DATA ITEM DESCRIPTION
Title: SOFTWARE PRODUCT DESIGN (SPD)

Number: DI-SESS-82036   **Approval Date:** 20160322
AMSC Number: N9644   **Limitation:**
DTIC Applicable: **GIDEP Applicable:**
Preparing Activity: AS   **Project Numbe**r: SESS-2016-006
Applicable Forms:

Use/relationship: The Software Product Design (SPD) describes the architectural and detailed design of the training system Software Items (SIs). The SPD includes descriptions of the software interfaces and any databases used by the SIs. The SPD also describes global design decisions being applied to the SIs.

The SPD provides the acquirer visibility into the software design; the information needed to construct the source code, and perform software life-cycle support.

Requirements:

1.   Referenced documents: Not applicable.

2.   Format: The SPD shall be in contractor format.

3.   Content: The SPD shall contain the following:

   3.1. Title page: The SPD shall have a title page providing the following information, as
         applicable:

   a.   Document identification number
   b.   Volume number
   c.   Version or Revision indicator
   d.   Security classification
   e.   Release date
   f.   Document title
   g.   Name of the system or subsystem to which this SPD applies
   h.   Name of the SI to which this SPD applies
   i.   Contract number
   j.   CDRL item number
   k.   Organization for which the document has been prepared
   l.   Name and address of the preparing organization
   m.   Distribution statement

   3.2. Record of changes
   The SPD shall have a record of changed pages from the prior document submission. Each
   submission shall append the changes to the record of changes.

3.3. Table of contents
The SPD shall have a table of contents providing the number, title, and page number for each titled paragraph, figure, table, and appendix.

3.4. Page numbering
Each page shall have a unique page number and include the document number, document version, volume, and date, as applicable.

3.5. Styles
Diagrams, tables, and other presentation styles are acceptable substitutes for text when the data required by this DID can be made more readable using these styles.

3.6. Multiple paragraphs and subparagraphs
Any section, paragraph, or subparagraph may be written as multiple paragraphs or subparagraphs to enhance readability.

3.7. Duplicated content
Any section, paragraph, or subparagraph shall include dissimilar information to avoid the duplication of information.

3.8. Design conventions
Design conventions used within the SPD to convey the design information shall be described or referenced.

3.9. Substitution of existing documents
Existing documents may be substituted for part of the SPD provided those documents contain the required information as defined by this DID and do not convey copyright or additional distribution restrictions to the SPD.

3.10. Document topics and numbering
The following paragraph titles and content shall be included in the SPD.

4. Scope
This section shall be divided into the following paragraphs.

4.1. Identification
This paragraph shall fully identify the training system and the SI to which this SPD applies, including as applicable, identifying number(s), title(s), abbreviation(s), acronym(s), version number(s), release number(s), and other identifying information.

4.2. System overview
This paragraph shall summarize the purpose of the training system or subsystem, and the SI to which this SPD applies. It shall describe the general nature of the system/subsystem and SI; summarize the system development history; identify the project sponsor, acquirer, user(s), developer(s), and support agencies; identify current and planned operating sites; and list relevant documents.

4.3. Document overview
This paragraph shall summarize the purpose of this SPD, and describe the security or privacy considerations associated with its use.

5.   Referenced documents
This section shall list the title, number, revision, and date of the documents referenced within the SPD. This section shall identify the source(s) for the documents not available through normal Government procuring activities.

6.   SI-wide design decisions
This paragraph shall describe SI-wide design decisions. SI-wide design decisions impact the design of one or more SIs. Supporting rationale shall be included for the SI-wide design decisions that are not explicitly driven by the specified requirements. SI-wide design decisions in response to the requirements shall be identified. The following are examples of SI-wide design decisions:

  a.   Decisions related to behavior(s) and action(s) in response to each input, state, or condition.
  b.   Decisions related to response time and other performance characteristics.
  c.   Decisions that address critical requirements, such as safety, cybersecurity or privacy.
  d.   Decisions that depend upon, or are related to specific training system states or modes.
  e.   Decisions regarding the SI's interface with users.
  f.   Decisions regarding the SI's inputs and outputs with other trainer systems.
  g.   Decisions regarding the SI's inputs and outputs with other SIs.
  h.   Decisions regarding the SI's inputs and outputs with hardware configuration items (HWCIs).
  i.   Decisions related to the modeling of the physical platform Operational Equipment (OE).
  j.   Decisions related to the selection of equations, algorithms, and rules.
  k.   Decisions related to the handling of improper, un-allowed, and incorrect inputs or conditions.
  l.   Decisions regarding how information, data, and databases appear to the user.
  m.   Decisions made in response to the requirements, such as stability, availability, and supportability.
  n.   Decisions related to programming language selection.
  o.   Decisions related to the reuse of previously constructed source code, such as Government Furnished Software (GFS) or Open Source Software (OSS).

