

DATA ITEM DESCRIPTION	
1. TITLE <p style="text-align: center;">SYSTEM/SUBSYSTEM DESIGN DESCRIPTION (SSDD) VERSION B</p>	2. Identification Number PPA-003461-5 25 May 2012
3. DESCRIPTION/PURPOSE OF THE SSDD <p>3.1 The System/Subsystem Design Description (SSDD) describes the architectural (conceptual) design of the system or subsystem which is the subject of the SSDD. The SSDD also may contain a description of system/subsystem external behaviour (how the system/subsystem will behave, from a user's point of view, in meeting its requirements, to the extent that the design defines behavior more detailed than, and consistent with, system requirements, and ignoring internal implementation). The SSDD may be supplemented by Interface Design Descriptions (IDDs) (see PPA-ME04-001133) for descriptions of design decisions relating to external interfaces. The SSDD may be supplemented by Database Design Descriptions (DBDDs) (see PPA-ME04-001134), for externally input databases, externally output databases, and databases internal to the system/subsystem that are not to be engineered as configuration items.</p> <p>3.2 The SSDD, with any associated IDDs and DBDDs, is used to communicate the architectural design within the design team, to design reviewers, acquirers, maintainers and modifiers, as applicable.</p> <p>3.3 Throughout subsequent sections of this DID, the term "system" should be interpreted to mean "system" or "subsystem", as applicable to the design object which is the subject of the SSDD. The resulting document should be titled System Design Description or Subsystem Design Description, as applicable.</p>	
4. APPLICATION/INTERRELATIONSHIP <p>4.1 This Data Item Description (DID) contains the format and content preparation instructions for the data product generated by the performance of design of a system at the architectural level, viz the level of detail which defines a concept of implementation, the set of system major components and their interfaces (external and internal to the system), the key characteristics of each component and the concept of interoperation of components to satisfy system requirements.</p> <p>4.2 This DID is used when the developer is tasked to define and record the architectural design of a system, excluding systems comprising only software, for which DID PPA-ME04-1132 (Software Design Description) is applicable, or only a database, for which DID PPA-ME04-1134 (Database Design Description) is applicable.</p> <p>4.3 This DID may be cited in a Statement of Requirement (SOR), Statement of Work (SOW), a Contract Data Requirements List (CDRL), within a standard invoked by a SOR or SOW, or within a plan or procedure.</p> <p>4.4 This DID incorporates and adapts some non-copyrighted material contained in the System/Subsystem Design Description DID DI-IPSC-81432 issued by the United States Government.</p>	
5. PREPARATION INSTRUCTIONS <p>5.1 General Instructions</p> <p>The term "document" in this DID means data and its medium, regardless of the manner in which the data are recorded.</p> <p>5.2 Content Requirements</p> <p>Content requirements begin on the following page. The numbers shown designate the paragraph numbers to be used in the document. Each such number is understood to have the prefix "5.2" within this DID. For example, the paragraph numbered 1.1 is understood to be paragraph 5.2.1.1 within this DID.</p>	
6. SOURCE <p>Copyright Project Performance International. This document may be reproduced and distributed without restriction except as below provided that all reproductions contain the original copyright statement in the original form and location. Derivative works may be produced provided each derivative work contains a copyright statement referring to the content in which PPI holds copyright, in a form and in a location no less prominent than the copyright statement on the original. Copies and derivative works may not be used for the delivery of training for profit.</p>	

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

1. SCOPE

This section should be divided into the following paragraphs.

1.1 Identification

This paragraph should contain a full identification of the system to which the SSDD applies, including, as applicable, identification number(s), title(s), abbreviation(s), version number(s) and release number(s). Where the system to which the SSDD applies includes variants of the system, the above information should be provided for each variant to which the SSDD applies.

1.2 Intended Use of the System

This paragraph should briefly state the intended use of the system to which the SSDD applies, relating it to any larger system of which the system which is the subject of the SSDD is to form a part. The paragraph should describe the general nature of the system.

1.3 Background

The paragraph may, if used, summarize the history of system development, operation, and maintenance (if any); and identify, as applicable, the project sponsor, acquirer, developer, user and support organizations, to any extent which aids in the use of the SSDD.

1.4 System Overview

This paragraph should summarize the architecture of the system as described in the remainder of the SSDD.

1.5 Document Overview

This paragraph should summarize the purpose and contents of the SSDD and should describe any security or privacy considerations associated with its use.

2. APPLICABLE AND REFERENCED DOCUMENTS

This section should list the number, title, revision and date of each document referenced in the SSDD. This section should also identify the source of each document not available through normal channels.

2.1 Applicable Documents

This paragraph should list each document which is invoked in whole or in part within the SSDD as a part of the design description.

2.2 Other Referenced Documents

This paragraph should list each document which is referenced in the SSDD but which does not comprise a part of the design description.

