HCL

Avionics testing:
a new dimension

Tool driven process for the DO178C
Testing and Certification Support

Avionics software development teams have been finding innovative ways to increase their flexibility and productivity even while dealing with increasing software complexities, changing requirements, and non-availability of hardware on time. However, finding and fixing embedded software defects early in the development cycle and on the actual target environments remains mostly a manual, time-consuming and error-prone process.

As the leading Avionics Engineering Services providers, HCL Software team has supported over 150 Stages of Involvement (SOI) audits over the last two decades. We are continuously pursuing opportunities to increase reusability, drive automation and apply standardization to accelerate avionics testing and to achieve productivity improvement.
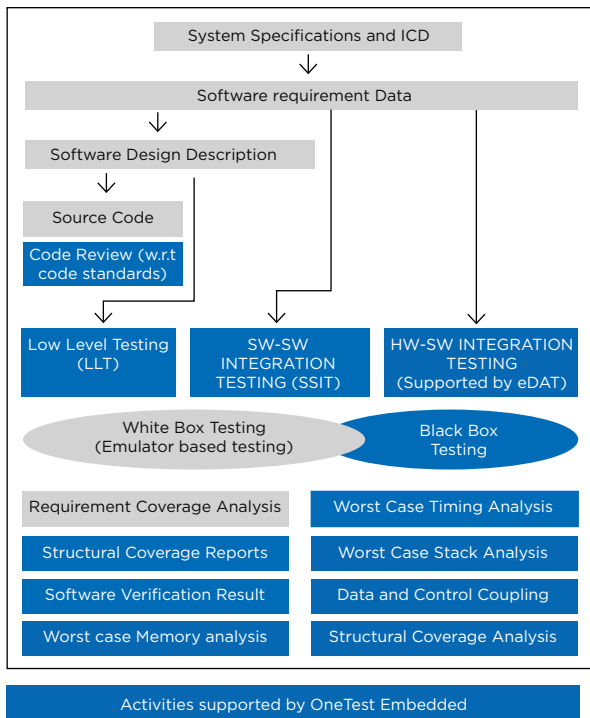
Solution Overview

HCL One Test Embedded (HOTE)

- Code Review (MISRA C 2012)

- Hardware Software Integration Testing (HSIT)

- Low Level Testing (LLT)

- Software-Software Integration Testing (SSIT)

- Structural Coverage in combinations or individual tests using HSIT, SSIT, LLT with using innovative framework

- Structural Coverage Analysis editor based on real time structural coverage

- Automation of Data Coupling and Control Coupling Analysis

- Automation of Memory and Timing Analysis

- Source To Object Analysis (for Level A)

- Supporting Tool Qualification Packages

The new HCL OneTest Embedded comes with ECLIPSE based environment for easy integration with other third party tools (such as SVN and GIT), IBM tool chain like DOORS, Rational Team Concert, Rational Quality Manager & Model Based Development tools like SCADE, MATLAB and other tools

Verification Activities Supported by OneTest Embedded

```
                System Specifications and ICD
                            ↓
                  Software requirement Data
                            ↓
              Software Design Description
                            ↓
                      Source Code
                  Code Review (w.r.t
                  code standards)
                            ↓
   Low Level Testing    SW-SW            HW-SW INTEGRATION
   (LLT)                INTEGRATION      TESTING
                        TESTING (SSIT)   (Supported by eDAT)

        White Box Testing              Black Box
        (Emulator based testing)       Testing
```

Requirement Coverage Analysis	Worst Case Timing Analysis
Structural Coverage Reports	Worst Case Stack Analysis
Software Verification Result	Data and Control Coupling
Worst case Memory analysis	Structural Coverage Analysis

Activities supported by OneTest Embedded

DO178B/C Test Objectives supported by OneTest Embedded

Verification of output of software coding and integration process (Table A5 of DO-178C)
- Software code is accurate and consistent (w.r.t Stack, Memory, Timing analysis).
- Source code conforms to coding standards.

