Overview of
MIL-STD-498
and its
Data Item Descriptions (DIDs)
Topics to be Discussed

- What is MIL-STD-498?

- Significant new terms and definitions

- MIL-STD-498’s general requirements (Section 4)

- MIL-STD-498’s detailed requirements (Section 5)

- Overview of the Data Item Descriptions (DIDs)

- Planned aids for applying MIL-STD-498
What is MIL-STD-498?

A new DoD software development standard designed to:

- "Harmonize" (merge):
  - DOD-STD-2167A, Defense System Software Development
  - DOD-STD-7935A, DoD Automated Information System Documentation

- Resolve issues identified in applying DOD-STD-2167A and its DIDs

- Ensure compatibility with recent changes in DOD directives, instructions, standards, and handbooks
Harmonizing DOD-STD-2167A with DOD-STD-7935

- DOD-STD-2167A:
  - Designed for mission critical/weapon system software
  - Specifies a set of software development activities
  - Offers 16 DIDs that define documentation

- DOD-STD-7935A
  - Designed for automated information systems
  - Defines the format and content of 11 documents
  - Provides guidance for applying the documents

- Objective: Combine the best of both to create a single standard for DoD
Key Issues Identified in Applying 2167A

1. Remove perceived preference for "waterfall" development model
2. Improve compatibility with Ada/object-oriented methods
3. Remove emphasis on preparing documents
4. Accommodate use of CASE tools
5. Improve links to systems engineering
6. Support use of management indicators
7. Provide pre-tailoring by categories of software
8. Improve coverage of modification, reuse, and reengineering
9. Put more emphasis on software supportability
10. Improve evaluation and review criteria
Key Issues Identified in Applying 2167A (cont.)

11. Improve distinction between requirements and design
12. Improve coverage of database development
13. Improve the criteria used for software product evaluations
14. Eliminate confusion between software quality assurance and software product evaluation
15. Improve use in data intensive systems
16. Clarify applicability to more types of projects
17. Extend configuration management concepts to in-process work products
18. Eliminate inconsistencies and holes in the DIDs
19. Decrease dependence on formal reviews and audits
20. Improve compatibility with incremental/evolutionary development methods
Compatibility with DODD, DODI, Standards, Handbooks

- Several DODD, DODI, standards, handbooks, etc. were issued, changed, or in transition since DOD-STD-2167A and 7935A, e.g.:
  - DODD 5000.1 and DODD 5000.2, Defense Acquisition Management
  - DODD 8120.1 and DODI 8120.2, AIS Life Cycle Management
  - MIL-STD-499B, Systems Engineering
  - MIL-STD-973, Configuration Management
  - MIL-HDBK-347, MCCR Software Support

- Challenge: Ensure compatibility with the new policy, requirements, and guidance
The MIL-STD-498 Package

Completed:

- MIL-STD-498: Software Development and Documentation
- 22 Data Item Descriptions (DIDs)
- A "Quick" guidebook explaining key concepts and tailoring of the standard

Planned:

- MIL-Guidebook 498 providing more detailed guidance
- Other aids
Format of MIL-STD-498 (and all MIL-STDs)

1. Scope

2. Referenced Documents

3. Definitions

4. General Requirements

5. Detailed Requirements

- Appendixes
**Significant New Terms and Definitions (1)**

**Acquirer** and **developer** as the parties involved in the standard

(Replaces "contracting agency" and "contractor." Supports non-contract SW development, such as Government in-house development)

**Build**: a version of software that meets a specified subset of a requirements that the completed software will meet.

(Supports incremental and evolutionary development -- MIL-STD-498 is oriented to developing software in a series of builds)

**Document**: A data medium and the data recorded on it, that generally has permanence and that can be read by humans or machines.

(Supports alternatives to traditional documents, e.g., data in CASE tools. MIL-STD-498 is about natural work products, not documentation)

**Software**: Computer programs and computer databases.

(Supports application of MIL-STD-498 to database systems)
**Significant New Terms and Definitions (2)**

**Software product**: Software or associated information created, modified, or incorporated to satisfy a contract.

(Provides a generic term for talking about the natural work products generated during SW development; need not be traditional documents)

**Software system**: A system consisting solely of software and possibly the computer equipment on which the software runs.