3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

This section should be divided into the following paragraphs.

3.1 Definitions

This paragraph should list alphabetically and define each word or term used in the SSDD for which reliance on dictionary definitions or usage in a relevant technical community is not appropriate. As a guide, terms which are not likely to be in the vocabulary of the intended users of the SSDD, terms which have multiple dictionary meanings but only a single SSDD meaning, specialist technical terms and terms which are used with special meanings should be defined in this paragraph.

Alternatively or additionally, this paragraph may specify by name and issue a suitable technical dictionary or other reference publication to be used in the interpretation of terms used in the SSDD and which meets the criteria above for definition of terms.

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

3.2 Acronyms

This section should list alphabetically each acronym used in the document, together with the acronym's expanded meaning.

3.3 Abbreviations

This section should list alphabetically each abbreviation used in the document, together with the abbreviation's expanded meaning, except that abbreviations within the International System (Si) system of units need not be listed.

4. SYSTEM-WIDE DESIGN DECISIONS

This section should be divided into paragraphs as needed to present system-wide design decisions (if any), that is:

- a. decisions about the system's behavioral design (how the system will behave, from a user's point of view, in meeting its requirements, consistent with but in more detail than the requirements, and ignoring internal implementation); and
- b. other system-wide design decisions affecting the selection and specification of system components, as illustrated below.

Examples of system-wide design decisions are:

- a. design decisions, within the decision envelope permitted by requirements, regarding inputs the system will accept and outputs the system will produce, including interfaces with other systems and with users (5.5.x of this DID identifies topics to be considered in this description). If part or all of this information is given in Interface Design Descriptions (IDDs), the IDDs may be invoked by reference;
Note: Interface Control Document/Description/Drawing (ICD) is a synonymous term to IDD.
- b. design decisions, within the decision envelope permitted by requirements, on system behavior in response to each input or condition, including actions the system will perform, response times and other performance characteristics, selected equations/algorithms/rules, and handling of unallowed inputs or conditions;
- c. design decisions, within the decision envelope permitted by requirements, on how system databases/data files will appear to the user (5.5.x of this DID identifies topics to be considered in this description). If part or all of this information is given in Database Design Descriptions (DBDDs), the DBDDs may be invoked by reference;
- d. selected system-wide approach, within the decision envelope permitted by requirements, to meeting safety, security, and privacy requirements;
- e. common design and construction choices for hardware or hardware-software systems, such as physical size, colour, shape, weight, materials, and markings, within the decision envelope permitted by requirements; and
- f. other system-wide design decisions made in response to requirements, such as selected approaches to providing required flexibility, availability, and maintainability.

If all such decisions are explicit in the requirements, this section should so state. System-wide design decisions that respond to requirements designated critical, such as those for safety, security, or privacy, should be placed in separate subparagraphs or otherwise be made clearly identifiable as such.

Design conventions needed to understand the design should be presented or referenced.

5. SYSTEM ARCHITECTURAL DESIGN

This section should be divided into the following paragraphs to describe the system architectural design as follows:

- a. design of the system physical architecture; and
- b. design of the system functional architecture, or an alternative useful form of logical architecture.

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

If design information falls into more than one paragraph, the information may be presented once and referenced from the other paragraphs. Any design conventions needed to understand the design, beyond those presented in 4., should be presented or referenced.

The level of detail should be sufficient for asking and answering the following questions in the positive:

- a. can this architecture, if implemented, meet all of the requirements, with a low level of risk arising from the possibility of failing to be able to do so; and, if so,
- b. is this architecture, of the alternatives, the architecture most likely to produce the most overall effective solution?

Note: For brevity, this section is written in terms of organizing a system directly into Hardware Configuration Items (HWCI)s, Computer Software Configuration Items (CSCI)s, and manual operations, but should be interpreted to cover organizing a system into subsystems, organizing a subsystem into HWCI)s, CSCI)s, and manual operations, or other technologies and variations as appropriate.

5.1 System Components

This paragraph should:

- a. identify the components of the system (HWCI)s, CSCI)s, and manual operations, as applicable). Each component should be assigned a project-unique identifier. *Note: a database may be treated as a CSCI or alternatively as part of a CSCI;*
- b. show the static (such as "consists of" and "connected to") relationships of the components. Multiple relationships may be presented, depending on the selected design methodology; and
- c. state the purpose of each component.

Note: For mechanical systems, this description may include a three-dimensional exploded diagram showing spacial relationships between components.

