization. **C1**
		Q4	Demonstrate that the required numbers of personnel are either available within your organization to staff this program or how they will be acquired. **C1**
		Q5	Describe the control and flexibility you have in assigning and retaining people that are key to this program. **C1**
		Q6	Describe your process for assessing personnel stability, its relationship to the application/function/subsystem, and your plans for maximizing it on the program. **C2**
		Q7	Describe your process for tracking and managing personnel turnover. **C2**

5	Organizational Resources and Program Support	
5.5	Technology Assessment and Transition	
5.5.1	Technology Transition Planning	
C1	Program needs are analyzed to identify required capability areas that need or could benefit from new technology. **Q1**	**Q1** Describe your approach for determining the requirements and capability areas where new technologies are needed or would be most helpful. How do you factor in the ongoing and planned program's needs? **C1**
C2	Responsibilities are assigned and resources allocated for monitoring, assessing, selecting, and adopting new technologies for the identified capability areas that need or could benefit from new technology. **Q2**	**Q2** Which group(s) or function(s) are responsible for monitoring, assessing, selecting, and adopting new technologies? Do these resources belong to the program only or to the organization? If for the organization, in what ways do their activities benefit the specific program? Which capability areas that need or could benefit from new technology are targeted for technology improvement? What expertise (e.g., technology change management, System/Software Engineering Environment, measurement) will be available to help in assessing and transitioning technology changes? **C2**

5	Organizational Resources and Program Support	
5.5	Technology Assessment and Transition	
5.5.2	Technology Monitoring and Assessment	
C1	Systematic efforts are made in the organization to identify and assess new technologies that might meet identified or anticipated needs. **Q1**	**Q1** How do you maintain awareness of commercially available technologies that might meet identified or anticipated needs? How do you maintain awareness of leading relevant technical work? What is your approach for gathering and reviewing documentation of experiences with using these technologies? **C1**
C2	Information on advanced technologies in use in the organization, which could benefit other programs, is disseminated. **Q2**	**Q2** How do you maintain awareness of advanced technologies in use in the organization? What information on these technologies do you disseminate to benefit other programs? How do you disseminate this information? **C2**

5	Organizational Resources and Program Support	
5.5	Technology Assessment and Transition	
5.5.3	Technology Selection and Adoption	
C1	Cost/benefit analyses are performed to determine technology changes that will confer the highest potential benefits. **Q1**	**Q1** How do you assess and evaluate a new technology to determine that it meets a technical requirement or need? Do you perform cost/benefit analyses on proposed technology changes? How do you use product and process data from the existing process in the cost/benefit analyses? What criteria do you use to determine the technology changes which will confer the highest potential benefits? **C1**
C2	Where appropriate, pilot efforts are planned and conducted before a new or unproven technology is introduced into practice: • pilot results reflecting on technically meeting the need, feasibility of adoption, and economics are collected, analyzed, and documented • costs/benefits of broader use in the organization are estimated **Q2**	**Q2** Describe your approach for piloting new or unproven technologies. What criteria do you use to determine whether a new or unproven technology should be piloted before incorporation? How do you plan for a pilot effort? How do you use the results of a pilot effort to assess the economics and feasibility of adopting the new technology? How are cost/benefits of broader use in the organization estimated? **C2**
C3	When a decision is made to introduce a new technology into practice, the applicable documented engineering development process(es) (e.g., program's, organization's) are updated to incorporate the new technology. **Q3**	**Q3** When a decision is made to introduce a new technology into practice, how are the applicable documented process(es) (e.g., program's, organization's) updated to incorporate the new technology? **C3**

5	Organizational Resources and Program Support
5.6	Organizational Process Management
5.6.1	Process Planning and Coordination

C1	An organizational plan for improvement of system and software development process(es): • is based on action plans resulting from assessments of the system and software development processes • identifies highest priority areas for improvement • indicates resources and assignments to develop the process improvements • identifies applicable procedures • identifies how these improvements are incorporated into ongoing and future programs **Q1 Q2**	**Q1**	How is the program plan for system and software development process improvement based on action plans resulting from process assessments? Which processes are covered in a process assessment? Are system processes included? How are findings from the assessment typically addressed (e.g., through action plans which identify the changes to be made)? What are the plan's highest priority areas for improvement? What are the program's priority areas for improvement and how are these addressed in the plan? **C1**
C2	The system and software process management activities of the organization are coordinated (in particular, these activities): • defining and managing changes to the organization's system and software processes • collecting and maintaining data on use of the organization's system and software processes **Q3**	**Q2**	Which activities are covered in the organizational plan for system and software development process improvement? Are group and individual responsibilities assigned and resources identified? Identify the procedures documented or referenced in your plan. How are improvements to be incorporated into ongoing and future programs? **C1**
		Q3	Which individual(s) or group(s) are responsible for coordinating the system development and software development process management activities of the organization? Who is responsible for managing changes to the organization's system and software development processes? Who is responsible for collecting and maintaining data on use of the organization's system and software development processes and making it available to other programs? How are these activities coordinated with the program? **C2**

5 Organizational Resources and Progam Support 5.6. Organizational Process Management 5.6.2 Improvement Process	
C1 Specific opportunities for system and software development process improvement, addressing any area of system or software development process, are documented and can be proposed by anyone. **Q1**	**Q1** By what mechanism(s) are specific opportunities for process improvement documented and submitted? Which employees can make use of these mechanism(s)? What areas of the system and software development process can they address? **C1**
C2 Systems and software development process improvement proposals are evaluated and decisions on whether or not to implement them are made based on expected benefits and relative priority. **Q2**	**Q2** Describe how employee-identified and other proposed opportunities for process improvement are evaluated. What criteria are used to determine whether or not to implement a particular proposed improvement? How are benefits and priorities of a proposed improvement determined? Which group(s) or individuals(s) are assigned responsibility for evaluating and tracking these processes improvement proposals? **C2**
C3 When the decision is made to transfer a system or software development process improvement into a program, the improvement is implemented in a way that ensures: • necessary resources to implement the improvement are determined and established • the appropriate defined development process(es) and training courses are updated • consultation support is established • changes in development process performance are measured **Q3**	**Q3** When the decision is made to transfer a system or software development process improvement into the program, what steps do you take to incorporate the improvement? What kinds of resources are assigned? How are the applicable document process(es) (e.g., program's, organization's) and training updated to incorporate the improvement? What training and consultation support do you typically plan to provide? How do you determine whether the change in process has improved technical performance and product and determine cost benefits? **C3**
C4 Managers and technical staff are informed of the status and results of the organization's and program's activities for system and software process development and improvement. **Q4**	**Q4** What groups and functions are informed of the status and results of the organization's and program's activities for system development and software development process improvement? How are they informed and how often? **C4**

5	Organizational Resources and Program Support
5.7	System/Software Engineering Environment (S/SEE)
5.7.1	S/SEE Definition Process

C1	The S/SEE requirements definition process takes into account the needs of the program. **Q1 Q2 Q3**	**Q1**	Describe the process by which the S/SEE requirements are defined for the program. **C1**
C2	The S/SEE requirements definition process takes into account past usage of the S/SEE. **Q4 Q5**	**Q2**	How are the tools selected, and what is the involvement of program personnel in the selection? **C1**
		Q3	How do you verify that the program's needs are met by the S/SEE? **C1**
		Q4	How do you leverage on lessons learned from the use of this S/SEE on other programs? **C2**
		Q5	Is there a mechanism for collecting S/SEE usage data and analyzing the effects of the S/SEE on software quality and productivity? If so, are the results of this data collection used in the definition of the program's S/SEE? **C2**

5	Organizational Resources and Program Support
5.7	System/Software Engineering Environment (S/SEE)
5.7.2	S/SEE Components

C1	The S/SEE components support the program's software engineering development and management requirements, functions, methodologies, and activities. **Q1 Q2 Q3**	**Q1**	Which software engineering development and software management requirements functions, methodologies, and activities are supported by the S/SEE and how? **C1**
C2	The S/SEE components are mature and well documented. New tools are determined through systematic evaluation to meet program needs. **Q4**	**Q2**	Describe how the hardware (configuration, hosts, targets, workstations, networks, disks, memory devices, and systems, etc.) and associated operating systems support program needs in terms of location, number of users, volume of computation, and compatibility with other contractors. **C1**
C3	The selected compiler has been benchmarked against program needs in terms of specific domain and application requirements and functions. **Q5 Q6**	**Q3**	Describe how each tool in the S/SEE supports the software development process functions and methodologies selected for the program. **C1**
C4	The S/SEE components are selected to provide maximum commonality in support of an integrated development across team members, whenever prime/subcontractor teaming arrangements exist. **Q7**	**Q4**	For each tool in the S/SEE, describe its functionality, its maturity, the quality of its documentation, and how it will be supported during the program. Explain the rationale for selecting new (not yet matured) tools and how confidence is established in the ability of these new tools to meet program needs. Describe the S/SEE as an integrated whole and explain how the S/SEE will efficiently and effectively perform its intended function. **C2**
		Q5	Describe your efforts in testing the selected implementation language compiler(s). **C3**
		Q6	Describe your efforts in benchmarking the selected compiler relative to the specific program application and domain needs. Have any guidelines been generated for use of the compiler on the program (special language features, run-time system interface, interface with other languages, etc.)? **C3**
		Q7	Are all components of the S/SEE common across all members of the bidding team? Identify those that are not and provide a rationale for selecting them. **C4**

5	Organizational Resources and Program Support
5.7	System/Software Engineering Environment (S/SEE)
5.7.3	S/SEE Architecture

