

How to Prepare a Cost Analysis Requirements Description (CARD) Release 2.0

30 April 2004

Prepared by

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Prepared for

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

Contract No. FA8802-04-C-0001

Systems Planning and Engineering Group

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HOW TO PREPARE A COST ANALYSIS REQUIREMENTS
DESCRIPTION
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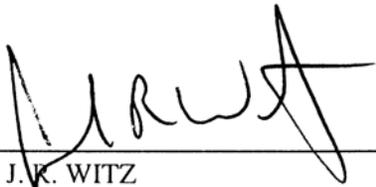
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Foreword

The purpose of this TOR is to instruct AF SMC system program office personnel in the preparation of a program specific Cost Analysis Requirements Description compliant with NSS Acquisition Policy 03-01, Paragraph AP3.6, and DoD 5000.4, Cost Analysis Guidance and Procedures.

The TOR is designed to be part of a comprehensive training program and workshop conducted for SMC SPO teams to help generate technical work products. It is not intended to be a standalone item.

Attention has been devoted to instruction on scheduling the CARD development consistent with space acquisition milestones and requirements including PSAB/DSAB and source selection. Also, a key element of the TOR addresses how information developed during the acquisition process feeds into the CARD (i.e., TRD, WBS, technical/system descriptions).

Although this particular TOR is directed towards space acquisition, the same principles apply relative to DoD 5000.2 compliant activities (Paragraph C4.5.3). It should be applied at the beginning of a program acquisition cycle as a guide for planning and developing/tailoring more program-specific plans and schedules.

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How to Prepare a Cost Analysis Requirements Description (CARD)

Release 2.0

A critical path element in systems acquisition

Center for Systems Acquisition Development
The Aerospace Corporation

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April 30, 2004



Contents/Training Topics

- Learning objectives
- Authority
- Guidance
- Definition
- General Procedures
- Special considerations
- Scoping, Development & Contents of a CARD
- Implementation
 - Critical questions
 - Critical issues
 - Expertise
 - CSAD Assistance
- Workshop

Learning Objectives

- Understand that a CARD is a critical path element in systems acquisition
- Understand what's in a CARD and its development process
 - Definition and purpose
 - Guidelines and best practices
 - Team approach
 - Schedule

Authority

- DoD Directive 5004.4, “OSD Cost Analysis Improvement Group (CAIG)”, November 24, 1992, Issued by the Assistant Secretary of Defense (ASD) for Program Analysis and Evaluation (PA&E)
- National Security Space (NSS) Acquisition Policy 03-01, October 6, 2003, Issued by the Under Secretary of the Air Force

Guidance Manual

- DoD 5000.4-M, Cost Analysis Guidance and Procedures, December 1992, ASD (PA&E)

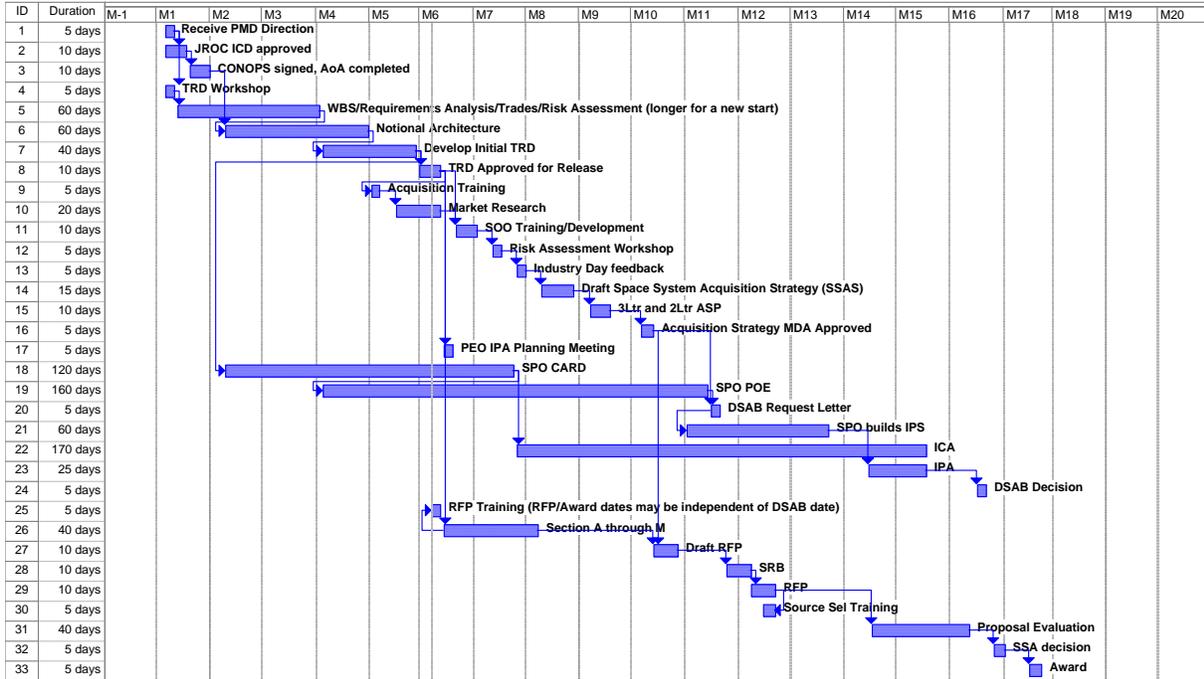
When is a CARD not needed? Do you still need a CARD when an ICA/ICE or CCA is not required?