### Testing of output of Integration process (Table A6 of DO178C)
- Executable object code complies with HLRs.
- Executable object code is robust with HLRs.
- Executable object code complies with LLRs.
- Executable object code is robust with LLR.s
- Executable object code is compatible with target computer

All the above objectives in integration process are ensured by software testing (HSIT/SSIT/LLT)

Verification of Verification Process Results (Table A7 of DO178C)
- Test results are correct and discrepancies explained (Actual Vs Expected).
- Test coverage of software structure (modified condition/ decision coverage).
- Test coverage of software structure (decision coverage) .
- Test coverage of software structure (statement coverage).
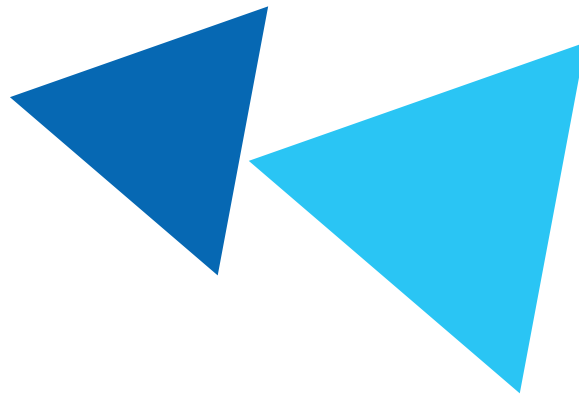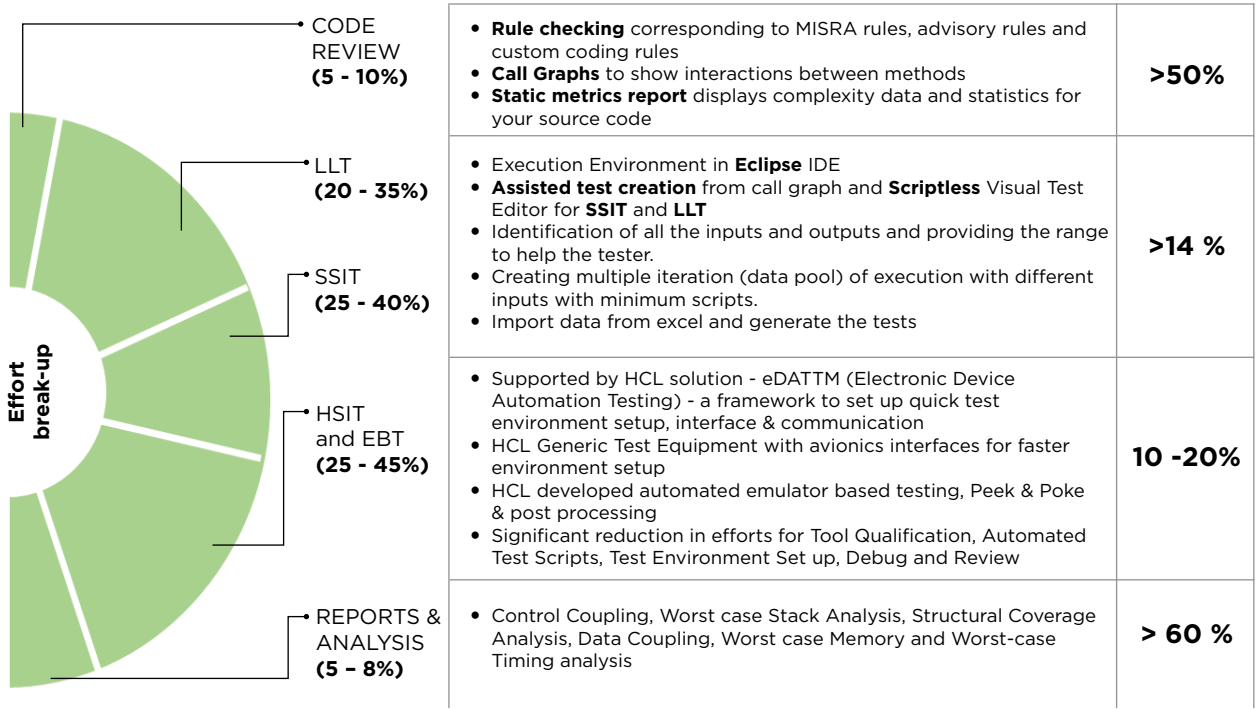- Test coverage of software structure (data coupling and control coupling).