C1	The S/SEE is extendible, easy to use, and well integrated. **Q1 Q2 Q3**	**Q1**	To what level are the components of the S/SEE integrated? **C1**
C2	The S/SEE memory utilization and throughput meet program requirements. **Q4 Q5**	**Q2**	Is there a common user interface to all the services provided by the S/SEE? **C1**
C3	The S/SEE security capabilities meet program requirements. **Q6**	**Q3**	Describe the mechanism for adding new tools to the S/SEE. **C1**
		Q4	What indicators are used to monitor memory utilization and throughput of the S/SEE? **C2**
		Q5	Describe the process for regenerating each software product generated with the S/SEE (new software build, new design specification, new requirements specification, etc.) after an update has been made. Estimate the time duration based on software size similar to this program. **C2**
		Q6	Describe the S/SEE security provisions and how they are used to manage unwanted intrusions and to protect information, consistent with the program's requirements. **C3**

5	Organizational Resources and Program Support
5.7	System/Software Engineering Environment (S/SEE)
5.7.4	S/SEE Maintenance and User Support

C1	A process exists to ensure that S/SEE problems are identified and corrected, and that changes to the S/SEE do not adversely impact the program. **Q1 Q2 Q3**	**Q1**	How are problems with the S/SEE reported and corrected? **C1**
C2	A process exists to ensure that the program's S/SEE users are adequately trained and supported. **Q4 Q5**	**Q2**	How are changes to the S/SEE managed and controlled? **C1**
		Q3	Describe the process of determining what portions of the S/SEE must be recompiled when a component of the S/SEE is modified. When a change is made to the S/SEE, how is the potential impact on the program determined? **C1**
		Q4	Who has the responsibility to support the program's S/SEE users in their daily use of the S/SEE? How is this support managed? **C2**
		Q5	Are there training courses on how to use the S/SEE? **C2**

5	Organizational Resources and Program Support
5.7	System/Software Engineering Environment (S/SEE)
5.7.5	Deliverable S/SEE

C1	The S/SEE needed in the field to support all of the deliverables has been identified. **Q1**	**Q1**	What S/SEE services will be needed in the support phase of the program? **C1**
C2	The installation and support of the deliverable S/SEE has been planned. **Q2**	**Q2**	What resources will be needed for installing the deliverable S/SEE? Have they been planned? **C2**
C3	All restrictions on the use of the S/SEE or its components have been identified, and are consistent with the life-cycle support requirements identified in the program's Request for Proposal. **Q3 Q4**	**Q3**	Describe your plans for supporting the deliverable S/SEE. **C3**
		Q4	Are there any restricted rights, licensing, or other restrictions on delivering any components of the S/SEE? **C3**

Functional Area 6: Program Specific Technologies

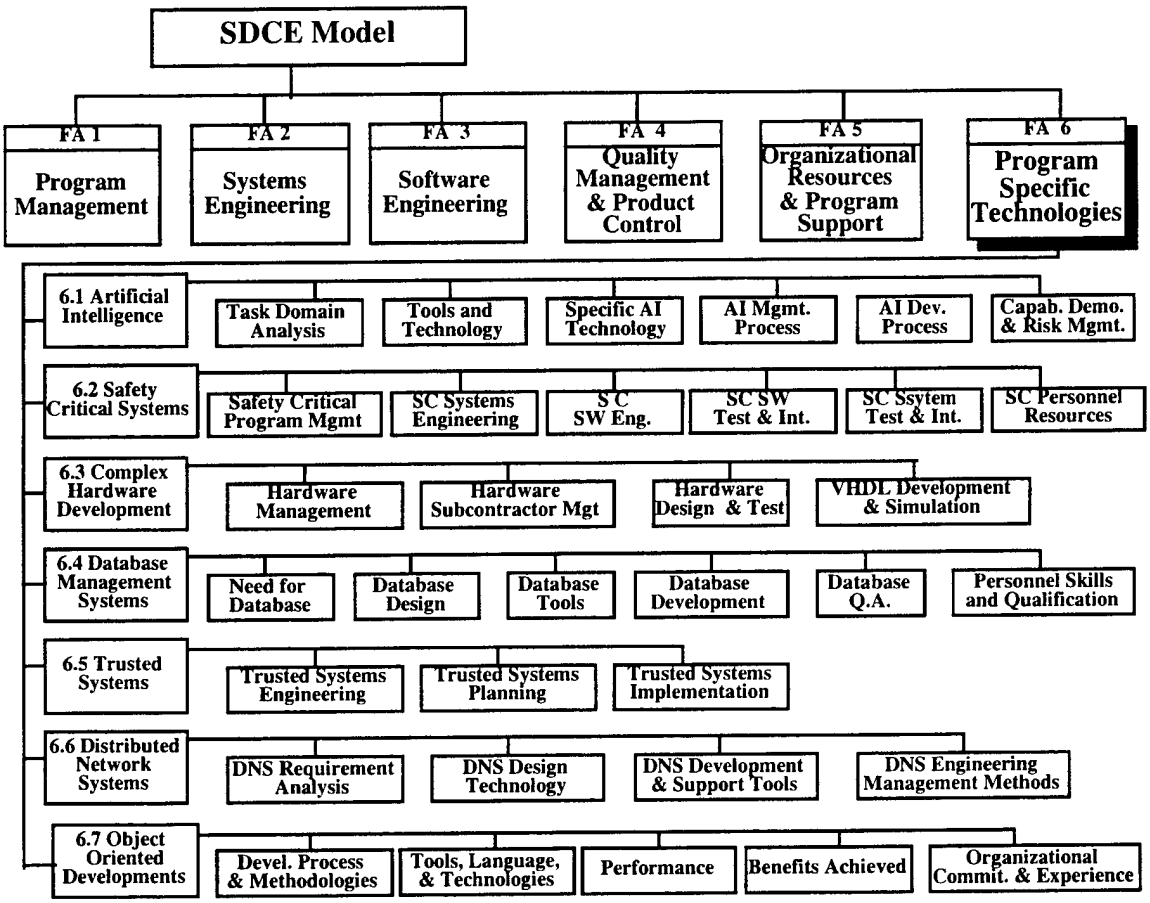

Figure 8. Program Specific Technologies

6	Program Specific Technologies	
6.1	Artificial Intelligence (AI)	
6.1.1	AI Task Domain Analysis	
C1	The contractor demonstrates an understanding of the requirements it is proposing to implement with AI technology. **Q1**	**Q1** Characterize the problem that the AI implementation (system) addresses. **C1**
C2	The contractor demonstrates an understanding of the functional characteristics of the problem to which AI technology will be applied. **Q2**	**Q2** What is the input/output behavior of the system? Can a sample dialog/script/trace be provided? **C2**
C3	The contractor understands the time and space constraints under which the AI implementation will operate (including development and operational constraints). **Q3**	**Q3** What are the operational time and space constraints for the proposed system? **C3**
C4	The contractor is familiar with state-of-the-art literature on similar systems. **Q4**	**Q4** Describe the current academic, industrial, commercial, and Government approaches to implementing similar systems. **C4**
C5	The contractor has past experience with AI solutions of the class they propose. **Q5**	**Q5** Describe any previous experience with implementing AI solutions of the class proposed. **C5**

6	Program Specific Technologies
6.1	Artificial Intelligence (AI)
6.1.2	AI Tools and Technology

C1 The contractor demonstrates an understanding of the technology they are proposing, competing technologies, and justification of their chosen technology. **Q1 Q2 Q3**	**Q1** What are competing approaches to implementing the AI solution? **C1**
C2 The contractor proposes and has the tools available to perform statistical analysis of the system behavior (e.g., number of rule firings, rule competitions, length of reasoning chains) or identifies plans for acquiring the tools. **Q4**	**Q2** Why is the proposed approach superior to competing approaches? **C1**
C3 The contractor has experience with any proposed commercial off-the-shelf (COTS) tools, or access to experience. **Q5 Q6**	**Q3** What are the limitations of the proposed approach? Are there special circumstances for which the proposed approach will not work? **C1**
C4 The contractor demonstrates an understanding of the canonical form of knowledge in the system (e.g., rules, frames, networks), and employs taxonomy for the types of knowledge used by the system. **Q7 Q8 Q9**	**Q4** Describe the reporting facilities of the proposed statistical analysis tools, the type of statistical data that the tools produce, and how that information will be used during development. **C2**
C5 A process exists for analysis of system behavior and verification and validation of the operational implementation. **Q10 Q11**	**Q5** Describe any previous experience with the proposed COTS products. In the absence of previous experience, provide the sources of expertise that will be applied to this program. **C3**
C6 The contractor has identified all of the tools necessary to develop the AI software. **Q12 Q13 Q15 Q16**	**Q6** Why were the particular COTS products selected? What other COTS products exist for the task, and how are the selected products superior? **C3**
C7 All of the tools exist and have been successfully used by the offeror. **Q14 Q15 Q16**	**Q7** What is the form of knowledge in the proposed AI implementation? Is there a taxonomy of knowledge classes that the system uses? **C4**
	Q8 Describe the knowledge engineering approach for the proposed AI implementation. Describe any previous experience in developing a knowledge base using this engineering approach. **C4**
	Q9 What is the form of knowledge selected and how is it superior to other knowledge representation formalisms? **C4**
	Q10 Describe the best and worst case performance expectations for the proposed AI implementation. **C5**

6 Program Specific Technologies 6.1 Artificial Intelligence (AI) 6.1.2 AI Tools and Technology (Cont'd)	
	Q11 Describe methods for verification and validation of the operational implementation. **C5** **Q12** Identify the tools that comprise the proposed AI tool set. Describe the established tool set selection criteria. **C6** **Q13** Is this tool set complete relative to supporting the subject AI software development? If not, what tools are missing? How will these be acquired in time to support the development? **C6** **Q14** Describe any experience with the proposed tool set. Also describe the level of maturity of the proposed tool set. **C7** **Q15** Identify any limitations of the tool set and plans to work around these limitations. **C6 C7** **Q16** Identify any program-specific enhancements planned for any of the tools. **C6 C7**