7. SI architectural design
  a.   If any part of the architectural design depends upon system states or modes, this dependency shall be indicated within the architectural design.
  b.   If architectural design information is duplicated in more than one paragraph, present the information once and reference the other paragraphs.

8. SI structure and hierarchy
  a.   This paragraph shall identify the Software Units (SUs) that comprise the SI. Each SU shall be assigned a unique project identifier. SUs may occur at different levels of a hierarchy within the SI, and the SPD may refer to SUs by any naming convention that is consistent with the design methodology being used.
  b.   This paragraph shall show the relationship and hierarchy of the SUs that make up the SI. Multiple relationships may be presented, depending on the selected design methodology;

for example, in an object-oriented design, this relationship may be presented using class diagrams and object structures as well as module and process architectures of the SI.

c. This paragraph shall state the purpose of each SU.
d. This paragraph shall identify the SI-wide design decisions applicable to each SU.
e. This paragraph shall identify the software requirement(s) allocated to each SU.
f. This paragraph shall identify each SUs development status, such as new, reused, and modified software. Reused and modified software shall have identifying information such as the original software name/identifier, vendor/source, version, supporting documentation references, etc.
g. This paragraph shall describe the SI's planned utilization of computer hardware resources, such a processor capacity, memory capacity, disk storage capacity, input/output device capacity, and network capacity.
    1) This description shall cover the spare resourcing requirements affecting the SI.
    2) The assumptions and conditions on which the utilization data are based shall be described, such as during typical usage, worst-case usage, and specific conditions.
    3) Special considerations affecting utilization, such as multiprocessors and the use of virtual memory, shall be described.
    4) The utilization shall be described with units of measure, such as a percent of processor capacity, cycles per second, megabytes of memory, and kilobytes per second.

9. Concept of execution

This paragraph shall describe the concept of execution among the SUs comprising the SI. Diagrams and descriptions shall show the dynamic relationship of the SUs during the operation of the SI. Descriptions of execution flow control, data flow, dynamically controlled sequencing, state transition diagrams, priorities among SUs, interrupt handling, timing & sequencing relationships, exception handling, concurrent execution, and other aspects of dynamic behavior, shall be included as applicable.

10. Interface design

The following subparagraphs shall describe each of the interfaces among the SUs and their interfaces with external interfaces, such as users, other SIs, HWCIs, and other systems.

10.1. Interface identification and diagrams

Each interface description shall include:

a. Interface Name
b. Project Unique Interface Identifier
c. Purpose or Type of Interface
d. Priority
e. Identify the interfacing entity (SU, user, other SIs, HWCIs, and other systems) by its name, number, version, and documentation reference, as applicable.
f. State which entities have fixed interface characteristics (and therefore impose interface requirements on interfacing entities) and which are being developed or modified (thus having interface requirements imposed on them).
g. One or more interface diagram(s), as necessary, to depict the interface functionality.

DI-SESS-82036

h. Characteristics of the individual data elements provided by the interface, as applicable:
   1) Non-technical data element name (descriptive name)
   2) Project unique identifier
   3) Technical data element name (e.g. variable name)
   4) Data type (e.g. string, integer, float, array, Boolean)
   5) Size and format/structure
   6) Unit of measure (e.g. seconds, knots, m/s, feet, millibars, degrees)
   7) Valid range (enumeration of possible values) (e.g. 00.0 – 99.9; "N,S,E,W", True/False)
   8) Accuracy (how correct)
   9) Precision (number of significant digits)
   10) Priority
   11) Timing / frequency
   12) Bandwidth / data volume
   13) Source (setting or sending entity)
   14) Destination (using or receiving entity)
   15) Safety, cybersecurity, and privacy constraints
i. Characteristics of the aggregate data assemblies, (e.g., displays, reports, messages, records, arrays, etc., as applicable:
   1) Non-technical data assembly name
   2) Project unique identifier
   3) Data assembly technical name (e.g. record or data structure name used in the code or database)
   4) Data elements and their structure/format in the data assembly
   5) Data storage medium (e.g. disk, memory)
   6) Structure of data elements on or in the storage medium
   7) Visual and auditory characteristics of outputting data on displays, reports, messages, etc., such as colors, layouts, fonts, icons, tones, beeps, etc.
   8) Relationships between and among other data assemblies
   9) Priority
   10) Timing / frequency
   11) Bandwidth / data volume
   12) Source (setting or sending entity)
   13) Destination (using or receiving entity)
   14) Safety, cybersecurity, and privacy constraints
j. Characteristics of the interface communication methods, as applicable (Note: Publically available commercial, and industry standard communication methods may be defined by reference to their documented standard):
   1) Project unique identifier
   2) Communication link characteristics
   3) Communication medium
   4) Message or data format
   5) Flow control mechanism
   6) Data transfer rate (e.g., bandwidth)
   7) Synchronous or asynchronous

