

The PDR presentations will be on Monday, December 4, Wednesday December 6, Friday, December 8 and Monday December 11 during regular Capstone Class Hours.

Each team has a 15 minute presentation time, 2 minutes for change over between teams.

Presentation Order will be determined by Monday, November 28.

The primary purpose of a Preliminary Design Review is for an external (outside the team) review of the design decisions that have been made, the progress to date, and the near term plans for completing the design. I have taken the content from the now unused MIL-STD-1521.

APPENDIX D

PRELIMINARY DESIGN REVIEW

This Appendix from US MIL-STD-1521 has been modified for use in CMPE450. Much of the MIL-STD-1521 material is far too detailed for the CMPE450 task. Within the body of the Appendix D material, the following designations indicate what material should be included in the PDR presentation.

(M) Mandatory – this information must be included in the PDR presentation

(P) Preferred – I'd like to see this information, but I recognize that time constraints may prevent a full discussion of this topic. Which of (P) topics is covered and the depth of the discussion is up to the various teams.

(O) Optional – This information may be included at the team's option.

(N) Not required – The presentation should not contain any information from these categories.

As part of the PDR presentation, the contractor team shall

(1) Address and resolve each of questions resulting from SRR (M) (review my notes from the SRR), and,

(2) Provide a cross reference Excel spreadsheet indicating which elements of the PDR are covered in the current presentation, which were previously covered in the SRR presentations, and which are not covered.

There's obviously too much for an 15 minute talk. Concentrate on the M items, and choose P and O items to fill your time.

The following sections from MIL-STD-1521 are provided as background material. PDR requirements are in MIL-STD-1521, Appendix D, Section 40.1 through 40.20, inclusive.

3.4 Preliminary Design Review (PDR).

This review shall be conducted for each configuration item or aggregate of configuration items (CIs) to

(1) evaluate the progress, technical adequacy, and risk resolution (on a technical, cost, and schedule basis) of the selected design approach,

(2) determine its compatibility with performance and engineering specialty requirements of the Hardware Configuration Item (HWCI) development specification,

(3) evaluate the degree of definition and assess the technical risk associated with the selected manufacturing methods/processes, and

(4) establish the existence and compatibility of the physical and functional interfaces among the configuration item and other items of equipment, facilities, computer software, and personnel.

For Computer Software CIs, this review will focus on:

(1) the evaluation of the progress, consistency, and technical adequacy of the selected top-level design and test approach,

(2) compatibility between software requirements and preliminary design, and

(3) on the preliminary version of the operation and support documents.

40. Preliminary Design Review (PDR)

40.1 General.

The PDR shall be a formal technical review of the basic design approach for a configuration item or for a functionally related group of configuration items. It shall be held prior to the start of detailed design. For each configuration item the actions described below may be accomplished as a single event, or they may be spread over several events, depending on the nature and the extent of the development of the configuration item, and on provisions specified in the contract [Statement of Work](#). [some MIL-STD-1521 text deleted as irrelevant to CMPE450].

40.2 Items to be Reviewed.

The contractor shall present the following for review

An up-to-date status against your SOW schedule. What task are done and what are your plans for January?

40.2.1 HWCIs:

a. **Preliminary design synthesis of the hardware** what hardware are you using and why.

(M – show me the current state of your hardware design)

b. **Trade-studies and design studies results** (M – could have been done at SRR)

c. Functional flow, requirements allocation data, and schematic diagrams. (M - could have been done at SRR)

d. Equipment layout drawings and preliminary drawings, including any proprietary or restricted design/process/ components and information. (O)

e. Environment control and thermal design aspects (O)

f. Electromagnetic compatibility of the preliminary design (O)

g. Power distribution and grounding design aspects (O)

h. Preliminary mechanical and packaging design of consoles, racks, drawers, printed circuit boards, connectors, etc. (O)