6	Program Specific Technologies	
6.1	Artificial Intelligence (AI)	
6.1.3	Specific AI Technology	
C1	(Expert Systems) The contractor has access to experts from which the expertise can be extracted. **Q1 Q2**	**Q1** Describe the sources and methods used to acquire expert knowledge. **C1**
C2	(Rule-based System) The contractor demonstrates an understanding of why a rule-based approach is suitable for its problem (as opposed to an algorithmic approach). **Q3 Q4**	**Q2** Describe methods for modifying the existing knowledge base as new knowledge becomes available. **C1**
C3	(Off-line Training) The contractor can provide sufficient training data (including the source of the data and how well the data mirrors the distribution of operational input). **Q5 Q6**	**Q3** Why is a rule-based approach better than an algorithmic approach? **C2**
C4	(Neural Networks) The contractor can identify the type of learning that the network will perform, and the equations that will be used by the connectionist units. **Q7**	**Q4** What are the projected cost savings for using a rule-based approach over conventional programming techniques? **C2**
C5	(Neural Networks) The contractor can identify the encoding of input and output data on feature vectors. **Q8**	**Q5** What is the source of training data? How does it correspond to input that the system will see operationally? How is it determined that the system will not overtrain on the training data? **C3**
C6	(Genetic Algorithms) The contractor has defined the evaluation procedures and how generations are constructed. **Q9**	**Q6** Describe the procedure for generating training data. Describe the process for establishing the criteria for how well the system performs on testing data. Relate these criteria to operational usefulness. **C3**
C7	(Genetic Algorithms) The contractor has defined how the evaluation function relates to operational performance. **Q10**	**Q7** Describe the type of connectionist network proposed, and the equations for weight modification and node firing. **C4**
C8	(Machine Learning Systems) The contractor demonstrates an understanding of when and what the system learns, and how the learned information is evaluated and used. **Q11**	**Q8** How is input and output data encoded for use by the network? **C5**
C9	(Search Algorithms) The contractor demonstrates an understanding of the time and space requirements of the search procedure. **Q12**	**Q9** What percentage of the population is used to construct the next generation? What mutation functions are used, and what percentage of a population is mutated? Describe the evaluation function, including how the genome is encoded. **C6**

6	Program Specific Technologies
6.1	Artificial Intelligence (AI)
6.1.3	Specific AI Technology (Cont'd)

C10	(State Space Search) The contractor demonstrates an understanding of the state space representation of the problem space. **Q13**	**Q10**	How does the evaluation function relate to operational performance (i.e., if the evaluation is .9, does that mean that the system will work 90% of the time?) **C7**
C11	(Heuristic Search) The contractor has demonstrated that their proposed search technique is admissible (always finds an answer), or optimal (always finds the best answer). **Q14**	**Q11**	What new knowledge does the system acquire? Describe the learning method. Is learning done off-line or operationally? How does the system validate learned knowledge? **C8**
C12	(Case-Based Reasoning) The contractor demonstrates an understanding of the representation of a case, the indexing scheme for cases, and how cases are compared, modified, and evaluated. **Q15**	**Q12**	What are the time and space characteristics of the search procedure? **C9**
C13	(Model-Based Reasoning) The contractor demonstrates an understanding of the representation of a model, and how the model is used to evaluate assertions of system performance. **Q16**	**Q13**	What is the representation of a node in the problem space? What are the operations/moves/arcs to move through the state space? Is the state space a tree or a graph? **C10**
C14	(Logic) The contractor demonstrates an understanding of the type of logic being proposed, and the proof procedure for formulas. **Q17**	**Q14**	Is the search algorithm admissible? Optimal? **C11**
C15	(Logic) The contractor demonstrates an understanding of the axioms used by the logic. **Q18**	**Q15**	What is the representation of a case? How are cases indexed, compared, modified, and evaluated? **C12**
C16	(Fuzzy Logic) The contractor demonstrates an understanding of the motivation and advantages of using fuzzy logic, and the overhead involved. **Q19**	**Q16**	How is the model represented? What methods are used to evaluate model performance? **C13**
		Q17	What type of logic is being proposed, and what is the proof procedure used to prove formulas? **C14**
		Q18	What are the axioms? What theorems have been proved about the axiom set? **C15**
		Q19	What advantages does fuzzy logic have over conventional logic for the proposed solution? What overhead does the calculation of fuzzy values add? What method is used for propagating values? **C16**

6	Program Specific Technologies
6.1	Artificial Intelligence (AI)
6.1.4	AI Management Process

C1 The contractor has a documented process for the engineering management and development of AI software and systems. **Q1 Q2 Q3**	**Q1** Describe the process for managing the AI development effort. **C1**
C2 The management process includes statusing and controlling mechanisms, with objective measures. **Q4 Q5**	**Q2** What specific process steps are used to manage the AI software development process? What is the role of systems engineering? **C1**
C3 A process exists to establish schedule durations, milestones, and effort allocation for the AI development effort. **Q6 Q7**	**Q3** Has the standard software development management process for AI been adapted? Describe these adaptations. **C1**
C4 The contractor has identified any unique work package requirements driven by AI development management requirements. **Q8 Q9**	**Q4** Describe the specific mechanisms proposed to status and control AI software development over the system development period. **C2**
C5 The contractor has a process for estimating software size which is based on actual AI software development experience. **Q10 Q11**	**Q5** Describe how the AI development progress will be measured and assessed to include analysis, requirements definition, design, code implementation, integration, and test. **C2**
C6 The AI technology necessary to develop the subject program exists and has been successfully applied by the contractor. **Q12 Q13**	**Q6** How are schedule durations of the AI development and its impact on the total program schedule determined? **C3**
	Q7 Describe the milestones, periods, and software effort allocated over the AI software development schedule. **C3**
	Q8 Has the definition and implementation of work packages for the AI software development effort been modified compared to the standard process? If so, describe the work packages intended to be used to plan, define, control, and status the development effort and why they have been modified. **C4**
	Q9 Identify the milestone product completion criteria for the various phased products relative to work completion. **C4**
	Q10 Describe the management approach to estimating the size of the AI software development effort. Identify any experience base used for this estimate. Describe how the estimating process reflects actual completed AI software development efforts. **C5**

6 6.1 6.1.4	**Program Specific Technologies** **Artificial Intelligence (AI)** **AI Management Process (Cont'd)**
	Q11 Recognizing that AI program size is not reflected in the empirically derived estimating models, how are estimates established for each of the items below? • Program size • Effort required • Development schedules • Distribution of effort over the schedule • Cost **C5** **Q12** Identify any management concerns with the status of AI technology relative to developing software within the subject program baseline. **C6** **Q13** What are the specific strategies to manage the risk associated with AI technology? **C6**

6 Program Specific Technologies 6.1 Artificial Intelligence (AI) 6.1.5 AI Development Process	
C1 The contractor has an engineering process for AI software development that is documented and has been successfully applied on past AI development programs. **Q1 Q2 Q3**	**Q1** Describe the overall AI development approach. Identify each step in the process, and the products of each step. **C1 C2**
C2 The engineering process for AI software development includes: • a systems engineering top-level architectural/design phase • measurable milestones with completion criteria • documentation of intermediate steps and final product design disclosure • analysis, requirements definition, design, code, test, and integration • capturing and retaining the rationale behind AI design decisions **Q1 Q4 Q5 Q6**	**Q2** Identify any changes to the traditional software development process as a result of using AI technology. **C1**
C3 The AI software/system development process includes a comprehensive verification methodology and phase to validate that (e.g.), the expert system meets the specified performance. **Q7**	**Q3** Has the development process been verified through previous development, prototype development, or Independent Research and Development? **C1** **Q4** Describe how the rationale behind the AI design decisions will be captured and retained. **C2** **Q5** Identify any special test levels unique to the AI applications. **C2** **Q6** Describe any special test facilities and resources required that are unique to AI applications. **C2** **Q7** How does the AI software/system development process validate AI system performance? **C3**

6	Program Specific Technologies
6.1	Artificial Intelligence (AI)
6.1.6	Personnel Skills and Qualifications for AI

C1	The contractor has the necessary AI skills and experience to accomplish the AI software and system development. **Q1 Q2 Q3 Q4 Q5**	**Q1**	Identify any staff AI development skills. Discuss all necessary AI skills to execute the subject AI development effort. **C1**
C2	The contractor's AI skills and experience are relevant to the subject program application. **Q6**	**Q2**	How were these AI skills acquired? **C1**
C3	A comprehensive AI training program exists that is sufficient to develop and maintain the skilled personnel for the subject program. **Q7 Q8 Q9 Q10 Q11**	**Q3**	How is AI proficiency measured and evaluated in the various skills required? **C1**
C4	The contractor has the skilled and experienced personnel available to perform development within the subject program baselines. **Q12 Q13 Q14**	**Q4**	Describe the corporate/division experience with actual application of AI. **C1**
		Q5	Describe any experience with the defined development activities and phases. **C1**
		Q6	Explain why the referenced AI experience is relevant and provides a basis for the subject program development. **C2**
		Q7	Describe the training program followed to train personnel in AI. **C3**
		Q8	Identify the total length of the training period and the subjects covered. **C3**
		Q9	Does the training provide technical and management coverage ? Explain. **C3**
		Q10	Is AI training required for all members of the staff? **C3**
		Q11	How is proficiency developed following the initial training? **C3**
		Q12	Demonstrate that sufficient AI-trained and -proficient personnel are available. How many are required throughout the development? **C4**
		Q13	From where are these personnel coming? **C4**
		Q14	What contingency provisions exist if enough personnel are not available? **C4**

6	Program Specific Technologies	
6.1	Artificial Intelligence (AI)	
6.1.7	AI Capability Demonstrations and Risk Management	
C1	The contractor has planned specific demonstrations to establish that AI technology and related tools exist in a form sufficiently mature and dependable to perform the subject program AI software development. **Q1 Q2**	**Q1** Describe planned demonstrations to establish the AI tools, capability and approach to this development program. **C1**
C2	The contractor has documented risk management methods to ensure a successful development effort within the subject program baselines. **Q3 Q4 Q5 Q6 Q7**	**Q2** What are the schedules and criteria for these demonstrations? **C1**
		Q3 Describe any shortfalls or deficiencies seen in the AI technology base to support the development effort. **C2**
		Q4 What backups, provisions, and contingency plans exist to compensate for these shortfalls? **C2**
		Q5 Recognizing AI as an evolving technology, what risks exist in developing the subject program using AI within program constraints? Identify specific technical and management risks. **C2**
		Q6 Describe any defined specific risk management provisions planned for use. **C2**
		Q7 Describe the criteria used to exercise each risk management provision. **C2**