5

        8) Data transfer interval (e.g., period of transmission)
        9) Data routing or addressing mechanism
        10) Safety, cybersecurity, and privacy constraints

  k. Characteristics of protocols used by the interface, as applicable, (Note: Publically available commercial, and industry standard protocols may be defined by reference to their documented standard):

        1) Project unique identifier
        2) Technical protocol name
        3) Protocol layer used
        4) Protocol priority
        5) Protocol standard

  l. Physical and other interface characteristics, as applicable:

        1) Connector / plug type
        2) Communication distance limitations
        3) Safety, cybersecurity, and privacy constraints

11. Detailed design

  a. This section shall be divided into paragraphs that describe the detailed design of each SU comprising the SI.
  b. The detailed design description shall include the information necessary to construct the trainer source code.
  c. If any parts of the detailed design depend upon training system states or modes, this dependency shall be indicated within the detailed design.
  d. If the detailed design information is duplicated in more than one paragraph, present the information once and reference the other paragraphs.

11.1. Software unit, or group of units unique identifier

  a. This paragraph shall identify a SU by its project unique identifier and shall describe the detailed design of the unit.
  b. Alternatively, this paragraph may identify a group of related SUs, and describe the detailed design of those SUs in subparagraphs. Naming conventions used to group and organize SUs shall be described.
  c. Additional paragraphs and subparagraphs, as applicable, shall be created to describe the SUs.
  d. Each SU detailed design description shall include the following information, as applicable:

        1) Unit level design decisions; such algorithms and equations used; response times; handling of improper, un-allowed, and incorrect inputs or conditions; and other decisions similar to those applicable to SI-wide decisions.
        2) Constraints, limitations, or unique capabilities/features of the SU design.
        3) If the SU contains logic, describe the logic to be used by the SU, including the following:

           i. Conditions in effect within the SU when execution is initiated.
          ii. Conditions under which control is passed to other SUs.

      iii. Responses (outputs) and response times to each input, including data conversion, renaming, and data transfer operations.

      iv. Sequence of operations and dynamically controlled sequencing during the SU's execution, including the method and logic of that control.

      v. Input and output validation checking logic.

      vi. Exception and error handling.

4) If the SU design contains, receives, or outputs data, a description of its inputs, outputs, other data elements, or aggregate data assemblies, provide a reference to the associated information in section 4, or provide it here.

5) If the SU design contains local data, describe that data using the content listed in section 4, as applicable.

6) If the SU design consists of, or contains procedural commands; such as with batch files, shell scripts, job control language, etc., then references to the documents that define these commands shall be provided.

7) If the SU consists of a Graphical User Interface (GUI) using automated code generation tools, then references to the document(s) that define the GUI generation process shall be provided.

8) If the SU is a database, then a reference shall be provided to the interface characteristics in section 4, or provide it here.

12. Traceability

This section shall include bidirectional traceability between the software requirements allocated to each SU, and those requirements allocated to the SI.

13. Noncommercial Software Rights and Documentation Rights

This section shall describe the rights for noncommercial computer software and noncommercial computer software documentation. The Software and Documentation Rights shall be documented and marked as specified in DFARS clause 252.227-7014.

13.1. Noncommercial Software Rights and Documentation Rights shall include:

a) The rationale for use of computer software having anything other than Unlimited Rights and describe the basis for the restrictions.

b) The design decisions that prevent the development of the computer software exclusively with government funds.

14. Software Assurance

This section shall describe the merging of cybersecurity requirements into the software design and the decisions made for minimizing exposure to the vulnerabilities. This section shall describe the methods for handling the impact to the software design of emerging cybersecurity requirements.

15. Notes

This section shall provide an alphabetic listing of acronyms, abbreviations, and their meaning as used in this SPD list of terms and definitions needed to understand the SPD Appendices

16. Single SPD
A single SPD may be used to incorporate the design information of multiple SIs by using appendices. In this case, the main body content of the SPD shall contain the common and global design information, while each appendix contains the specific information related to the applicable SI. Each appendix shall describe only one SI.

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