- Not clearly stated in guidance, but can be inferred from following criteria:
 - ACAT category: required for ACAT I; might be for ACAT II (AF/Navy no mention, Army yes); ACAT III not required unless subordinate authority feels one is needed
 - If no requirement for ICA/ICE or CCA, if only one estimate is being done; however, alternative program direction, descriptive documentation may be required

What is a CARD?

- Technical and programmatic basis for cost estimates; not an actual cost estimate
- Requirements document outlining a description of program's salient features and of the system being acquired
- Cost estimates/analyses in support of acquisition milestone reviews—***schedule critical***

Notional Acquisition & Related Systems Engineering Timeline



General Procedures for Preparing and Submitting CARDs

- Prepared by the program office and approved by PEO (usually SMC/CC)
- Provided to POE estimating team (included as documentation); also basis for ICA/ICE

General Procedures for Preparing and Submitting CARDS

Joint Programs

- In the case of joint programs, the CARD should include the common program agreed to by all participating DoD Components ***and*** all unique program requirements of the participating Components

General Procedures for Preparing and Submitting CARDS

Data Collection, Analysis & Review

- Between initial strawman and final approval there is a process of data collection, analysis and review that should be documented on a separate “IPT schedule”

General Procedures for Preparing and Submitting CARDS

Schedule Relationships

- Draft CARD is due no later than 15 days after Cost Data Gathering and Analysis Plan Meeting occurs (convened by CAIG POC); CARD finalized within 1 week of DSAB request letter for KDP-A, or within 12-18 months for KDP-B and KDP-C*
- In practice, the CARD is the basis for the program office estimate (POE) and is required at the beginning of the ICA—normally 8 months before the KDP