(Supports application of MIL-STD-498 to software-only systems (such as payroll systems) as well as to software-hardware systems)

**Software unit**: A logical element of the design of a CSCI; for example, major subdivision of a CSCI, a component of that subdivision, a class, object, module, function, routine, or database.

(Replaces both CSU and CSC. Provides greater flexibility in expressing software design. More compatible with object-oriented design)
MIL-STD-498

General

Requirements
Software Development Process

- Establish a SW development process consistent with contract requirements

- Include the following activities:

  Project planning and oversight
  Establish SW devel environment
  System requirements analysis
  System design
  SW requirements analysis
  SW design
  SW implementation and unit testing
  Unit integration and testing
  CSCI testing
  CSCI/HWCI integration and testing
  System testing
  Preparing for software use
  Preparing for software transition

  Software configuration management
  Software product evaluations
  Software quality assurance
  Corrective action
  Jt technical and management reviews
  Other (miscellaneous) activities
  Risk management
  Software management indicators
  Security and Privacy
  Subcontractor Management
  Interface with IV&V agents
  Coordination with assoc. developers
  Improvement of project processes
General Req’ts for SW Development (1)

- Use systematic, documented methods

- Develop and apply standards for representing requirements, design, code, and test information

- Evaluate reusable SW products for use in fulfilling contract requirements; incorporate those that meet the criteria in the SW Development Plan

- Identify opportunities for developing SW products for reuse; notify the acquirer of those that have cost benefits
General Req’ts for SW Development (2)

- Establish and apply strategies for handling critical requirements, such as those with safety, security, or privacy implications

- Analyze and fulfill the computer hardware resource utilization requirements (such as memory reserves)

- Record rationale for key decisions, for use by the support agency

- Provide the acquirer access to developer and subcontractor facilities
## MIL-STD-498 Activities and the Build Framework

| Activity                                           | Build 1 | Build 2 | Build 3 | Build 4 ...
|---------------------------------------------------|---------|---------|---------|-------------
| 5.1 Project planning and oversight                | x       | x       | x       | x           |
| 5.2 Establishing a SW development environment     | x       | x       | x       | x           |
| 5.3 System requirements analysis                  | x       | x       |         |             |
| 5.4 System design                                  | x       | x       | x       |             |
| 5.5 Software requirements analysis                | x       | x       | x       | x           |
| 5.6 Software design                                | x       | x       | x       |             |
| 5.7 Software implementation and unit testing      | x       | x       | x       | x           |
| 5.8 Unit integration and testing                  | x       | x       | x       | x           |
| 5.9 CSCI qualification testing                    |         | x       | x       | x           |
| 5.10 CSCI/HWCI integration and testing            |         | x       | x       | x           |
| 5.11 System qualification testing                 |         |         | x       | x           |
| 5.12 Preparing for software use                   | x       | x       | x       | x           |
| 5.13 Preparing for software transition            |         |         |         | x           |
| 5.14 Software configuration management            | x       | x       | x       | x           |
| 5.15 Software product evaluation                  | x       | x       | x       | x           |
| 5.16 Software quality assurance                   | x       | x       | x       | x           |
| 5.17 Corrective action                            | x       | x       | x       |             |
| 5.18 Joint technical and management reviews       | x       | x       | x       | x           |
| 5.19 Other activities                             | x       | x       | x       | x           |

- 19 activities; each may be performed in one or more builds on a project
- Activities may be concurrent, sequential, iterative, ..., as appropriate
Example Showing One Build

Note: All activities may be more ongoing, overlapping, and iterative than the figure is able to show.
Example Showing Incremental Development in 2 Builds

BUILD 1: Establish system and software requirements and install software implementing a subset of those requirements at user sites

Project planning and oversight

SDP (focus on Build 1) STP for Build 1 SIP for Build 1; Preliminary StrP

CSCI 1: Software Design Partial SDD/IDD/DBDD SRS/IRS*

System Design

CSCI 2: Software Design Partial SDD/IDD/DBDD

SDP updated STP updated for Build 2 SIP for Build 2; completed StrP

CSCI 1: Software Design Complete SDD/IDD/DBDD SRS/IRS*

System Design

CSCI 2: Software Design Complete SDD/IDD/DBDD

CSCI 1: Software Integ/ Test Unit Integ/ Test STR for Build 1

CSCI Qual Test STD for Build 1

CSCI 2: Software Integ/ Test Unit Integ/ Test STR for Build 2

CSCI Qual Test STD for Build 2

CSCI/HWCI Integ/ Test

System Qual Test

STD STR for Build 1

(No Software Transition)