- i. Safety engineering considerations (O except for BCI – could have been done at SRR)
- j. Security engineering considerations (O)
- k. Survivability/Vulnerability (including nuclear) considerations (N)
- l. Preliminary lists of materials, parts, and processes (N)
- m. Pertinent reliability/maintainability/availability data (N)
- n. Preliminary weight data (O)
- o. Development test data (O)
- p. Interface requirements contained in configuration item Development Specifications and interface control data (e.g., interface control drawings) derived from these requirements. (P)
- q. Configuration item development schedule (N)
- r. Mock-ups, models, breadboards, or prototype hardware when appropriate (N)
- s. Producibility and Manufacturing Considerations (e.g., materials, tooling, test equipment, processes, facilities, skills, and inspection techniques). Identify single source, sole source, diminishing source. (N)
- t. Value Engineering Considerations, Preliminary VECs and VECs (if applicable). (N)
- u. Transportability, packaging, and handling considerations (N)
- v. Human Engineering and Biomedical considerations (including life support and Crew Station Requirements). (N)
- w. Standardization considerations (N)
- x. Description and characteristics of commercially available equipment, including any optional capabilities such as special features, interface units, special instructions, controls, formats, etc., (include limitations of commercially available equipment such as failure to meet human engineering, safety, and maintainability requirements of the specification and identify deficiencies) . (O)
- y. Existing documentation (technical orders, commercial manuals, etc.,) for commercially available equipment and copies of contractor specifications used to procure equipment shall be made available for review by the contracting agency. (N)
- z. Firmware to be provided with the system: microprogram logic diagrams and reprogramming/instruction translation algorithm descriptions, fabrication, packaging (integration technology (e.g., LSI, MSI), device types (e.g., CMOS, PMOS)), and special equipment and support software needed for developing, testing, and supporting the firmware. (N)
- aa. Life Cycle Cost Analysis (N)
- ab. Armament compatibility (N)

- ac. Corrosion prevention/control considerations (N)
- ad. Findings/Status of Quality Assurance Program (N)
- ae. Support equipment requirements. (N)

40.2.2 CSCIs:

aa. **CSCI Identification** What software are you developing, and why? Briefly summarize what each software unit does. **(M)**

- a. Functional flow. The computer software functional flow embodying all of the requirements allocated from the Software Requirements Specification and Interface Requirements Specification(s) to the individual Top-Level Software Units (TLSU) of the CSCI. (P – could have been done at SRR)
- b. Storage allocation data. This information shall be presented for each CSCI as a whole, describing the manner in which available storage is allocated to individual TL SW Units. Timing, sequencing requirements, and relevant equipment constraints used in determining the allocation are to be included. (O)
- c. Control functions description. A description of the executive control and start/recovery features for the CSCI shall be available, including method of initiating system operation and features enabling recovery from system malfunction. (O)
- d. CSCI structure. The contractor shall describe the top-level structure of the CSCI, the reasons for choosing the components described, the development methodology which will be used within the constraints of the available computer resources, and any support programs which will be required in order to develop/maintain the CSCI structure and allocation of data storage. (N)
- e. Security. An identification of unique security requirements and a description of the techniques to be used for implementing and maintaining security within the CSCI shall be provided. (N)
- f. Re-entrancy. An identification of any re-entrancy requirements and a description of the techniques for implementing re-entry routines shall be available. (N)
- g. Computer software development facilities. The availability, adequacy, and planned utilization of the computer software development facilities shall be addressed. (N)
- h. Computer software development facility versus the operational system. The contractor shall provide information relative to unique design features which may exist in a TLCSC in order to allow use within the computer software development facility, but which will not exist in the TLCSC installed in the operational system. The contractor shall provide information on the design of support programs not explicitly required for the operational system but which will be generated to assist in the development of the CSCI(s). The contractor shall also provide details of the Software Development Library controls. (N)
- i. Development tools. The contractor shall describe any special simulation, data reduction, or utility tools that are not delivered under the terms of the contract, but which are planned for use during software development. (N)
- j. Test tools. The contractor shall describe any special test systems, test data, data reduction tools, test computer software, or calibration and diagnostic software that are not deliverable under terms of the contract, but which are planned for use during product development. (N)
- k. Description and characteristics of commercially available computer resources, including any optional capabilities such as special features, interface units, special instructions, controls,

formats, etc. Include limitations of commercially available equipment such as failure to meet human engineering, safety and maintainability requirements of the specification and identify deficiencies. (N)

l. Existing documentation (technical orders, commercial manuals, etc.) for commercially available computer resources and copies of contractor specifications used to procure computer resources shall be made available for review by the contracting agency. (N)

m. Support resources. The contractor shall describe those resources necessary to support the software and firmware during operational deployment of the system, such as operational and support hardware and software, personnel, special skills, human factors, configuration management, test, and facilities/space. (N)

n. Operation and support documents. The preliminary versions of the CSOM, SUM, CSDM, and CRISD shall be reviewed for technical content and compatibility with the top-level design documentation. (N)

o. Updated since the last review to all previously delivered software related CDRL items. (N)

p. Review considerations applicable to 40.2.1 as appropriate. (R through N, as in 40.2.1)

40.2.3 Support Equipment (SE):

Nothing in this paragraph is required for CMPE450.

a. Review considerations applicable to paragraph 40.2.1 and 40.2.2 as appropriate.