*Source: NSS Acquisition Policy 03-01



General Procedures for Preparing and Submitting CARDS

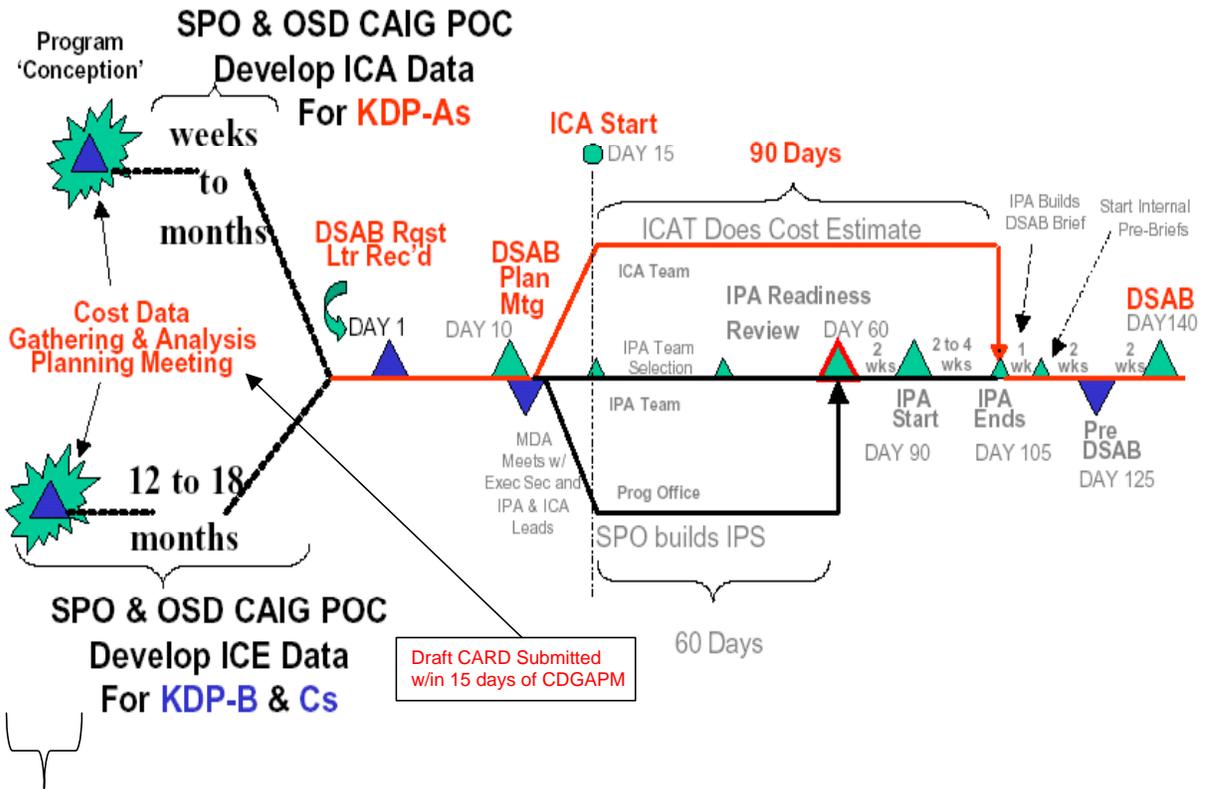
DSAB

- ICA Team must have the final CARD by DSAB Planning Meeting which occurs 10 days after request letter is received*
 - In practice, the CARD is required 8 months before the DSAB
- ICA, using final CARD, begins within 1 week after DSAB Planning Meeting*
- DSAB occurs 140 days after DSAB request letter is received*

*Source: NSS Acquisition Policy 03-01



Critical CARD Planning Events*



FINAL CARD REQUIRED 8 MONTHS BEFORE DSAB—CARD IS BASIS FOR POE & ICA/ICE

*Source: NSS Acquisition Policy 03-01

General Procedures for Preparing and Submitting CARDS

Accommodating Alternatives

- Separate CARD will may be prepared to accommodate alternatives—rarely done in practice
- CAIG is resource constrained—doesn't usually have time to spare
- Must show that an optimal alternative exists (meets threshold requirements and is affordable)
- Other approaches summarized in AoA or appendices

General Procedures for Preparing and Submitting CARDS

More on Alternatives

- CARDS can be prepared as excursions to the preferred alternative(s) or one of the other alternatives
- Each competing contractor may be required to produce a CARD description for its unique system
- Number of alternatives/CARDS will be reduced as the program moves to maturity

Special Considerations

- “Living Document” updated periodically primarily in preparation for DSAB (and program reviews)
- Level of detail available will vary depending on maturity of program
 - Must include ranges when uncertainties exist
- Cost analysts should review for thoroughness but not be authors for CARD

Special Considerations (continued)

- Program office cost analysts must be involved in iterating the design to do POE (an initial CAIV process)
- CARD is then provided to the independent CAIG for the ICE

Special Considerations (continued)

- Comprehensive and flexible
 - Must facilitate identification of all areas that could have an effect on life-cycle costs
 - Must accommodate the use of alternative estimation methodologies
 - Documentation of assumptions and inputs— references and source documents
 - Use “best assumptions” if development/production approach is not clear yet