Solution Accelerators

HCL developed Generic ATE with needed Avionics interfaces
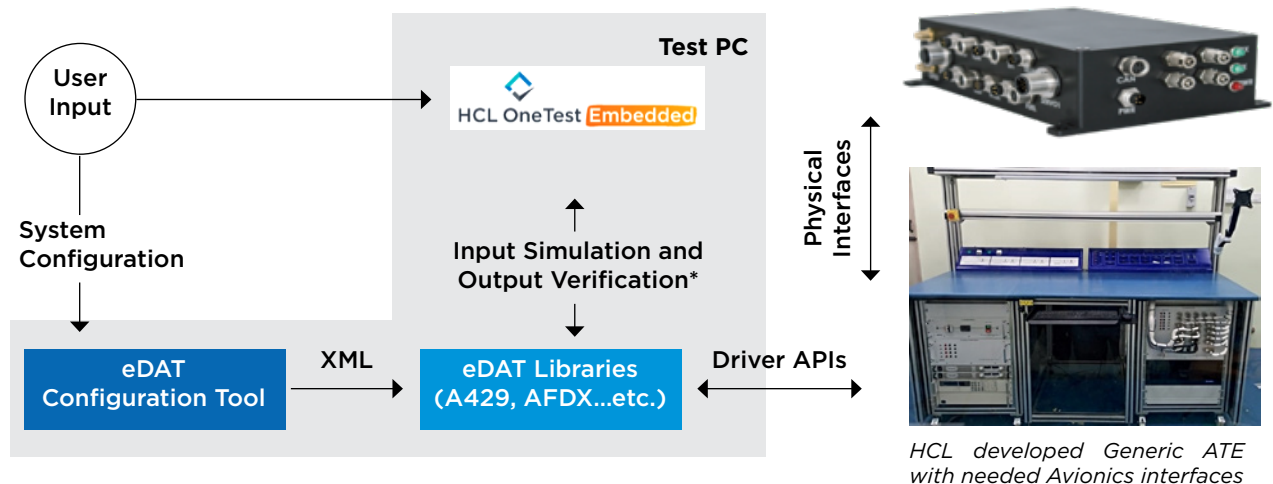
* *Script Execution in Test Application Tool decides when to communicate with DUT / eDAT and also similar for responses*
(eDAT™ (Electronic Device Automation Testing) – A HCL Proprietary solution
HOTE (HCL OneTest Embedded) can be integrated with customer specific target environment as well

Benefits / Potential Savings

Effort break-up		Potential Savings

Effort break-up

- CODE REVIEW (5 - 10%)
- LLT (20 - 35%)
- SSIT (25 - 40%)
- HSIT and EBT (25 - 45%)
- REPORTS & ANALYSIS (5 – 8%)

Details	Savings
• **Rule checking** corresponding to MISRA rules, advisory rules and custom coding rules • **Call Graphs** to show interactions between methods • **Static metrics report** displays complexity data and statistics for your source code	**>50%**
• Execution Environment in **Eclipse** IDE • **Assisted test creation** from call graph and **Scriptless** Visual Test Editor for **SSIT** and **LLT** • Identification of all the inputs and outputs and providing the range to help the tester. • Creating multiple iteration (data pool) of execution with different inputs with minimum scripts. • Import data from excel and generate the tests	**>14 %**
• Supported by HCL solution - eDATTM (Electronic Device Automation Testing) - a framework to set up quick test environment setup, interface & communication • HCL Generic Test Equipment with avionics interfaces for faster environment setup • HCL developed automated emulator based testing, Peek & Poke & post processing • Significant reduction in efforts for Tool Qualification, Automated Test Scripts, Test Environment Set up, Debug and Review	**10 -20%**
• Control Coupling, Worst case Stack Analysis, Structural Coverage Analysis, Data Coupling, Worst case Memory and Worst-case Timing analysis	**> 60 %**