Prepare for SW Use

Executable SW SVDs User/op manuals for Build 1

Prepare for SW Transition

Executable SW Source files Support manuals

SW devel environment, SW configuration management, SW product evaluation, SW quality assurance, corrective action, joint reviews, other activities

*Updated only if SPSs, updated SSDDs necessary; not intended to change

*Intended to be HWCI(s) (Not covered by MIL-STD-498)

SW devel environment, SW configuration management, SW product evaluation, SW quality assurance, corrective action, joint reviews, other activities
Example Showing Evolutionary Development in 2 Builds

BUILD 1: Establish preliminary system/software requirements and install a prototype implementing a subset of those requirements at selected user sites

Project planning and oversight

SDP (focus on Build 1) (No STP for Build 1; no qual testing) (No STR for Build 1) (No STD for Build 1) (No STrP for Build 1; Preliminary STrP)

CSCI 1: Software Design Unit Test (No Qual Test) Software Implement/ Unit Test (No STD for Build 1) SVDs (No Sys Qual Test) CSCI/HWCI Integ/ Test (No STD/STR for Build 1)

Partial SDD/IDD/DBDD OCD* SSS/IRS* Partial SRS/IRS HWCI(s) (Not covered by MIL-STD-498) *Preliminary/ partial

System Design

System Req Analysis

CSCI 2: Software Design Unit Test Software Implement/ Unit Test (No STD for Build 1) SVDs (No Sys Qual Test) CSCI/HWCI Integ/ Test (No STD/STR for Build 1)

Partial SDD/IDD/DBDD SDD/IDD* Partial SRS/IRS HWCI(s) (Not covered by MIL-STD-498) *Preliminary/ partial

System Design

System Req Analysis

SW devel environment, SW configuration management, SW product evaluation, SW quality assurance, corrective action, joint reviews, other activities

BUILD 2: Refine and complete the requirements; install the completed software at user sites; transition the software to the software support agency

Project planning and oversight

SDP updated for Build 2 (No STP for Build 2; no qual testing) (No STR for Build 2) (No STD for Build 2) (Preliminary/ HWCI(s) (Not covered by MIL-STD-498) Support manuals and completed

CSCI 1: Software Design Unit Test Software Implement/ Unit Test (STD for Build 2) STR for Build 2 CSCI Qual Test

SDD/IDD/DBDD* SDD/IDD/DBDD* Partial SRS/IRS CSCI/HWCI Integ/ Test (STD STR for Build 2)

OCD* SSS/IRS* Partial SRS/IRS HWCI(s) (Not covered by MIL-STD-498)

CSCI 2: Software Design Unit Test Software Implement/ Unit Test (STD for Build 2) STR for Build 2 CSCI Qual Test

SDD/IDD/DBDD* SDD/IDD/DBDD* Partial SRS/IRS CSCI/HWCI Integ/ Test (STD STR for Build 2)

CSCI Req Analysis

System Req Analysis

CSCI Req Analysis

CSCI Req Analysis

System Req Analysis

CSCI Req Analysis

CSCI Req Analysis

CSCI Req Analysis

SW devel environment, SW configuration management, SW product evaluation, SW quality assurance, corrective action, joint reviews, other activities

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Project Planning and Oversight

Tasks: Include all applicable items in this DID*:

- Plan the software development effort . . . . . . SW Development Plan (SDP)

- Plan for CSCI qualification testing . . . . . . SW Test Plan (STP)

- Participate in system test planning . . . . . . SW Test Plan (for SW sys)

- Plan for installing SW at user sites . . . . . . SW Installation Plan (SIP)

- Plan for transitioning SW to support agency SW Transition Plan (STrP)

- Follow approved plans; conduct management reviews; get approval for updates

* DIDs are used as checklists of items to be included in the task; no deliverables or traditional documents are implied; such requirements would be imposed via the CDRL
Establishing a Development Environment

- Establish, control, and maintain:
  - A software engineering environment
  - A software test environment
  - A software development library
  - Software development files