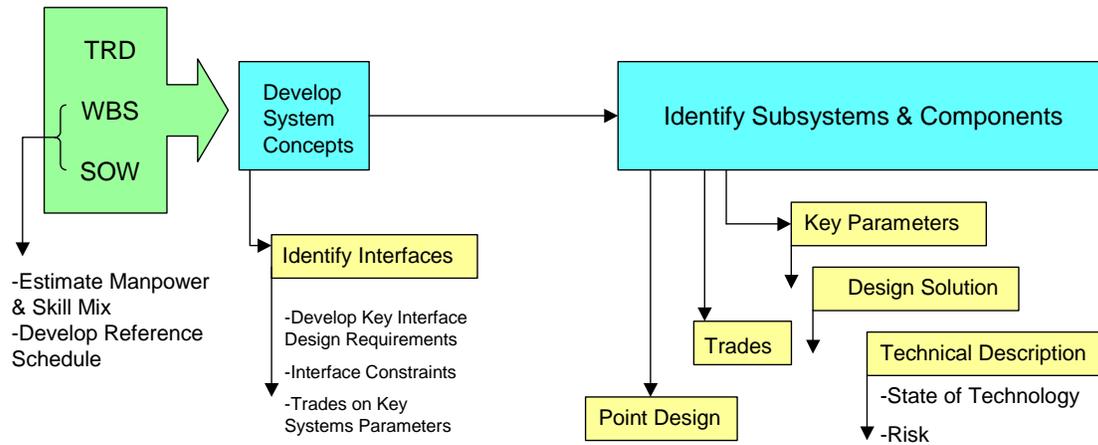
Contents of a CARD

- System Overview (most developed section)
- Risk
- System Operational Concept
- Quantity Requirements
- System Manpower Requirements
- System Activity Rates
- System Milestone Schedule & Significant Events
- Acquisition Plan and/or Strategy
- System Development Plan
- Element Facilities Requirements
- Track to Prior CARD
- Contractor Cost Data Reporting (CCDR) Plan
- Enclosures

Other CARD Scoping Factors

- Scope of the program for timeframes
- What is to be estimated
- What phases are covered
- Consideration of sunk costs, hardware, warranty, O&M, GFE, OGC requirements

CARD DEVELOPMENT: THE CONTROLLING ELEMENTS



Develop Systems Concepts

- From TRD select key functions and performance requirements
- Select key parameters that reflect performance attributes that impact mission objectives
 - Example:
 - Key parameter is coverage/resolution
 - Some attributes
 - Orbital altitude
 - Orbital inclination
 - Natural environment
 - Constellation size

Develop Systems Concepts (continued)

- Conduct parametric trades that consider the variation of attributes and the level of sensitivity to key parameters
 - Select least sensitive parameter(s) and “fix” this value
 - Iterate the most sensitive parameter and “fix” at near optimum value
- Define system point design

Develop Subsystems and Components

- From system point design
 - Identify subsystem functions and performance parameters
 - Allocate specific requirements to subsystems and components
 - Specify the state of technology and define risk
 - Conduct “trades” and select a point design

Develop Subsystems and Components (continued)

- A key consideration in selecting a point design
 - Mission life (reliability, failure rates...)
 - Risk of meeting requirements

System Overview

System Characterization

Basic Attributes

- System Description
- System Functional Relationships
- System Configuration
- Government-furnished Equipment and Property

System Characteristics

Technical & Physical Description

- Usually breakouts of weight and power at “box level” for satellites
- Additional parameters for solar arrays
- For ground elements, equipment lists—requirements for OTS items and SWAP for developed items

System Characteristics

Technical & Physical Description

(continued)

- Mil/commercial specs
 - Supplier chain
 - Bill of materials
 - Hardware descriptions
 - Software descriptions
 - OTS items
 - Parts numbers
 - Manufacturers
 - Acceptance test plan
 - Manufacturing environment that will produce product
-

Software Description

- Software Sub-elements
 - Host Computer Hardware Description
 - Programming Description
 - Design and Coding Constraints
 - Commonality
 - SLOC CSIs broken out into new, modified and reused code
- } Useful, but go beyond standard knowledge bases in SW estimating tools

Software Description (continued)

- SLOC
 - ✓ New S/W
 - ✓ Reuse S/W
 - ✓ Retest S/W
 - Programming language
 - Level of programmers required
 - Any interface requirements with current or new hardware
 - How to handle
 - ✓ Upgrades
 - ✓ Maintenance
 - ✓ Training
-

Human Performance, Systems Safety, Survivability, Security & Reference Systems

- Human Performance Engineering—MIL-STD 1472D
- System Safety—MIL-STD-882B, MIL-STD-454M
- System Survivability
- Embedded Security
- Predecessor and/or Reference System
 - Commonalities
 - Reliance on predecessor systems
 - Significant similarities and differences