5.2 System Functional Architecture

This paragraph should:

- a. describe the functional architecture in terms of a set of functions, related hierarchically to system functional requirements, such that at the lowest level(s) of functions in the hierarchy, each function is able to be allocated for its performance to one, and one only, system component identified in 5.1;
- b. describe the logical sequence in which functions must be performed, together with the logic of any concurrency and/or conditional relationships between functions;
- c. describe the interfaces and associated flows of items (data items, physical items, continuous flows of liquids or gasses, etc.) between functions;
- d. associate with each allocatable function the applicable set of key performance measures and values;
- e. demonstrate consistency between the performance values associated with allocatable functions and the parent performance requirements of the system. Unallocated margins should be explicitly and quantitatively identified; and
- f. relate allocatable functions to states and modes of the system, where such relationships exist.

5.3 System Physical Architecture

This paragraph should, within the conceptual nature of architecture,

- a. identify, for each component, the function(s) in the functional architecture allocated to that component, and associated measure(s) and value(s) of performance of each function;

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

- b. identify, for each component, non-functional requirements created for and allocated to that component, and the basis for the allocation, showing consistency between the allocated requirements and the parent system requirement(s). Unallocated margins should be explicitly and quantitatively identified;
- c. identify, for each component, that component's development status/type, if known (such as new development, existing component to be reused as is, existing design to be reused as is, existing design or component to be reengineered, component to be developed for reuse, component planned for Build N, etc.) For existing design or components, the description should provide identifying information, such as name, version, documentation references, location, etc.;
- d. for each computer system or other aggregate of computer hardware components identified for use in the system, if any, describe its computer hardware resources (such as processing, memory, input/output capacity, auxiliary storage, and communications/network capacity). Each description should, as applicable, identify the configuration items that will use the resource, describe the allocation of resource utilization to each CSCI that will use the resource (for example, 20% of the resource's capacity allocated to CSCI 1, 30% to CSCI 2), and describe the conditions under which utilization will be measured.

Each description should also include, as applicable, growth capabilities, diagnostic capabilities, and any additional component capabilities relevant to the description; and

- e. present, usually by reference, a specification tree for the system, that is, a diagram or view that identifies and shows the relationships among the planned specifications for the system and the system components and interfaces.

5.4 Concept of Execution

This paragraph should describe the concept of execution among the system components. It should include diagrams and descriptions showing the dynamic relationship of the components, that is, how they will interact during system operation, including, as applicable, flow of execution control, item flow, dynamically controlled sequencing, state transitions, timing diagrams, priorities among components, handling of interrupts, timing/sequencing relationships, exception handling, concurrent execution, dynamic allocation/deallocation, dynamic creation/deletion of objects, processes, tasks, and other aspects of dynamic behavior, as applicable.

5.5 Interface Design

This paragraph should be divided into the following subparagraphs to describe the required interface characteristics of the system components. The paragraph should include both interfaces among the components and their interfaces with external entities such as other systems and users.

Note: There is no need for complete interface designs to be included in the SSDD. Rather, this paragraph makes provision for the recording of internal interface requirements decisions and system external interface design decisions necessarily made as part of system architectural design. If part or all of this information is contained in Interface Requirements Specifications (IRS) or elsewhere, these sources may be referenced.

5.5.1 Interface Identification and Diagrams

This paragraph should state the project-unique identifier assigned to each interface and should identify the interfacing entities (systems, configuration items, users, etc.) by name, number, version, and documentation references, as applicable. The identification should state which entities have existing interface characteristics (and therefore impose interface requirements on interfacing entities) and which are being developed or modified (thus having interface requirements imposed on them). One or more interface diagrams should be provided, as appropriate, to depict the interfaces.

5.5.x (Project-Unique Identifier of Interface)

This paragraph (beginning with 5.5.2) should identify an interface by project-unique identifier, should briefly identify the interfacing entities, and should be divided into subparagraphs as needed to describe the interface characteristics of one or both of the interfacing entities consistent with the conceptual nature of architecture. If a given interfacing entity is not covered by this SSDD (for example, an external system) but its interface characteristics need to be mentioned to describe interfacing entities that are, these characteristics should be stated as assumptions or as "When [the entity not covered] does this, [the entity that is covered] will". This paragraph may reference other documents (such as data dictionaries, standards for protocols, and standards for user interfaces) in place of stating the information here. The design description should include the following, as applicable, presented in any order suited to the information to be provided, and should note any differences in these

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

characteristics from the point of view of the interfacing entities (such as different expectations about the size, frequency, or other characteristics of data elements):