6	Program Specific Technologies	
6.2	Safety-Critical Digital Systems (SCDS)	
6.2.1	Safety-Critical Program Management	
C1	An approach is defined to account for changes to Government-furnished equipment and contractor-furnished equipment safety-critical items that impact development efforts. **Q1**	**Q1** Describe the proposed approach to accounting for changes to Government-furnished equipment and contractor-furnished equipment safety-critical items that impact development efforts. **C1**
C2	Interfaces and management agreements are proposed to facilitate communication and interaction of the development organization and other safety-critical developers/maintainers, other nonsafety-critical developer/maintainers, the subsystem Integrated Product Team (IPT) lead management functions, and the organization (IPT) responsible for management at the system level (e.g., aircraft level). **Q2**	**Q2** What formal or informal agreements exist between the development organization and other safety-critical developers/maintainers, other nonsafety-critical developer/maintainers, the subsystem IPT lead management functions, and the organization (IPT) responsible for management at the system level (e.g., aircraft level)? **C2**
C3	The safety certification process is defined in the Software Development Plan (SDP) or other appropriate vehicles. **Q3**	**Q3** Is the safety certification process defined in the SDP? If not, describe the vehicle used to define the certification process. **C3**
C4	The proposed schedule estimation and definition system accommodates the safety-critical development activities defined by the contractor. **Q4**	**Q4** How is it ensured that the schedule will accommodate all safety-critical activities required? **C4**

6	Program Specific Technologies	
6.2	Safety-Critical Digital Systems (SCDS)	
6.2.2	Safety-Critical Systems Engineering	
C1	A process is defined to accomplish or update system-wide safety and hazard analysis. This process includes criteria for defining and identifying safety-critical elements including safety-critical subsystems, components, and software. **Q1 Q2 Q3 Q4 Q10**	**Q1** Provide the baseline definitions of safety-critical subsystems, components, and software. **C1**
C2	A process exists to assess MIL-STD-882C tasks for applicability and incorporation into organizational standards and procedures. **Q5**	**Q2** Describe the approach and processes to accomplish a system-wide safety analysis. Describe the process and criteria for identifying safety-critical subsystems, components, hardware, and software. What criteria are used to identify safety-critical functions at the system and subsystem level? Describe the approach to updating and maintaining any existing safety hazard analyses. **C1**
C3	A process exists to incorporate the results of system-wide hazard analyses into specific system safety requirements for software development including system, subsystem, and software specifications. **Q6 Q11**	**Q3** Describe the software hazard analysis process performed on safety-critical software. How are identified hazards associated with software assessed for hazard severity and probability of occurrence? **C1**
C4	A mechanism is defined to identify system and software functions that are essential to safe operation. Criteria for establishing critical elements and associated testing are defined. **Q7**	**Q4** Describe the process to ensure that all flight-critical/safety-critical functions and systems have been identified. **C1**
C5	A process is used to ensure that design changes account for and do not violate existing safety analyses and trade studies. **Q8**	**Q5** How are the software safety tasks identified in MIL-STD-882C, System Safety Program Requirements, assessed for applicability? Which tasks are included in the organizational standards and procedures? Identify any differences between these standards and procedures and MIL-STD-882C. **C2**
C6	A process exists that defines how system/subsystem component qualification/requalification with actual hardware and the latest operational version release of software is performed. A process is defined to qualify/requalify software associated with hardware modifications that affect software performance/timing/sizing. **Q9**	**Q6** How are the results of system-wide hazard analyses transformed into specific system safety requirements for software development? **C3**

6	Program Specific Technologies
6.2	Safety-Critical Digital Systems (SCDS)
6.2.2	Safety-Critical Systems Engineering (Cont'd)

C7 The process for performing and updating fault trees, failure mode effects analysis (FMEA) and failure mode effects and criticality analysis (FMECA) is defined. Mature tools are available and experience using these tools is demonstrated. **Q10**	**Q7** Describe how the functions that are essential to safe operation are determined. What criteria are used to determine the flight-critical areas and the associated testing required? What criteria establish a function as being critical? **C4**
C8 A system/subsystem architectural analysis process is used to verify that the architecture meets identified system-level safety requirements. **Q12**	**Q8** Describe the mechanisms you have established to ensure that design changes account for and do not violate existing safety analyses and trade studies. Describe your approach for updating these analyses and trade studies. **C5**
C9 A process is proposed that ensures the autonomy and integrity of the SCDS. **Q13**	**Q9** Discuss the process to perform system/subsystem component qualification/ requalification with actual hardware and the latest operational version release of software. Discuss how hardware requalification will be addressed for all modifications planned. How will software qualification/requalification be managed for an associated hardware modification which affects software performance/timing/sizing? **C6**
	Q10 Have the safety-critical hardware and software components been identified? Describe the use of the safety analysis process and supporting tools such as fault trees FMEAs and FMECAs in identifying safety-critical hardware and software components at the system and subsystem level. Describe any experience in using the tools on previous developments. From these, has a subsystem safety analysis, FMEA, and FMECA been performed? Is it kept current with each modification to assess safety-critical aspects and risks? **C1 C7**
	Q11 Describe the methodology to be used to identify specific safety requirements to be integrated into the software development specification. **C3**

6 Program Specific Technologies 6.2 Safety-Critical Digital Systems (SCDS) 6.2.2 Safety-Critical Systems Engineering (Cont'd)	
	Q12 What specific process and procedures are used to verify that the top-level system/subsystem architecture meets the system-level safety-critical requirements (e.g., fault identification) fault tolerance? How does this process ensure flight-critical systems are designed with the necessary redundancy management to accommodate fault tolerant reliability specific requirements? **C8** **Q13** Describe how the top-level design approach ensures the autonomy and integrity of SCDS. How does this process identify safety-critical component interconnectivity as it relates to the identification and control of error propagation through the system? How does this process prevent contamination of safety-critical systems and components by nonsafety-critical systems? **C9**

6	Program Specific Technologies		
6.2	Safety-Critical Digital Systems (SCDS)		
6.2.3	Safety-Critical Software Engineering		
C1	A process is proposed and defined to translate and trace safety-specific system requirements into the software requirements baseline. **Q1**	Q1	Describe the specific process to translate and trace safety-specific system requirements into the software requirements baseline. Describe how traceability of these software safety-critical requirements back to their higher-level system- and subsystem-level safety-critical requirements is maintained. **C1**
C2	The identified top-level design process defines the method to verify the design against the established safety requirements, products, and completion criteria. **Q2**	Q2	What is/are the product(s) of the top-level design activity? What are the criteria for completion of the top-level design activity? Describe the process to assess whether the software design implements (satisfies) the established safety requirements. **C2**
C3	A process exists to evaluate and analyze the software design to hazardous conditions. **Q3**	Q3	Describe the process to evaluate and analyze software designs (top level and detailed level) for hazardous conditions. **C3**
C4	A process exists that continues the identification of safety-critical elements down to Computer Software Components (CSCs) and Computer Software Units (CSUs). **Q4**	Q4	Describe the process to identify safety-critical CSCs and CSUs. **C4**
C5	A process is proposed that ensures the autonomy and integrity of the structure and interfaces between safety-critical elements and nonsafety-critical elements. configuration items (CIs), Computer Software Configuration Items (CSCIs), CSCs, and CSUs. **Q5 Q6**	Q5	Describe the processes and procedures to ensure autonomy of structure and interfaces between safety-critical CSCs and CIs and nonsafety-critical CSCs and CIs. **C5**
C6	A process exists to trace safety-critical parameters within the code to the functions that modify them or to the functions that use these safety-critical parameters. **Q7**	Q6	What process is used to ensure that design changes to nonsafety-critical CSCs and CSUs do not adversely impact safety-critical CSCs and CSUs? **C5**
C7	If specific safety-critical coding standards are used, these standards are defined and verified as to compliance. **Q8**	Q7	Describe the approach to verifying that safety-critical parameters are properly traced within the code to the functions that modify them or to the functions that use these safety-critical parameters. Does this approach allow impact analyses performance to determine if modifications made to any part of the system will have some effect on critical parameters contained in safety-critical software? Does this approach facilitate mapping safety-related message paths with external interfaces? **C6**

6 6.2 6.2.3	**Program Specific Technologies** **Safety-Critical Digital Systems (SCDS)** **Safety-Critical Software Engineering (Cont'd)**
	Q8 What internal standards and procedures define the safety-critical coding standards to be applied? Which organization verifies compliance to the established coding standards? **C7**

6	Program Specific Technologies
6.2	Safety-Critical Digital Systems (SCDS)
6.2.4	Safety-Critical Software Test and Integration

