DEFENDING WORLD SECURITY

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Test Engineering Services UK

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IEEE 1641 Validation – An Overview of Tools Developed for DE&S

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IEEE 1641 and ATML - Overview of Purpose and Benefits Background

- MoD Policy in this area is defined by:
  - The AOF Governing Policy 2.4 – ATS and Test & Measurement Equipment.
  - DEF-STAN 66-31 Part 8, Requirements for Electronic and Electrical Test and Measurement Equipment.

- The Policy requires IEEE 1641 (Signal & Test Definition) and strongly favours ATML (IEEE 1671).

- There have been a number of Studies and implementations that support the Policy.

- DE&S have made a number of documents and tools available to support this Policy:
  - A Guidance Document to explain the requirements.
  - A Validation Process Document to define the requirements for validation.
  - A Compliance Matrix for the validation requirements.

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IEEE 1641 and ATML - Overview of Purpose and Benefits
The Problem

- MoD and other military support organisations have used ATS and ATE systems for decades.
- Systems were supplied by many vendors and despite early efforts, there was little compatibility between them.
- These early systems generally worked well, but problems arose when the test equipment and software within them became obsolete and unsupportable because:
  - There was no absolute way of specifying the signals required; many systems relied on addressing a specific instrument.
  - Signal definitions were not comprehensive.
  - Test programming languages were not portable.
  - Systems were proprietary and closed.
- These issues led to unacceptable costs when the time came to rectify obsolescence.

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IEEE 1641 and ATML - Overview of Purpose and Benefits
The Solution

- Work on IEEE standards 1641 (Signal & Test Definition) and 1671 (Automatic Test Markup Language) commenced around 10 years ago to address these problems.

- Both Standards are now approved and in use.

- IEEE 1641 (Signal and Test Definition) specifically addresses signals.

- IEEE 1671 (Automatic Test Markup Language) specifically addresses test information needed for ATS solutions and support.

Under the AOF, IEEE 1641 is mandatory and ATML is preferred.

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IEEE 1641 and ATML - Overview of Purpose and Benefits
Signal & Test Definition

- The IEEE 1641 Standard says:

This standard provides the means to define and describe signals used in testing. It provides a set of common basic signal definitions, built upon formal mathematical specifications, so that signals can be combined to form complex signals usable across all test platforms. The standard provides support for structural textual languages and programming language interfaces for interoperability.

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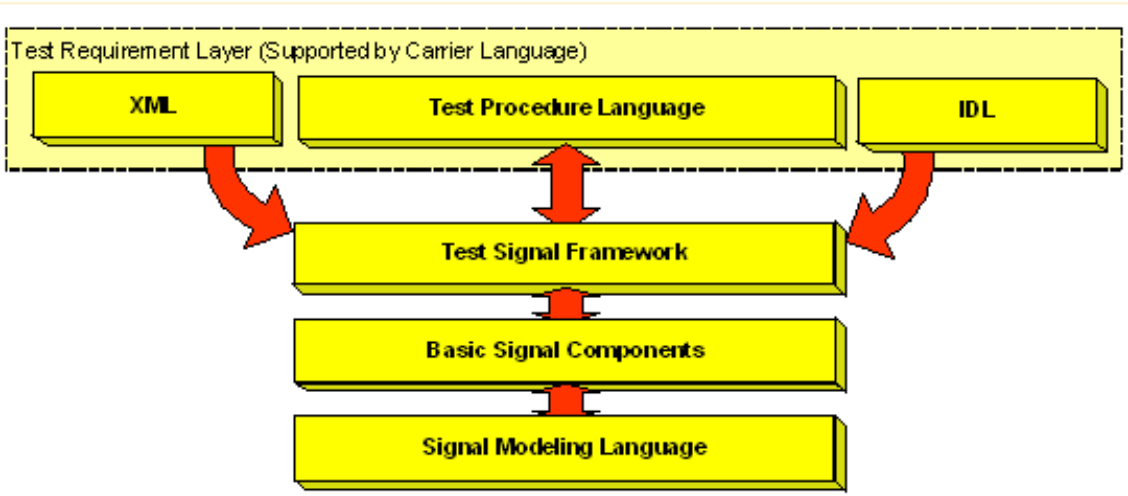
IEEE 1641 and ATML - Overview of Purpose and Benefits
Signal & Test Definition: Structure



- STD is made up of the four layers shown in the diagram.
- The bottom-most layer is key as it defines everything else above it.