- Use non-deliverable software only if:
  - Operation/support of the deliverable SW do not depend on it, or
  - The acquirer has or can obtain the same software
System Requirements Analysis

Tasks: Include all applicable items in this DID:

- Analyze user input provided by the acquirer

- Participate in defining and recording the system operational concept Operational Concept Description (OCD)

- Participate in defining and recording system requirements System/Subsystem Specification (SSS)

(Include those characteristics of the system that are conditions for acceptance; defer to design descriptions those characteristics that the acquirer is willing to leave up to the developer)

(If deliverable, system interface requirements may be in the SSS or in Interface Requirements Specifications (IRs))
Tasks: Include all applicable items in this DID:

- Participate in defining and recording System/Subsystem Design the system-wide design decisions . . . . . . Description (SSDD)
  
  (Decisions about the system’s behavior, ignoring internal implementation, and other decisions affecting selection and design of system components)

  (Design decisions remain at the discretion of the developer unless formally converted to requirements. Design decisions act as developer-internal "requirements," to be implemented, imposed on subcontractors, if applicable, and confirmed by developer-internal testing.)

- Participate in defining and recording System/Subsystem Design the system architectural design . . . . . . Description (SSDD)
  
  (System components (HWCIs, CSCIs, manual operations), their interfaces, and a concept of execution among them)

  (If deliverable, interface design may be in SSDDs or in Interface Design Descriptions (IDDs); database design may be in SSDDs or in Database Design Descriptions (DBDDs))
Task: Include all applicable items in this DID:

- Define and record the SW requirements Software Requirements to be met by each CSCI Specification (SRS)

  (Include those characteristics of the CSCI that are conditions for CSCI acceptance; defer to design descriptions those characteristics that the acquirer is willing to leave up to the developer)

  (If deliverable, CSCI interface requirements may be included in SRSs or in Interface Requirements Specifications)
Software Design

Tasks:

Include all applicable items in this DID:

- Define and record CSCI-wide Software Design
design decisions ................................ Description (SDD)
  (Decisions about the CSCI's behavior, ignoring internal implementation, and other decisions affecting
  selection and design of SW units)

- Define and record the architectural Software Design
design of each CSCI .............................. Description (SDD)
  (SW units, their interfaces, and a concept of execution among them)
  (Software units may be made up of other software units and may be organized into as many levels as
  are needed to represent the CSCI architecture)

- Define and record the detailed Software Design
design of each CSCI .............................. Description (SDD)
  (Design of each software unit)
  (If deliverable, interface design may be in SDDs or in IDDs; database design may be in SSDDs or in
  DBDDs)
Software Implementation and Unit Testing

- Develop and record software corresponding to each software unit, using an approved programming language for deliverable software

  (Includes coding computer programs, building databases, populating databases, and any other activity needed to implement the design)

  (Resulting code and data entities need not be in 1-to-1 relationship with the software units in the design)

Unit testing:

- Prepare unit test cases, procedures, and data (record in SDFs)

- Perform unit testing

- Revise and retest as needed

- Analyze the results and record in software development files (SDFs)
Unit Integration and Testing

- Prepare unit integration test cases, procedures, data (record in SDFs)

- Perform unit integration testing

- Revise and retest as needed

- Analyze the results and record in software development files (SDFs)

Notes:

- Since units may consist of other units, some of this testing may have been accomplished during unit testing and need not be repeated

- The last stage of this testing, with all units in a CSCI integrated, is developer-internal CSCI testing
CSCI Qualification Testing

Tasks: Include all applicable items in this DID:

- Prepare test cases, procedures, data for CSCI qualification testing Description (STD)

- Dry run the test cases if testing is to be witnessed by the acquirer

- Perform CSCI qualification testing

- Revise and retest as needed

- Analyze and record test results Software Test Report (STR)

- Assign responsibility to persons who did not perform detailed design or implementation of the CSCI(s) being tested

- Include testing on the target computer or an approved alternative
CSCI/HWCI Integration and Testing

- Prepare CSCI/HWCI integration test cases, procedures, data (record in SDFs)

- Perform CSCI/HWCI integration testing

- Revise and retest as needed

- Analyze the results and record in software development files (SDFs)

Notes:

- This testing includes integrating CSCI’s with interfacing CSCIs and HWCIIs and testing the results; it is developer-internal testing

- The last stage of this testing, with all CIs integrated, is developer-internal system testing
System Qualification Testing

For a software system, include applicable items in this DID:

Tasks--participate in:

- Developing and recording test cases, procedures, data for system testing . . . . . . SW Test Description (STD)

- Dry run of the test cases if testing is to be witnessed by the acquirer

- Performing system qualification testing

- Revising and retesting as needed

- Analyzing and recording test results . . . . . Software Test Report (STR)

- Assign responsibility to persons who did not perform detailed design or implementation of the software in the system being tested

- Include testing on the target computer or an approved alternative

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Preparing for Software Use

Tasks:

- Prepare the executable software for user sites
- Identify and record the exact version of SW to be sent to each site
- Prepare information needed for:
  - Hands-on use of the software
  - Submitting (batch) inputs and interpreting outputs
  - Operating the SW in software centers or networked environments
  - Operating the computers
- Install at user sites; provide training and other assistance as required

Include all applicable items in this DID:

- Software Product Specification (SPS)
- Software Version Description (SVD)
- SW User Manual (SUM)
- Software Input/Output Manual (SIOM)
- Software Center Operator Manual (SCOM)
- Computer Operation Manual (COM)
Preparing for Software Transition (1)

Tasks:

- Prepare the executable software for the support site.
- Prepare the source files for the support site.
- Identify and record the exact version of SW to be sent to support site.
- Update the CSCI design descriptions and prepare other info needed for support.
- Update the system design descriptions.

Include all applicable items in this DID:

- Software Product Specification (SPS)
- Software Product Specification (SPS)
- Software Version Description (SVD)
- Software Product Specification (SPS)
- System/Subsystem Design Description (SSDD)
Preparing for Software Transition (2)

Tasks: Include all applicable items in this DID:

- Prepare information needed to:
  - Program the host and target computers ......................... Manual (CPM)
  - Program/reprogram the firmware devices ......................... Manual (FSM)

- Install the software at the support site; demonstrate that it can be regenerated from source; provide training and other assistance as required
Software Configuration Management

- Identify all entities to be controlled during development: CSCIs, computer files, documents, other software products, elements of the SW environments

- Establish and implement procedures for controlling each entity

- Prepare and maintain records of the status of all entities under project-level or higher control

- Support acquirer-conducted configuration audits as specified in the contract

- Establish and implement procedures for packaging, storage, handling, and delivery
Software Product Evaluation

- Perform in-process and final evaluations of software products

- Focus is on the natural output of the software development process

- Criteria are given in Appendix D of the standard

- Prepare records of the evaluations, and:

  - For software products under project-level or higher control, prepare problem/change reports for the corrective action system

- Assign responsibility for each evaluation to persons other than those who developed the product being evaluated

  - Those who developed the product can take part
Software Quality Assurance

- Perform on-going evaluations to assure that:
  - Activities required by the contract or described in the SDP are being performed in accordance with the contract and SDP
  - Required software products exist and have undergone software product evaluation, testing, and corrective action as required by the standard and other contract provisions

- Prepare records of the evaluations, and:
  - For software products under project-level or higher control, prepare problem/change reports for the corrective action system
  - Assign responsibility for each evaluation to persons other than those who developed the product, performed the activity, or are responsible for them
  - (And other fine print about resources, authority, etc.)
Corrective Action

- Prepare problem/change reports for problems found in:
  - Software products under project-level or higher control
  - Activities required by the contract or described in the software development plan

- Implement a corrective action system for handling these problems
  - Make sure system is closed loop, including reporting problems, initiating action, achieving resolution, tracking status
  - Classify problems by category and priority
  - Perform analysis to detect trends
  - Evaluate corrective actions
Joint Technical & Management Reviews

- Plan and participate in joint (acquirer/developer) technical reviews
  - Include persons with technical knowledge of the work
  - Review evolving software products (focus is on natural work products)
  - Surface and resolve technical issues/risks
  - Identify issues/risks to be raised at joint management reviews

- Plan and participate in joint management reviews
  - Include persons with authority to make cost/schedule decisions
  - Resolve issues/risks not resolved at technical reviews
Other Activities