C1	Regression test procedures are defined from Computer Software Unit (CSU) to Computer Software Configuration Item (CSCI) and CSCI integration, including the use of a core test process if planned. **Q1 Q10**	Q1	Describe the process for regression testing from CSU to CSCI/CSCI integration. Describe how core test cases are identified at all levels of testing for critical functions within the software and hardware. What process ensures that core tests include all portions of software testing that must be executed to ensure that operation of critical functions are safe and work as intended? **C1**
C2	Test coverage procedures are defined for unit test, including the process to execute all software instructions and branches during unit testing. **Q2**	Q2	Describe the process to ensure that all software instructions are executed during unit test. Describe the process to ensure that all branches within the unit are tested during unit test. **C2**
C3	Test coverage procedures are defined to ensure that all safety-critical software is tested at and beyond systems limits, with abnormal/erroneous conditions, as well as all transition points (e.g., mode to mode). **Q3 Q4 Q5**	Q3	What are the processes and procedures to test at and beyond the limits (in-bounds, out-of-bounds) as well as at all transition points? **C3**
C4	Integration and test procedures exist to perform timing and sizing analysis verification. **Q6**	Q4	What specific process is used to verify and assess the adequacy of the software test coverage? **C3**
C5	Test cases, descriptions, procedures, and reports are maintained and updated for each level of test from unit test to CSCI test. **Q7 Q8 Q9**	Q5	Describe the process for performing abnormal/erroneous condition testing at each level of identified testing. **C3**
C6	A process exists for determining the level of test for safety-critical components. **Q10**	Q6	Describe the process for performing timing and sizing analysis verification. Is this process contained in standard integration and test procedures? **C4**
C7	The software test planning process incorporates an analysis of whether the use of fault injection is warranted. **Q11**	Q7	Describe how unit test cases are maintained and updated during unit test. How are these test cases used for regression testing? Are these unit test cases maintained in the Software Development Folder (SDF)? **C5**
C8	A process exists to define the required target digital processor and other system hardware in the successive buildup to software integration and test. Alternative plans are defined if the required integration test hardware is unavailable. **Q12**	Q8	Which vehicles/procedures/methods are used to maintain test software descriptions and procedures for retest? Are these procedures maintained in the SDF? **C5**
		Q9	Which organization maintains the test results for each level of test? **C5**

6 Program Specific Technologies 6.2 Safety-Critical Digital Systems (SCDS) 6.2.4 Safety-Critical Software Test and Integration (Cont'd)	
	Q10 Describe the process for determining the required level of test and retest for safety-critical components. For example, if an error requiring a code change is discovered in subsystem testing, describe the levels and completeness of the retest starting at the unit level and progressing to higher levels. **C1 C6** **Q11** How is fault injection used in the validation and verification of safety-critical requirements performance? What process is used to decide if fault injection is appropriate? **C7** **Q12** Describe the use of target digital processor and other system hardware in the successive buildup of the software integration and test. In the absence of actual hardware, how are software functions that are dependent on hardware interfaces tested? **C8**

6	Program Specific Technologies	
6.2	Safety-Critical Digital Systems (SCDS)	
6.2.5	Safety-Critical Subsystem/System Test and Integration	
C1	A process exists for including established criteria to control the test article with regard to discrepancy resolution incorporation into system-level test phases such as Developmental Test and Evaluation (DT&E) flight test. **Q1**	**Q1** What criteria are established to control the test article in regard to discrepancy resolution incorporation during system-level test phases such as DT&E flight test? **C1**
C2	Processes and procedures exist to define the depth and completeness of the retest effort for each level of subsystem integration and system level testing. **Q2**	**Q2** Describe plans for retest management. Describe the process and practices which define the depth and completeness of the retest effort for each level of subsystem integration and system-level testing. **C2**
C3	A process exists to maintain configuration control of the test environment, including hardware and software, during hardware/software testing as well as higher levels of subsystem and system testing. **Q3**	**Q3** Describe how the configuration of the test environment including hardware and software is maintained and controlled for hardware/software testing as well as higher levels of subsystem and system integration and test. **C3**
C4	Integration and test procedures exist to perform timing and sizing analysis verification at the subsystem and system level. The timing and sizing analysis verification results are maintained. **Q4**	**Q4** Describe the process to perform timing and sizing analysis verification at the subsystem and system level. How are the results of this verification maintained? **C4**
C5	A process is defined to perform abnormal/erroneous condition testing at the subsystem and system level. **Q5**	**Q5** Describe the process for performing abnormal/erroneous condition testing at the subsystem and system level. Is Failure Modes Evaluation Testing (FMET) used? **C5**
C6	Regression test procedures are defined for hardware/software integration, subsystem test and integration, and system test, including the use of a core test process, if planned. **Q6**	**Q6** What plans exist for regression testing from subsystem to system level? Describe how core test cases are identified at all levels of testing for critical functions within the system. What process ensures that core tests include all portions of system testing that must be executed to ensure that operation of critical functions are safe and work as intended? **C6**
C7	The software development/generation process facilitates updates to safety-critical systems without the use of object code patches. The process for accomplishing this is defined and ensures that patches are not promulgated into safety-critical software. **Q7**	**Q7** How does the software development process preclude the use of object code patches at any level relative to SCDS software? How are changes to the software during development and test accomplished to ensure that patches are not promulgated into flight- and safety-critical software? **C7**

6 Program Specific Technologies 6.2 Safety-Critical Digital Systems (SCDS) 6.2.5 Safety-Critical Subsystem/System Test and Integration (Cont'd)	
C8 Test cases, descriptions, procedures, and reports are maintained and updated for each level to test during subsystem and system test. Processes exist that define how the test cases, descriptions, procedures and reports are used for regression testing. **Q8**	**Q8** Describe how subsystem/system test descriptions, procedures, and cases are maintained during subsystem and system test. How are these procedures used for regression testing? **C8**
C9 An approach to ensure adequate subsystem development team involvement and support of system-level integration and test activities for SCDS is defined. This approach defines the subsystem development team involvement in the following levels of system integration and test: • System integration laboratory testing • Dynamic simulation testing • On-system ground test • Flight tests **Q9**	**Q9** Describe the approach to ensure adequate subsystem development team involvement and support of system-level integration and test activities for SCDS covering the following levels: **C9** • System integration laboratory testing - Static environment testing - Interface compatibility - Communication/timing - Operability • Dynamic simulation testing - Operational (actual) hardware/software - High fidelity environmental/simulation models - FMET - Performance/operational confidence tests - Interface compatibility validation • On-system ground test - System operational/compatibility/connectvity/ integration tests - Ground vibration and other ground safety checks - Electromagnetic countermeasures validation • Flight tests - Controlled envelope expansion - Test start/objectives/criteria defined - Test levels/quantities/coverage analysis process **C9**
C10 A procedure exists and is used to analyze and determine the level of fidelity required at each level of subsystem and system test. **Q10**	**Q10** Describe the process to analyze and determine the level of fidelity required at each level of subsystem and system testing. Describe how the proposed facilities satisfy established fidelity requirements. **C10**

6	Program Specific Technologies	
6.2	Safety-Critical Digital Systems (SCDS)	
6.2.6	Safety-Critical Personnel Resources	
C1	The application-specific personnel resources needed to support the safety-critical design, development, integration, and test effort are available or a plan is defined to acquire the needed resources. **Q1**	**Q1** Are the application-specific personnel resources needed to support the safety-critical design, development, integration, and test effort available? If not, describe plans to acquire the needed resources. Address the following combinations and types depending on the application: • functional engineers including safety engineering • systems engineers with specific functional and integration experience along with a complete understanding of SCDS architecture and integration criticality. • a strong understanding of how the software functions integrate with the subsystem/system and the software development process that must be followed to minimize changes made to SCDSs. **C1**
C2	The application-specific personnel resources available have the relevant experience, academic qualifications and programming language skills and experience required for the subject program. **Q2 Q3 Q4**	**Q2** Identify the average number of years of relevant safety-critical system development experience existing among the safety-critical development staff and contractors. **C2** **Q3** What are the academic requirements and standards for software/system safety engineers to be used in the safety-critical software development? **C2** **Q4** Describe any experience with actual application of the selected programming language to SCDS applications. How is this experience relevant for this development? **C2**

6 Program Specific Technologies 6.3 Complex Hardware Development 6.3.1 Hardware Management	
C1 A process for managing complex integrated circuit (CIC) development and procurement is described. This process includes the following: • workload estimates and budgets • development schedules and relationship to specific work packages • methods for tracking progress of individual work assignments • work assignment prioritization • budget and schedule impacts Management tools used in the requirements flowdown and design process are identified. **Q1 Q2**	**Q1** Describe the basic process used to manage CIC hardware development. **C1**
C2 A documented process for managing the flowdown of CIC hardware requirements to individual integrated circuits (ICs) is described. **Q3 Q4**	**Q2** How is the workload estimated and budgeted? How are overall schedules developed and how do they relate to specific work packages assigned to individuals? How are work assignments prioritized and what system is used to track progress of individual work assignments? How are budget and schedule impacts identified "from the bottom up" via these detail assessments? **C1**
C3 A method to coordinate hardware and software designs and resolve conflicts is implemented. **Q5**	**Q3** Identify any tools used to assist in managing of the CIC hardware requirements flowdown and design process. These may include computer-based commercial off-the-shelf packages, in-house systems, or nonautomated accountability systems. **C2** **Q4** What is the organizational structure for managing the flowdown of CIC hardware requirements to the level of individual complex ICs? **C2** **Q5** How will CIC hardware designers coordinate their designs with those of software designers via this organizational structure? How are conflicting concepts in the (hardware/software) designs surfaced and resolved? **C3**

6 Program Specific Technologies 6.3 Complex Hardware Development 6.3.2 Hardware Subcontractor Management	
C1 Management standards are imposed on subcontractors that require status reporting compatible with the in-house management information system. **Q1**	**Q1** What management standards for complex integrated circuit hardware development are imposed on subcontractors? What information is required from subcontractors to report status? In what form is this information required to be submitted (i.e., compatible with a particular commercial off-the-shelf package)? How is this information used with in-house management information to assess status of the project? How is this subcontractor information made visible/available to the Government? **C1**