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IEEE 1641 and ATML - Overview of Purpose and Benefits
Automatic Test Markup Language

- The IEEE 1671 Standard says:

  Automatic test markup language (ATML) is a collection of IEEE standards and associated extensible markup language (XML) schemas that allows automatic test system (ATS) and test information to be exchanged in a common format adhering to the XML standard.

- The Standard includes a framework and six 'child' Standards covering the following areas:
  - Test Descriptions (Test Description).
  - Instrument Descriptions (Instrument Description).
  - UUT Description Information (UUT Description).
  - Test Configuration Description Information (Test Configuration).
  - Test Configuration Adapter Information (Test Adapter).
  - Test Station Information (Test Station).

- The ATML Framework provides for the organisation of the 'child' standards.

- The use of ATML for ATS development is now preferred by MoD policy, but not mandated.

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IEEE 1641 & ATML – Validation of IEEE 1641 Solutions: Guidance Document

- The Guidance Document provides an explanation of the key factors that any Project Team must understand about IEEE1641 and ATML. It includes:
  - Motivation for the use of IEEE 1641 and ATML.
  - Detailed Description of IEEE 1641, including:
    - Structure including:
      - Signal Modelling Language.
      - Basic Signal Components.
      - Test Signal Frameworks.
      - The Test Requirement Layer:
        - » Carrier Language requirements.
        - » Test Procedure Language.
        - » Signal Definitions in XML.
        - » Interface Definition Language.
    - Other Considerations:
      - Signal Accuracy, Uncertainty and Range.
      - Maximising Test Platform Independence & Test Application Interchangeabilty.
  - ATML Overview.
  - Areas of Allowed Variance.
  - Validation Overview.

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IEEE 1641 & ATML – Validation of IEEE 1641 Solutions: Validation Process Document

- The Validation Process Document provides full details of the Key requirements to Validate TPSs and complete ATSs that are required to conform to IEEE 1641. It includes the requirements and suitable methods to check compliance.

- Key requirements are:
  - Provision of TPS source code, including signal models, TSF Libraries, test program code and all associated libraries and schemas.
  - Signal models and TSF Libraries are written in valid and well-formed XML.
  - Signal models provide an unambiguous definition of the required signal.
  - Carrier Language code conforms to Annex G of the standard and the AOF.
  - The TPS may be successfully built and executed.

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IEEE 1641 & ATML – Validation of IEEE 1641 Solutions: Test Methods

- The Validation Process Document indicates a number of test methods that may be used:
  - Provision of TPS source code – by formal review against the contract.
  - Signal models and TSF Libraries are written in valid and well-formed XML – tools from a variety of suppliers are available to perform these tasks.
  - Signal models provide an unambiguous definition of the required signal - by formal review against the IEEE 1641 standard and the test requirements.
  - Carrier Language code conforms to Annex G of the standard and the AOF – by formal review against the IEEE 1641 standard and the AOF.
  - The TPS may be successfully built and executed – either on the target tester or by simulation.

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IEEE 1641 & ATML – Validation of IEEE 1641 Solutions: Tools

- Together with the Test Methods the Validation Process Document indicates a number of tools that may be used:
  - For Review of deliverables:
    - Style sheets to make XML documents human readable.
  - For XML validation:
    - XML Editors:
      - Altova XMLSpy®,
      - Microsoft® XML Notepad,
      - Liquid XML Studio.
    - IEEE 1641 signal development tool:
      - Cassidian newWaveX®-SD.
  - Signal Integrity Checks:
    - Style sheets as described above to read the signal .
    - XML editors as described above.
    - Cassidian newWaveX®-SD may be used to examine signal content and to simulate sources to allow visual examination of the generated signal.