- a. priority assigned to the interface by the interfacing entity(ies);
- b. type of interface (such as real-time data transfer, storage-and-retrieval of data, etc.) to be implemented;
- c. characteristics of individual data elements that the interfacing entity(ies) will provide, store, send, access, receive, etc., such as:
 - (i) names/identifiers:
 - (a) project-unique identifier;
 - (b) non-technical (natural-language) name;
 - (c) standard data element name;
 - (d) technical name (e.g., variable or field name in code or database);
 - (e) abbreviation or synonymous names;
 - (ii) data type (alphanumeric, integer, etc.);
 - (iii) size and format (such as length and punctuation of a character string);
 - (iv) units of measurement (such as meters, dollars, nanoseconds);
 - (v) range or enumeration of possible values (such as 0-99);
 - (vi) accuracy (how correct) and precision (number of significant digits);
 - (vii) priority, timing, frequency, volume, sequencing, and other constraints, such as whether the data element may be updated and whether business rules apply;
 - (viii) security and privacy constraints;
 - (ix) sources (setting/sending entities) and recipients (using/receiving entities);
- d. characteristics of data element assemblies (records, messages, files, arrays, displays, reports, etc.) that the interfacing entity(ies) will provide, store, send, access, receive, etc., such as:
 - (i) names/identifiers:
 - (a) project-unique identifier to be used for traceability;
 - (b) non-technical (natural language) name;
 - (c) technical name (e.g., record or data structure name in code or database);
 - (d) abbreviations or synonymous names;
 - (ii) data elements in the assembly and their structure (number, order, grouping);
 - (iii) medium (such as disk) and structure of data elements/assemblies on the medium;
 - (iv) visual and auditory characteristics of displays and other outputs (such as colours, layouts, fonts, icons and other display elements, beeps, lights);
 - (v) relationships among assemblies, such as sorting/access characteristics;

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

- (vi) priority, timing, frequency, volume, sequencing, and other constraints, such as whether the assembly may be updated and whether business rules apply;
 - (vii) security and privacy constraints;
 - (viii) sources (setting/sending entities) and recipients (using/receiving entities);
- e. characteristics of communication methods that the interfacing entity(ies) will use for the interface, such as:
- (i) project-unique identifier(s);
 - (ii) communication links/bands/frequencies/media and their characteristics;
 - (iii) message formatting;
 - (iv) flow control (such as sequence numbering and buffer allocation);
 - (v) data transfer rate, whether periodic/aperiodic, and interval between transfers;
 - (vi) routing, addressing, and naming conventions;
 - (vii) transmission services, including priority and grade;
 - (viii) safety/security/privacy considerations, such as encryption, user authentication, compartmentalization, and auditing;
- f. characteristics of protocols that the interfacing entity(ies) will use for the interface, such as:
- (i) project-unique identifier(s);
 - (ii) priority/layer of the protocol;
 - (iii) packeting, including fragmentation and reassembly, routing, and addressing;
 - (iv) legality checks, error control, and recovery procedures;
 - (v) synchronization, including connection establishment, maintenance, termination;
 - (vi) status, identification, and any other reporting features; and
- g. other characteristics, such as physical compatibility of the interfacing entity(ies) (dimensions, tolerances, loads, voltages, plug compatibility, etc.).

Note: Where data is referred to above, the reference should be interpreted to include input and output items of other types, to the extent permitted by the context.

6. NOTES

This section should contain, by inclusion or by reference, any general information that aids in understanding or using the SSDD (e.g. background information, evaluation of design alternatives, rationale for the selected architecture).

This section may include the following paragraphs, as applicable.

6.1 Cross-Reference of Safety-Related Requirements to Design Provisions

This paragraph, if used, should cross-reference the system requirements, if any, concerned with preventing or minimizing unintended hazards to personnel, property and the physical environment to the information in the SSDD which describes the implementation of those requirements.

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

6.2 Cross-Reference of Information Security-Related Requirements to Design Provisions

This paragraph, if used, should cross-reference the system requirements, if any, concerned with maintaining information security, viz confidentiality and integrity or privacy of information, to the information in the SSDD which describes the implementation of those requirements.

6.3 Requirements Traceability

This paragraph, if used, may contain:

- a. reference to the record of the subset of system requirements which were considered to drive development of system architecture and used in that development;
- b. traceability from each system requirement used to develop the architecture to the requirement(s) of the system component(s) which implement the system requirement; and
- c. traceability from each requirement of each system component identified in this SSDD to the system requirement(s) which it satisfies/helps satisfy.
- d. Reference to the record of traceability between each requirement in the full set of system requirements and each requirement of a subsystem (including interface requirements) which forms a part of the system solution, at an implementable level of detail.

6.4 Design Rationale

This paragraph, if used, should describe the rationale for significant decisions between design alternatives, cross-referenced to the corresponding aspect of the design described in 4. or 5.

5. PREPARATION INSTRUCTIONS - 5.2 Content Requirements (continued)

A. ANNEXES

Annexes may be used to provide information published separately for convenience in document maintenance (e.g., charts, security-classified data). As applicable, each annex should be referenced in the main body of the document where the data would normally have been provided. Annexes may be bound as separate documents for ease in handling. Annexes should be lettered alphabetically (A, B, etc.).

Appendices may be used to annexes. Appendices should be numbered numerically (1, 2, etc.).