6 Program Specific Technologies 6.3 Complex Hardware Development 6.3.3 Hardware Design and Test	
C1 A documented process is described to allocate design requirements to hardware and software and to identify specific complex integrated circuit (CIC) types. **Q1**	**Q1** How are design requirements, once allocated to hardware and software in general, flowed down to an identified need for a particular CIC (e.g., an application-specific integrated circuit (ASIC) or gate array)? Describe where this flowdown is documented, including documentation of the specific, detailed requirements to be met by the identified CIC. How is this flowdown process and documentation of the results made visible/available to the Government? **C1**
C2 Design validation is accomplished prior to release to fabrication. **Q2 Q3**	**Q2** Describe the process for design validation of CICs (e.g., ASICs, complex gate arrays, very high speed integrated circuits) prior to release to fabrication. This description should include identification of design tools and methodologies, hardware and/or software simulators, development of test vectors for on-board Built-in Test circuits, and any standards to be met prior to release of the IC design. **C2**
C3 In-house standards for acceptance of CIC hardware have been established. **Q4**	**Q3** Describe the process to ensure that vendor-supplied chips are designed properly with regard to tolerance buildup, timing variability, and other similar concerns. How are these design requirements documented? **C2**
C4 CIC documentation standards are established consistent with the need for long-term support and reprocurement by the program. **Q5**	**Q4** What standards exist for in-house acceptance of CIC hardware? **C3**
	Q5 Describe the documentation standards for CICs developed for this project. How is transportability of this design information to the DOD-required VHSIC Hardware Description Language ensured? How will documentation produced through these standards be sufficient to permit future design changes in IC functionality by other than the original developer? **C4**

6	Program Specific Technologies
6.3	Complex Hardware Development
6.3.4	VHSIC Hardware Description Language (VHDL)

C1 The contractor has a documented engineering process for VHDL model development that has been successfully applied on previous hardware development efforts. **Q1 Q2 Q3**	**Q1** Describe past experience with VHDL model development, including the number and scope of VHDL descriptions completed. **C1**
C2 The contractor either acquires or generates adequate references pertaining to the device or system being modeled. **Q4**	**Q2** Describe the overall VHDL design methodology. Identify each step in the process, and the products of each step. Identify where this methodology is documented. **C1**
C3 The VHDL models conform to the IEEE Standard 1076-1987 Language Reference Manual. **Q5**	**Q3** Is each physical implementation level of an electronic system described both structurally and behaviorally? **C1**
C4 The contractor employs an appropriate suite of VHDL development tools. **Q6 Q7**	**Q4** What references determine the functionality, timing, and operation of the electronic systems being modeled? Explain the typical conditions for inclusion of each of the following: military or contract specifications, Data Item Descriptions (DIDs), system-level specifications, application-specific integrated circuit (ASIC) design specifications, standard IC databooks/specifications, and hardware test plans. **C2**
C5 The VHDL development methodology includes a comprehensive validation phase to certify that the VHDL models meet their specifications. **Q8 Q9**	**Q5** How are VHDL models ascertained to comply with IEEE Standard 1076? Which VHDL analyzers are used for compilation? **C3**
	Q6 Describe the various tools routinely used for VHDL development, covering analysis, simulation, and logic synthesis. **C4**
	Q7 Are the hardware designers trained in the use of VHDL tools? **C4**
	Q8 Describe the process whereby VHDL models are tested. What constitutes specification of correct model operation? Are all aspects of functional behavior covered by a test bench? Are the test vectors written in the Waveform and Vector Exchange Specification (WAVES), IEEE Standard 1029.1-1992 format? **C5**
	Q9 Are high-level simulations carried out, as well as behavioral simulations at the card level? How are interfaces between chips simulated? What timing tests are performed? **C5**

6 Program Specific Technologies 6.4 Database Management 6.4.1 Need for Database	
C1 The contractor's processes and procedures address initial trade-off issues relating to database usage as an implementing technology. **Q1 Q2 Q3 Q4**	**Q1** What issues have been identified that indicate a need to use a database? **C1** **Q2** What attributes of databases would effectively address the issues identified? **C1** **Q3** In terms of life-cycle support, how does the support of a database in the operational mode compare to that of the alternative solution? **C1** **Q4** For a distributed or heterogeneous environment, what are the critical technical issues in database technology, and how will they be addressed? **C1**

6	Program Specific Technologies
6.4	Database Management
6.4.2	Database Design

C1	The contractor demonstrates an understanding of how to identify the best database methodology to satisfy system requirements. **Q1 Q2 Q3 Q4**	Q1	What is the selected database model type? **C1**
C2	The contractor demonstrates an understanding of how to select an acceptable data modeling methodology. **Q5**	Q2	What are the competing approaches for satisfying the system requirements? **C1**
C3	A process is defined for validating the database design. **Q6**	Q3	What are the advantages of the selected approach? **C1**
C4	The database design is developed interactively with the user. **Q6**	Q4	What are the limitations of the selected approach? **C1**
		Q5	Describe the data modeling methodology to be used. **C2**
		Q6	Describe the database model type and rationale for selection. How will the chosen database design be validated? How will the user be incorporated into the design process? **C3 C4**

6	Program Specific Technologies
6.4	Database Management
6.4.3	Database Tools

C1	The contractor demonstrates an understanding of how to identify the tools required and document the selection rationale. **Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11**	**Q1**	What is the selected database management system and why was it chosen? **C1**
		Q2	Describe any experience with this database management system. **C1**
		Q3	What are the competing commercial off-the-shelf products? **C1**
		Q4	What selected tools are available, and how will each support this system (program requirements, hardware, operating systems, user interface, interface with the selected programming language)? **C1**
		Q5	How do the selected tools support the selected database management system? **C1**
		Q6	Describe the commercial vendor's place in the market relative to other database products. **C1**
		Q7	Define the support and training available from the vendor. **C1**
		Q8	For the products selected, show the vendor's compliance to any required standards, as well as the commitment to the evolution of these standards. **C1**
		Q9	Describe the levels of security provided by the selected database tools, as needed. **C1**
		Q10	Describe any experience with the selected database tools. Describe the training required to use the selected tools. **C1**
		Q11	Are versions of the selected tools available today on all required platforms? **C1**

6	Program Specific Technologies		
6.4	Database Management		
6.4.4	Database Development		
C1	The database development process and procedures are defined in internal development standards and procedures and include internal reviews, walkthroughs, statusing, testing, and discrepancy resolution. **Q1 Q2 Q3**	**Q1**	Describe the database development processes and phases with respect to the software development. Do these phases provide a realistic schedule for the database development? **C1**
C2	The database development processes and procedures are compatible with the selected database methodology. **Q4 Q5**	**Q2**	Describe the internal review process of the database development in terms of software and requirement reviews. Who is involved? Who is ultimately responsible? How are discrepancies resolved? Define the progression of testing through internal reviews, walkthroughs, and software inspection. **C1**
		Q3	Describe how external reviews, walkthroughs, and software inspections will be carried out. **C1**
		Q4	Describe how the selected database development process is compatible with the selected database methodology. **C2**
		Q5	How is data integrity enforced during development? **C2**

6 Program Specific Technologies 6.4 Database Management 6.4.5 Database Quality Assurance	
C1 A process is defined for verification and validation of the database system. **Q1 Q2 Q3 Q4 Q5 Q6 Q7**	**Q1** Describe the methods for verification and validation of the database system. **C1** **Q2** Describe how the software releases and database releases are configured with one another. **C1** **Q3** How is the interface between the software and the database management system tested? **C1** **Q4** How is a database release version documented? Who controls releases? **C1** **Q5** How is the integrity of the data ensured and controlled? **C1** **Q6** How will spot-checks of the data by the domain experts be carried out? **C1** **Q7** What configuration control procedures are established for the database? **C1**

6	Program Specific Technologies
6.4	Database Management
6.4.6	Personnel Skills and Qualifications for Database

C1	The contractor has the necessary database skills and experience to accomplish the database software and system development. **Q1 Q2 Q3 Q4 Q5 Q6 Q7**	Q1	Identify any staff database development skills. Discuss all necessary database skills to execute the subject database development effort. **C1**
C2	The contractor's database skills and experience are relevant to program application. **Q6**	Q2	How were these skills acquired? **C1**
C3	A comprehensive database training program exists that is sufficient to develop and maintain the skilled personnel for the program. **Q7 Q8 Q9 Q10 Q11**	Q3	How is database proficiency measured and evaluated in the various skills required? **C1**
C4	The contractor has the skilled and experienced personnel available to perform the development within program baselines. **Q12 Q13 Q14**	Q4	Describe the corporate/division experience with actual application of databases to Mission-Critical Computer Resources applications. **C1**
		Q5	Describe any database experience pertaining to the defined development activities and phases. **C1**
		Q6	Explain why the referenced database experience is relevant and provides a basis to do the subject program development. **C2**
		Q7	Describe the staff training program followed to train database development skills. **C3**
		Q8	Identify the total length of the training period and the subjects covered. **C3**
		Q9	Does this training provide technical and management coverage? **C3**
		Q10	Is database development training required for all members of the staff? **C3**
		Q11	How is proficiency developed following the initial training? **C3**
		Q12	Demonstrate that sufficient database development trained and proficient personnel are available. How many are required throughout the development? **C4**
		Q13	From where are these personnel coming? **C4**
		Q14	What contingency provisions exist if enough personnel are not available? **C4**

6	Program Specific Technologies
6.5	Trusted Systems
6.5.1	Trusted Systems Engineering

C1 The contractor understands how to engineer security into its system such that it is an integral part of the overall design of the system. **Q1 Q2 Q3**	**Q1** Describe your plans, including task scheduling, staffing allocation, and personnel training, for implementing the security requirements of the proposed development. **C1**
C2 The security requirements for the system, both functional requirements and assurance requirements, are well understood by the contractor. **Q4**	**Q2** Has a security policy been defined for the proposed system? **C1**
C3 The contractor understands how to develop, operate, and maintain a secure interface between classified processes and unclassified ones. **Q5 Q6 Q7**	**Q3** Have you performed any architectural studies to establish how computer security will impact the architecture of your proposed development? **C1**
	Q4 Describe your understanding of the top-level security requirements that your system must meet, including the security modes of operation that will be used in your system, and the Trusted Computer System Evaluation Criteria level that your system must meet. **C2**
	Q5 Describe the design approach that you will use to ensure that users and processes are given access to the information and processes they need to perform their assigned functions and that they are not given privileges beyond those required to complete their assigned functions. **C3**
	Q6 Describe the design approach that you will use to minimize the amount of trusted application code in your system. **C3**
	Q7 Describe the design approach and mechanisms that you will use to ensure that classified and sensitive information is protected within components of your system, at interfaces between system components, and at interfaces between your system and external systems and networks. **C3**