b. Verify testability analysis results. For example, on repairable integrated circuit boards are test points available so that failure can be isolated to the lowest level of repair (See Section 3 Definitions, for "Level of repair"). (N)

c. Verify that the Government furnished SE is planned to be used to the maximum extent possible. (N)

d. Review progress of long-lead time SE items, identified through interim release and SE Requirements Document (SERD) procedures. (N)

e. Review progress toward determining total SE requirements for installation, checkout, and test support requirements. (N)

f. Review the reliability/maintainability/availability of support equipment items. (N)

g. Identify logistic support requirements for support equipment items and rationale for their selection. (N)

h. Review calibration requirements. (N)

i. Describe technical manuals and data availability for support equipment. (N)

j. Verify compatibility of proposed support equipment with the system maintenance concept. (N)

k. If a Logistic Support Analysis (LSA) is not done, then review the results of SE tradeoff studies for each alternative support concept. For existing SE and printed circuit boards testers, review Maintainability data resulting from the field use of these equipments. Review the cost difference between systems using single or multipurpose SE vs. proposed new SE. Examine technical feasibility in using existing, developmental, and proposed new SE. For mobile systems, review the mobility requirements of support equipment. (N)

- l. Review the relationship of the computer resources in the system/subsystem with those in Automatic Test Equipment (ATE). Relate this to the development of Built In Test Equipment (BITE) and try to reduce the need for complex supporting SE. (N)
- m. Verify on-equipment versus off-equipment maintenance task trade study results, including support equipment impacts. (N)
- n. Review updated list of required support equipment. (N)

40.2.4 Engineering Data.

Review Level 1 engineering drawings for ease of conversion to higher levels and, if available, review Level 2 and 3 drawings for compliance with requirements. The review of engineering data, as defined in paragraph 3.15, should consider the checklist items discussed in para 100.6, as properly tailored. (N)

40.3 Evaluation of Electrical, Mechanical, and Logical Designs.

The following subparagraphs describe how the information will be evaluated.

40.3.1 HWCI.

The material of paragraph 40.2.1 above shall be evaluated to:

- a. Determine that the preliminary detail design provides the capability of satisfying the performance characteristics paragraph of the HWCI requirements.
- b. Establish compatibility of the HWCI operating characteristics in each mode with overall system design requirements if the HWCI is involved in multi-mode functions.
- c. Establish the existence and nature of physical and functional interfaces between the HWCI and other items of equipment, computer software, and facilities.

40.3.2 CSCI.

The material of paragraph 40.2.2 above shall be evaluated to:

- a. Determine whether all interfaces between the CSCI and all other configuration items both internal and external to the system meet the requirements in the CORE database.
- b. Determine whether the top-level design embodies all the requirements in the CORE database.
- c. Determine whether the approved design methodology has been used for the top-level design. (N)
- d. Determine whether the appropriate Human Factors Engineering (HFE) principals have been incorporated in the design. (N)
- e. Determine whether timing and sizing constraints have been met throughout the top level design. (N)
- f. Determine whether logic affecting system and nuclear safety has been incorporated in the design. (N)

40.4 Electromagnetic Compatibility.

The design will be evaluated to ensure, to the extent possible, that the transmissions are within the bands required by the system specifications.

40.5 Design Reliability.

[not applicable to CMPE450]

40.6 Design Maintainability.

[not applicable to CMPE450]

40.7 Human Factors.

40.7.1 The contractor shall present evidence that substantiates the functional allocation decisions. The Review shall cover all operational and maintenance functions of the configuration item. In particular, ensure that the approach to be followed emphasizes the functional integrity of the man with the machine to accomplish a system operation. (O, may use SRR Material)

40.7.2 Review design data, design descriptions and drawings on system operations, equipments, and facilities to insure that human performance requirements of the hardware Development and Software Requirements Specifications are met. Examples of the types of design information to be reviewed are:

- a. Operating modes for each display station, and for each mode, the functions performed, the displays and control used, etc. (O)
- b. The exact format and content of each display, including data locations, spaces, abbreviations, the number of digits, all special symbols (Pictographic), alert mechanisms (e.g., flashing rates), etc. (O)
- c. The control and data entry devices and formats including keyboards, special function keys, cursor control, etc. (O)
- d. The format of all operator inputs, together with provisions for error detection and correction. (O)
- e. All status, error, and data printouts - including formats, headings, data units, abbreviations, spacings, columns, etc. (O)

These should be presented in sufficient detail to allow contracting agency personnel to judge adequacy from a human usability standpoint, and design personnel to know what is required, and test personnel to prepare tests.

40.7.3 Make recommendations to update the System/Subsystem, or Software Requirements Specification and Interface Requirements Specification(s) in cases where requirements for human performance need to be more detailed. (N)

40.7.4 Review man/machine functions to insure that man's capabilities are utilized and that his limitations are not exceeded. (N)

40.8 System Safety.

[not applicable to CMPE450]

40.9 Natural Environment.

[not applicable to CMPE450]

[sections 40.10 through 40.20 deleted as irrelevant to CMPE450]