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IEEE 1641 & ATML – Validation of IEEE 1641 Solutions: Compliance Matrix

- The Compliance Matrix provides a starting point for Project Teams to build their Acceptance Requirements:
  - It gathers together all the requirements identified in the Guidance and Validation Process Documents.
  - It includes optional and mandatory elements, so that the requirements can be customised as necessary.
  - It can be used at Procurement stage to identify compliance in Suppliers' solutions.
  - It provides a checklist for use during the Acceptance process.

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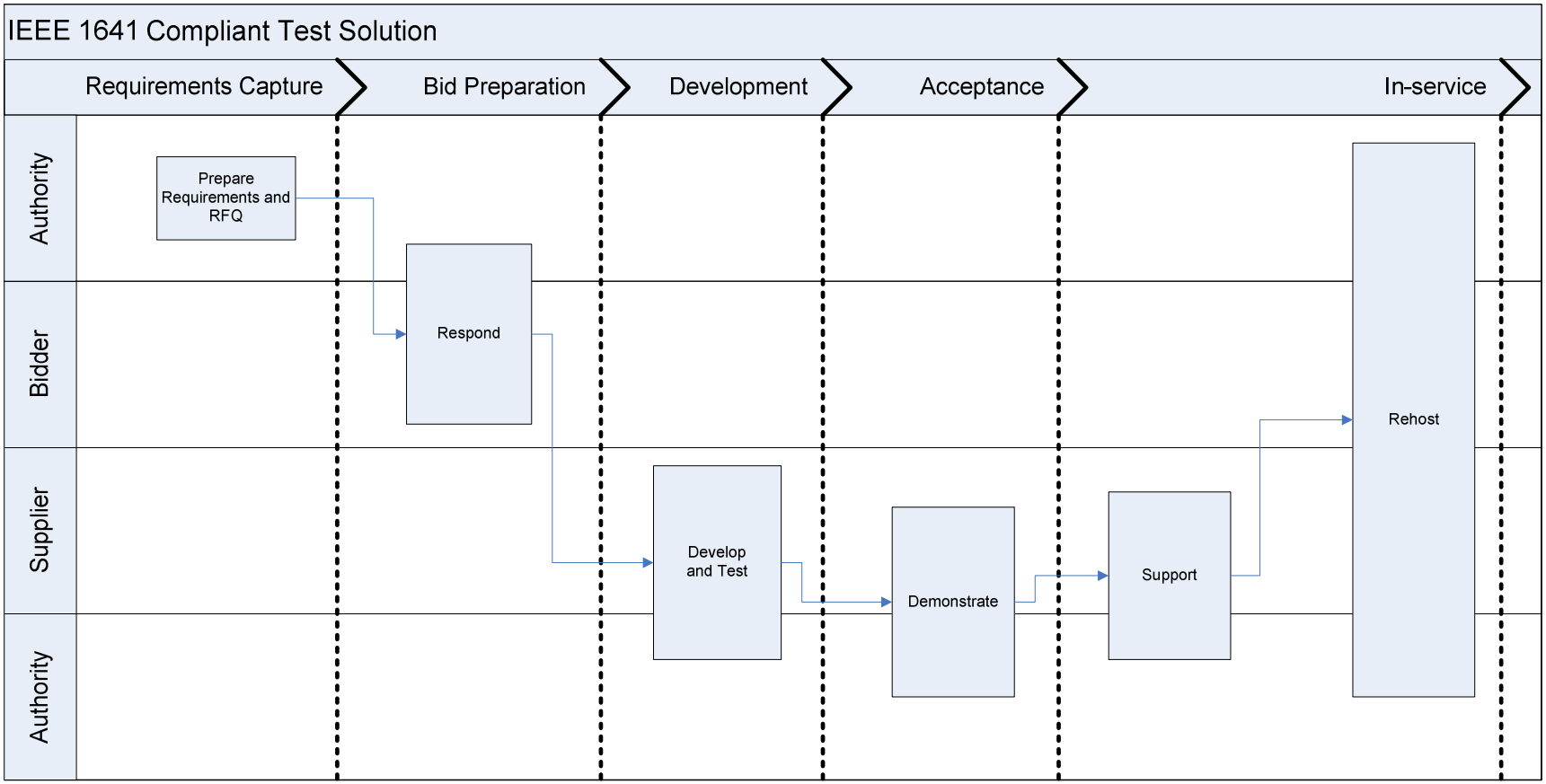
IEEE 1641 and ATML - Overview of Purpose and Benefits
Current Procurement and Development Solution