6	Program Specific Technologies	
6.5	Trusted Systems	
6.5.2	Trusted Systems Planning	
C1	The contractor understands the certification and accreditation processes for Automated Information Systems that are applicable to the program (Air Force, Defense Information Agency, National Security Agency, etc.). **Q1**	**Q1** Describe your plans for ensuring that the security accreditation process will be successful. Is your plan based on any past experience with security accreditation? What accrediting agency did you work with? **C1**
C2	The contractor has a plan for supporting the program's security staffing needs consistently with the program's development schedule. **Q2**	**Q2** Describe your plans for ensuring that people with the required security experience are assigned to the program at the appropriate development phases. **C2**

6	Program Specific Technologies
6.5	Trusted Systems
6.5.3	Trusted Systems Implementation

C1	The contractor understands how to design and implement a system that meets the Trusted Computer System Evaluation Criteria (TCSEC) to the applicable TCSEC level (C1, C2, B1, etc.). **Q1 Q2**	**Q1**	Describe your experience in designing and implementing the security mechanisms that meet the applicable TCSEC requirements. **C1**
C2	The contractor understands how to test and verify high-assurance hardware and software. **Q3**	**Q2**	Describe your experience in implementing assurance mechanisms that meet the applicable TCSEC requirements. **C1**
C3	The contractor understands how to document and operate a system that meets the TCSEC to the applicable level (C1, C2, B1, etc.). **Q4 Q5**	**Q3**	Describe your experience in testing and verifying high-assurance hardware and software. How did you budget resources to support security testing and verification? **C2**
		Q4	Describe your experience in documenting your system development to the satisfaction of the applicable TCSEC requirements. **C3**
		Q5	Describe your experience in operating a trusted system to the satisfaction of the TCSEC requirements applicable to the program. **C3**

6.	Program Specific Technologies
6.6	Distributed Network-based Systems (DNS)
6.6.1	DNS Requirements Analysis

C1	The contractor understands what is involved in the analysis and modeling of DNS and has previous experience doing analysis and modeling of DNS. **Q1**	**Q1**	Describe past experiences with analyzing and modeling DNSs. What were the successes and what were the lessons learned? **C1**
C2	The contractor analyzes how DNS technology should be applied to the system. **Q2**	**Q2**	Why is DNS technology chosen to implement this system? What DNS-related needs such as autonomy, incremental expansion, or reliability are satisfied by the use of DNS technology? **C2**
C3	The contractor models the functions, behavior, and data of the system and compares alternative distributed architectures. **Q3**	**Q3**	Have you considered alternative system architectures for functions, data, and behavior? Provide justification for the selected ones. **C3**
C4	The contractor depicts the physical configuration of the system and compares it with alternative configurations. **Q4**	**Q4**	What alternative physical and logical configurations were considered? Why was the selected one chosen? **C4**
C5	The contractor's analysis considers how DNS technology influences the system's performance of the mission. **Q5**	**Q5**	How does the use of DNS technology influence the system's performance of the mission? Specifically, what are the affects of physical dispersion of functions and data, distributed synchronization, distributed failures, and distributed security on the mission? **C5**
C6	The contractor formulates a standardization policy for the system and identifies standardization processes. **Q6 Q7**	**Q6**	What purposes are achieved by the application of standardization such as cost reduction, reusability, extensibility, and interoperability to this system? **C6**
C7	The contractor analyzes how DNS-type requirements can contribute to the system's qualities at each phase of its life cycle. **Q8 Q9**	**Q7**	What standardization processes will be applied to the system? **C6**
C8	The contractor evaluates the usefulness of various distributed services for the system and evaluates the applicability of standardized distributed services. **Q10**	**Q8**	How will DNS-type requirements affect each phase of the system's life cycle, considering that different system components may simultaneously be at different life-cycle stages? **C7**
C9	The contractor establishes distributed data management requirements for all data in the system, and determines data quality requirements. **Q11 Q12**	**Q9**	How can the DNS-type requirements used for this system influence the system's qualities such as reliability, availability, failure recovery, flexibility, and extensibility? **C7**

6. Program Specific Technologies 6.6 Distributed Network-based Systems (DNS) 6.6.1 DNS Requirements Analysis (Cont'd)	
C10 The contractor defines the DNS-type performance requirements for the system and analyzes how those requirements will evolve over the lifetime of the system. **Q13 Q14**	**Q10** How does the system make use of distributed services, especially standardized distributed services such as naming, time synchronization, network security, remote operations, distributed file management and data transport? Why are they used? **C8**
C11 The contractor analyzes the system's performance requirements and determines the underlying network and station platforms requirements in order to support the users and using applications. **Q15 Q16**	**Q11** How are data qualities such as correctness, consistency, timeliness, integrity, accessibility, usefulness, availability, and efficient storage incorporated into the system? **C9**
C12 The contractor identifies the users and using applications of the DNS and analyzes how the use of DNS technology supports the users and using applications. **Q17 Q18 Q19**	**Q12** What data management strategies are applicable to the system, considering the need to maintain data quality and the need to provide for concurrent system processes? **C9**
C13 The contractor evaluates priorities among the users and uses of the system to establish priorities among DNS-type requirements. **Q20**	**Q13** What are the DNS-type performance requirements for the system such as end-to-end delay, access delay, utilization, capacity, bit error rate (BER), and quality of service? How do they derive from the system requirements? **C10**
C14 The contractor examines various modeling methods that can be used to represent the architecture of the system, and selects one that is suitable for DNSs. **Q21 Q22**	**Q14** How are the performance requirements of the system expected to evolve? **C10**
	Q15 What are the requirements for network and station platforms such as various types of computer networks, multiprocessor computers, or database servers? **C11**
	Q16 Why were the selected set of network and station platform requirements chosen? **C11**
	Q17 Who are the users and what are the using applications of the DNS? **C12**
	Q18 How well are the using applications and personnel roles supported by the use of DNS technology for this system? **C12**
	Q19 What is the usefulness of applying process reengineering, applied to the human-computer processes of the system, for the DNS-type requirements of the system? **C12**

6. Program Specific Technologies 6.6 Distributed Network-based Systems (DNS) 6.6.1 DNS Requirements Analysis (Cont'd)	
	Q20 What are the priorities and where should then be applied to the functions, data, and behaviors of this system? **C13** **Q21** What alternative modeling methods were considered for the DNS? Why was the selected one chosen? **C14** **Q22** What are the advantages and disadvantages of using object-oriented modeling (OOM)? Which OOM methodology would be best? **C14**

6. Program Specific Technologies 6.6 Distributed Network-based Systems (DNS) 6.6.2 DNS Design Technology	
C1 The contractor understands DNS technology and has previous experience with design of DNSs. **Q1 Q2**	**Q1** Describe past experiences with designing DNSs. What were the successes and lessons learned? **C1**
C2 The contractor understands and has experience with open systems concepts such as adoption of industry standards. **Q3 Q4 Q5**	**Q2** Is heterogeneity in applications types, vendors, hardware platforms, and computer network protocols applicable to this system? **C1**
C3 The contractor identifies computer networking and station technologies and requirements that form a DNS platform for the system and has an implementation approach for the system using the selected technologies. **Q6 Q7 Q8**	**Q3** Describe your experience with implementing open systems. What have been the successes and lessons learned? **C2**
C4 The contractor identifies applicable computer application architectures that meet the DNS platform requirements for the system and an initial architecture. **Q9 Q10**	**Q4** What specific standards and types of standards are applicable to the system under development? **C2**
C5 The contractor understands automated distributed systems management and designates applicable features to the system design. **Q11 Q12**	**Q5** How will standards be considered, promulgated, adopted, created, and updated during development and support of the system? **C2**
C6 The contractor's design incorporates DNS maintenance and support functions. **Q13 Q14**	**Q6** What types of computer networks and station technologies are applicable to this system? Why are they applicable? **C3**
C7 The contractor ensures achievement of the system's qualities and presents an approach for achieving data quality requirements. **Q15**	**Q7** What types of computer network requirements are needed by this system? **C3**
C8 The contractor ensures the appropriate amount of access transparency and uses appropriate DNS services for the system. **Q16 Q17**	**Q8** What is the implementation approach for the platform computer network and stations? **C3**
C9 The contractor provides for the appropriate amount of security and considers security in the use of DNS services where applicable. **Q18**	**Q9** What types of application architectures such as varieties of client-server, are applicable to the system? Why are they applicable? **C4**
C10 The contractor understands and incorporates DNS-specific characteristics applicable to the system. **Q19 Q20**	**Q10** What is the best way to implement the selected application architecture to meet the requirements for the system? **C4**

6. Program Specific Technologies 6.6 Distributed Network-based Systems (DNS) 6.6.2 DNS Design Technology (Cont'd)	
C11 The contractor has an approach for measuring and anticipating the need for expanded system capacity. **Q21**	**Q11** What are alternative system management approaches? Why is distributed system management needed or not needed for the system? **C5**
C12 The contractor provides for automated measurement and optimization of the DNS services to meet the system's performance requirements. **Q22 Q23 Q24 Q25**	**Q12** What provisions are made for the following system management areas: performance management, fault management, account management, security management, network configuration control (note: this is control of operations, not design), and network planning. **C5**
	Q13 Does the development approach integrate the development functions of the system with its support functions after it becomes operational? **C6**
	Q14 Does the development approach unify the administration of the system for all life-cycle phases? **C6**
	Q15 How will the adopted computer network technologies, application architectures, distributed systems management, backup, archiving, and recovery methods achieve quality requirements, and (particularly) data quality requirements of the system? **C7**
	Q16 How will DNS services in general and access-related services in particular such as naming, addressing, routing, and directory services be used in the system? **C8**
	Q17 What amount of access transparency is needed for the system? How will it be implemented? **C8**
	Q18 What degree of security is required for the system? How will it be implemented? **C9**
	Q19 How will the DNS services be used to implement security, considering the special security problems of DNSs? **C10**
	Q20 How will DNS-specific characteristics such as distributed file management, remote interprocess communications, load balancing, copy management, distributed resource scheduling, and distributed timing synchronization be used? **C10**
	Q21 How will upgrades or insertion of new technology be handled when there is a need to respond to increasing demands? **C11**