- Identify project risks; develop/implement strategies to manage them

- Identify and apply software management indicators

- Comply with the security and privacy requirements in the contract

- Include in subcontracts all requirements necessary to ensure that software products are developed in accordance with the prime contract

- Interface with IV&V agents as specified in the contract

- Coordinate with associate developers, working groups, and interface groups as specified in the contract

- Periodically assess the processes used on the project; identify improvements; propose in SDP updates; implement if approved
Appendices

A. Acronyms and abbreviations
B. Interpreting MIL-STD-498 for incorporation of reusable software products
C. Classification schemes for problem reports
D. Requirements for software product evaluations
E. Candidate joint management reviews
F. Candidate management indicators
G. Guidance on program strategies, tailoring, and build planning
H. Guidance on ordering deliverables
I. Conversion guide from DOD-STD-2167A and DOD-STD-7935A
## Data Item Descriptions (1)

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<th>MIL-STD-498 DID</th>
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# Data Item Descriptions (2)

|------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Software Test Plan (STP)                 | 2167A Software Test Plan (STP)  
7935A Test Plan (PT) - high-level information                                                             |
| Software Test Description (STD)          | 2167A Software Test Description (STD)  
7935A Test Plan (PT) - detailed information                                                                  |
| Software Test Report (STR)               | 2167A Software Test Report (STR)  
7935A Test Analysis Report (RT)                                                                  |
| Software User Manual (SUM)               | 2167A Software User’s Manual (SUM)  
7935A End User Manual (EM)                                                                     |
| Software Center Operator Manual (SCOM)   | 7935A Computer Operation Manual (OM)                                                                  |
| Software Input/Output Manual (SIOM)      | 7935A Users Manual (UM)                                                                                   |
| Computer Programming Manual (CPM)        | 2167A Software Programmer’s Manual (SPM)                                                                 |
| Firmware Support Manual (FSM)            | 2167A Firmware Support Manual (FSM)                                                                       |
| Software Product Specification (SPS)     | 2167A Software Product Specification (SPS)  
2167A CRISD - modification procedures  
7935A MM - maintenance procedures                                                             |
| Software Version Description (SVD)       | 2167A Version Description Document (VDD)                                                                  |
Planned Aids

- A "quick guidebook" -- available now in draft -- providing an overview of the standard and the basics of tailoring it

- A "detailed guidebook" on:
  - How an acquirer applies the standard
  - Detailed information regarding topics in the standard

- Other methods of accessing the standard and guidebooks:
  - Hypertext versions of the standard, DIDs, and guidebooks (CD-ROM version of 498 and DIDS available now from STSC, guidebooks to follow).
  - Other word processing versions: WP5.1 (DOS) and Word 6.0 of the standard and DIDs available now, Word 2.0 to follow soon. Others planned.
  - On-line access to softcopy for downloading via SPAWAR and DISA servers (details on following page).
HOW DO I GET A COPY OF MIL-STD-498 AND GUIDES?

Electronic files: Available in WP5.1 and Word 6.0 formats
- Files with the suffix .EXE indicate self-extracting zip formats for PC users only
- Files with the suffix .ZIP indicate PKZIP 2.04 compressed files
  -- use UNZIP

- DISA Center
  ITSI BBS Help Desk: (703) 735-8338 DSN 653-8338
  helpdesk@itsi.disa.mil

- SPAWAR:
  ftp: diamond.spawar.navy.mil (directory MIL498)
  LCDR Dana Majors: (703) 602-9188
    e-mail . . . . . . . . . majors@smtp-gw.spawar.navy.mil

- Logicon
  ftp: glider.logicon.com (directory /pub/standards
  help -- (619) 455-7663 x-4001 or
  MIL-STD-498@logicon.com

- Hardcopies: Defense Printing Service Detachment Office
  (ATTN: Customer Service)
  700 Robbins Avenue, Bldg. 4D
  Philadelphia, PA 19111-5094 Fax request 215/697-1462
Conclusion


- MIL-STD-498 addresses and resolves the issues raised during use of DOD-STD-2167A

- MIL-STD-498 provides the flexibility needed to cover:
  - Large and small projects
  - Projects using a wide variety of methodologies
  - Projects using a wide variety of software development approaches

- MIL-STD-498 provides the basis for the joint EIA/IEEE project now underway to develop a commercial software development standard