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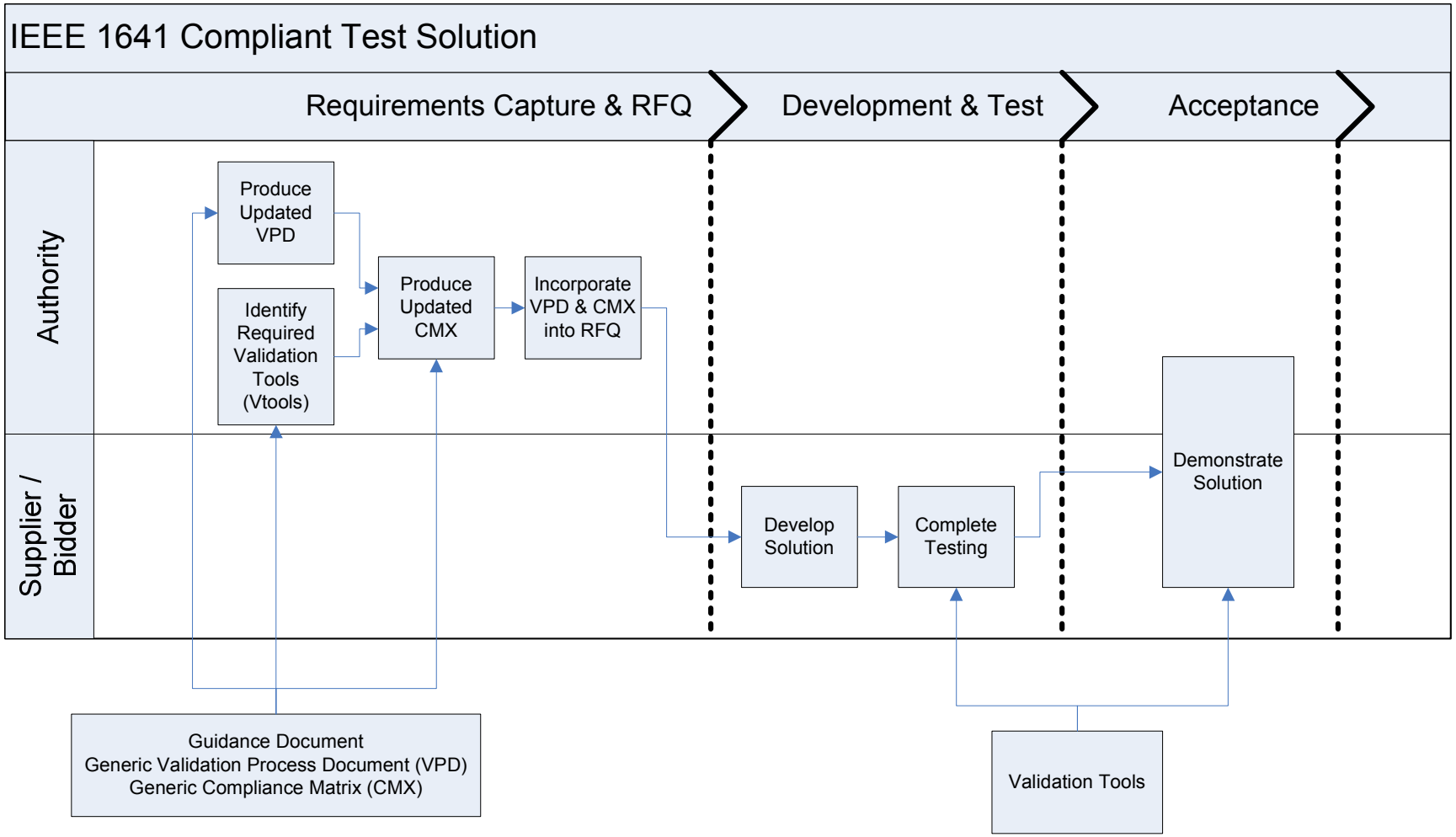
IEEE 1641 & ATML – Validation of IEEE 1641 Solutions: Enhanced Process Diagram



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