6. Program Specific Technologies 6.6 Distributed Network-based Systems (DNS) 6.6.2 DNS Design Technology (Cont'd)	
	Q22 Will testing, monitoring, simulation, or emulation of the distributed services be required for the DNS system? **C12** **Q23** What are appropriate goals for optimization of the DNS services? **C12** **Q24** How will DNS-related performance be measured and assessed? **C12** **Q25** What measurements are needed to optimize the system? **C12**

6. Program Specific Technologies 6.6 Distributed Network-based Systems (DNS) 6.6.3 DNS Development and Support Tools	
C1 The contractor understands tools suitable for DNSs, and has experience using tools on DNSs. **Q1**	**Q1** Describe your experience using DNS tools for development and support of DNSs. What were the successes and lessons learned? **C1**
C2 The proposed system has designed-in features to allow development and support (such as administration) tools to adequately monitor and control the system. **Q2**	**Q2** What design features should the system have that help development and support tools perform their functions? **C2**
C3 The contractor proposes a set of tools that are suitable for developing and supporting DNSs. **Q3**	**Q3** What tools do you own or plan to acquire for this system that provide for DNS partitioning of applications, including both contractor- and Government-funded ones? **C3**
C4 The contractor proposes an integrated suite of development and support tools that automatically exchange information using standards. **Q4**	**Q4** In what ways are the proposed development and support tools integrated? For instance, do they exchange information using standards such as Simple Network Management Protocol (SNMP)? **C4**
C5 The contractor's internal office automation system will be integrated with the development and support tools. **Q5**	**Q5** How does your office automation system integrate with contractor-owned and -planned development and support tools including both contractor- and Government-funded ones? **C5**
C6 The contractor proposes a set of tools to help optimize the DNS-type performance characteristics of the system. **Q6**	**Q6** How do the proposed tools perform the measurements needed to optimize the system? How do the tools help achieve optimum performance? **C6**

6.	Program Specific Technologies
6.6	Distributed Network-based Systems (DNS)
6.6.4	DNS Engineering Management Methods

C1	The contractor establishes procedures to reuse or integrate legacy components, and establishes procedures for migrating applications from legacy platforms to new ones. **Q1 Q2**	**Q1**	What procedures are established to reuse legacy components and migrate applications from legacy systems to new ones? **C1**
C2	The contractor institutes procedures to control the cost of the system and to adjust expenditures based on updated system development priorities. **Q3 Q4**	**Q2**	What methods are used to integrate legacy and newly developed portions of the system? **C1**
C3	The system design approach allows various components to be simultaneously at different life-cycle phases. **Q5**	**Q3**	What procedures are instituted to control costs and to adjust expenditures based on development system priorities which may change? **C2**
C4	The contractor has an approach for inserting new technologies in the DNS. **Q6**	**Q4**	How is a cost-benefit analysis used to guide the development and support of the system? **C2**
		Q5	What methods will be used to engineer and manage different components of the system that are simultaneously at different life-cycle phases? **C3**
		Q6	What methods are used to ease technology insertion for the DNS characteristics of the system? **C4**

6.	Program Specific Technologies
6.7	Object Oriented (OO) Developments
6.7.1	Development Process and Methodologies

C1	The contractor has selected a development process that will minimize the major process risks associated with OO developments. **Q1 Q2 Q3**	**Q1**	Describe your overall development process, how the different development activities are sequenced, the expected outputs from each activity, what percentage of the schedule is allocated to each activity, what criteria are used for proceeding from one activity to the next and who controls that decision. **C1**
C2	The contractor has demonstrated the ability to control the quality of an OO design. **Q4 Q5 Q6 Q7**	**Q2**	Describe the metrics you use for tracking and monitoring your development cost and schedule, how often they are measured and analyzed, and by whom. **C1**
C3	The contractor has demonstrated the ability to combine OO systems with non-OO systems in its development. **Q8**	**Q3**	Describe your process for controlling and coordinating requirements and design changes. **C1**
		Q4	Describe your process for defining objects, classes, and class hierarchies, and the relationships between them. **C2**
		Q5	Describe your process for defining and documenting the high-level system architecture and the static and dynamic models that will be employed in the analysis and design of the system. **C2**
		Q6	Describe your process for evaluating the quality of your design and for controlling its complexity, and the metrics used to that effect. **C2**
		Q7	Describe your process for ensuring that the soundness of the overall architecture is maintained. **C2**
		Q8	Describe any experience you may have in interfacing an OO system with legacy or commercial off-the-shelf software that is not OO. For each example, describe how you interfaced the design methodologies and the development languages associated with each system. **C3**

6. Program Specific Technologies 6.7 Object Oriented (OO) Developments 6.7.2 Tools, Language and Related Technologies	
C1 The contractor has selected development tools that are appropriate for the program. **Q1 Q2 Q3 Q4**	**Q1** Describe in tabular form the development tools that will be used on the program, what development activity they support, what methodology they support, what their origin is (Government-furnished equipment, vendor-supplied, in-house developments, etc.) and what plans you have for maintaining them. **C1**
C2 The contractor has a good understanding of the development language selected for the program. **Q5 Q6**	**Q2** Assess the maturity of each of the selected OO tools, and explain the basis for your assessment. **C1**
C3 The contractor has adequate experience with OO technologies applicable to the program **Q7**	**Q3** Describe any guidelines you have for the use of your OO tools. Describe any areas where the selected tools have weaknesses and describe your plans to mitigate them. **C1**
	Q4 Describe any studies you may have on how well the tools will scale up to the development at hand in terms of number of users, performance, and memory use. **C1**
	Q5 Describe the programming language proposed for the program, and your experience with the language and the associated compile and build tools. **C2**
	Q6 Describe any plans and associated rationale you may have for restricting the use of specific features of the language. Describe any OO constructs (e.g., multiple inheritence) you plan to use that are not directly supported by the language, and describe your plan to work around these deficiencies. **C2**
	Q7 Describe your experience with OO-related technologies such as object request brokers, object-oriented database management systems, etc. **C3**

6. Program Specific Technologies 6.7 Object Oriented (OO) Developments 6.7.3 Performance	
C1 The contractor has demonstrated the ability to control the timing overhead associated with OO developments. **Q1 Q2 Q3**	**Q1** Describe your efforts at minimizing the overhead associated with layering. **C1**
C2 The contractor has demonstrated the ability to mitigate memory management risks associated with OO developments. **Q3 Q4 Q4 Q5 Q6**	**Q2** Describe your efforts to analyze the overhead associated with message passing. Have you done an analysis of the messaging overhead expected on the program at hand? **C1**
	Q3 Describe your use of inlining functions and the associated price in memory use. **C1 C2**
	Q4 Describe your efforts to plan and manage your memory resources effectively. **C2**
	Q5 Describe your efforts to analyze the use of dynamic memory allocation. Do you have any plans for when and how to use dynamic memory allocation? What risk mitigation steps will you take if no memory is available when the allocation is done? **C2**
	Q6 Explain how garbage collection will be handled. **C2**

6. Program Specific Technologies 6.7 Object Oriented (OO) Developments 6.7.4 Benefits Achieved	
C1 The contractor has demonstrated that its use of OO methods will yield reuse benefits. **Q1 Q2 Q3 Q4 Q5**	**Q1** Describe the class libraries you have, what their origins are (in-house development, vendor-supplied, public domain, etc.), and what experience you have with them. **C1**
C2 The contractor has demonstrated that its use of OO methods will yield maintainability benefits. **Q6 Q7 Q8**	**Q2** Describe the domains your class libraries cover, and explain their applicability to the program at hand. **C1**
	Q3 Describe your process for developing and maintaining class libraries, the acceptance criteria used for configuring them, and how often they are changing. **C1**
	Q4 If multiple contractors are involved, describe your process for identifying and sharing reusable products between contractors. **C1**
	Q5 Describe the percentage of reuse you achieved on past programs and explain how that percentage is derived. **C1**
	Q6 Describe any trade-off studies you have regarding maintainability benefits resulting from your OO developments. **C2**
	Q7 Describe your experience with adding features to an OO system, and explain how the cost compares with a situation where the system was not OO. **C2**
	Q8 Describe any exprience you have with another organization maintaining OO products developed by your organization. **C2**

6.	Program Specific Technologies
6.7	Object Oriented (OO) Developments
6.7.5	Organizational Commitment and Experience

C1	The contractor has extensive experience with OO developments. **Q1 Q2 Q3 Q4**	**Q1**	Describe the other OO developments you are or have been involved in; their missions, phases (demonstration/validation, full scale development, etc.), and current status. **C1**
C2	The contractor has a good OO training program. **Q5 Q6**	**Q2**	Describe your experience with managing and developing OO systems. What percentage of your team is OO experienced and what is the level of experience in terms of number and size of programs? **C1**
C3	The contractor's decision to pursue an OO development is backed by a strong resource commitment. **Q7 Q8**	**Q3**	Describe the level of experience of your most senior OO experts and their commitment to this program. Describe your plans for deploying them. **C1**
		Q4	Describe the pool of OO experts you can draw from for the program at hand; their experience and current commitments. Describe your plans for deploying them. **C1**
		Q5	Describe the training available in the use of the selected OO methods and tools, the source of the training, and the steps taken for encouraging your personnel to obtain adequate training. **C2**
		Q6	Describe your efforts for keeping your personnel current in OO technologies. **C2**
		Q7	Explain how you will ensure that the number of software development platforms and tool licenses will remain adequate for the duration of the program. **C3**
		Q8	Explain how you will ensure that the developers have adequate support in their use of the selected tools and methodologies for the duration of the program. **C3**

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