System Quality Factors

“-ilities”

- Reliability (including specs/measures)
 - Maintainability (specific requirements)
 - Availability (vs. timelines)
 - Portability and Transportability
 - Additional Quality Factors
 - Test requirements
 - Test plans
 - Acceptance testing
 - Warranty requirements
-

Risk

- Program Manager's assessment of risk factors and risk management/mitigation to reduce those risks
 - Sources include: design concept, technology development, yield, test requirements, schedule, acquisition strategy (all phases), funding availability, contract stability or any other potential deviation from plan
 - Address data quality (low, med, high)
-

System Operational Concept

- Organizational Structure
- Basing and Deployment Description
- Security
- Logistics
 - Support Concept
 - Hardware Support Concept
 - Software Support Concept
- Supply
- Training

Quantity Requirements

- Identify (matrix) quantities to be developed, tested, produced, and deployed by acquisition phase and year
- Should account for maintenance, readiness (floats), peacetime attrition requirements, end item initial and replacement spares (identify separately)

System Manpower Requirements

- Should be consistent with appendices B through G of the Operating and Support Cost Estimating Guide and with projections from the Manpower Estimate Report (Part 6 of DoD 5000.2-M)
- Formal MER should be developed as program matures
 - For Phases A & B, POE usually suffices

System Activity Rates

- Defines number of operating hours per year, flight hours per month or year, operating shifts per day for each system or subsystem

System Milestone Schedule

- Gantt Chart showing major milestones by phase
 - Hardware (including production breaks and/or upgrades, etc)
 - Software (including planned upgrades, etc.)
 - Include detailed program master schedule (or excursion MPS, if alternatives exist to be evaluated) as a reference or appendix
 - Include specific element schedules, if known, with descriptions of those elements
-

Acquisition Plan and/or Strategy

- Contract Type(s), if known; only for awarded contracts existing at time of CARD
 - Rates for contractors
 - Points of contact for the contractors
 - Contractors
 - Supplier Chain
 - Fee structure for suppliers
-

System Development Plan

- Development Phases
- Development Test and Evaluation
- Operational Test and Evaluation

Element Facilities Requirements

- Test and Production Facilities
- Operational Support Facilities
- Facilities Commonality
- Environmental Impact Analysis

Track to Prior CARD

- Summarizes changes from the previous CARD
- Addresses changes in system design, program direction, and program schedule
- Notes impact of key program decisions or changes in program direction

Contractor Cost Data Reporting (CCDR) Plan

- Copy of the CCDR Plan approved for program
- If not approved, submit proposed CCDR Plan as submitted to the OSD CAIG

Critical Questions and Issues

Critical Questions

- Is there enough lead time to make DSAB?
- How many alternatives are under consideration?
- Has system been completely and adequately described for appropriate phase under consideration (consistent with TRD)?
- Have program office cost estimators reviewed document for completeness?

Critical Issues

- Launch and terminal costs included in acquisition domain
 - Service Terminal Program Office and Launch Vehicle SPO provides white papers describing what they are providing and top level estimates and comparisons to their funding
 - White papers included in CARD as appendices
-

Implementation

What Expertise is Required for the CARD Team?

- Program management
- Systems engineering & integration
- Test & evaluation
- Operations (concept & requirements)
- Understanding of cost estimating/analysis process

How Can CSAD* Help SMC ACE and the SPOs?

*Aerospace Center for Systems Acquisition Development

-
- Strategic planning for CARD development
 - Help organize technical teams—tap into Aerospace technical resources
 - Provide technical and systems engineering advice and perspective
 - Provide templates and examples for CARD development
 - Review of drafts and final documents
 - Help expedite responses to comments
-

Workshop/Assignment

- Apply mission and program specific details to produce a top level first cut at key parameters and attributes
 - Identify and perform system trades
 - Decompose to subsystem level
 - Perform subsystem trade studies
 - Reach a point design as a basis for the CARD
-

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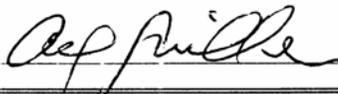
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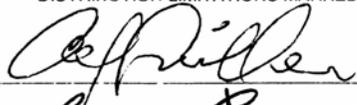
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