Lessons Learned from Army Interoperability Certification Testing

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Analysis of Software Block 2 (SWB 2) Test Incident Reports (TIRs)

Background:

- The CTSF is the Army Interoperability Certification (AIC) agent for LandWarNet/Battle Command systems
- The Army incorporates a blocking process of multiple systems to introduce new capability set into the Army
- Software Block 2 had 50+ systems
- SWB 2 was initially scheduled for 9 months of Test-Fix-Tes, AIC and Backward Compatibility (BWC) testing – however it took over 2 years before the CIO G6 certified the block and fielding began.
Methodology

- Focused on Level 1-3 TIRs
- Date range is 10/06 thru 12/15/08
- Did not evaluate BWC issues
- Segregated the TIRs into 5 Test Windows: Test-Fix-Test; AIC 1; TIR Evaluation; AIC 2; Regression 1 & 2

Evaluated the following type of data:
- Number of TIRs over time for entire 2-year period
- Number of TIRs over time for each Test Window
- Individual system TIRs and sub-category by severity level
- TIRs by Issue Category
- System of System (SoS) vs. System TIRs
- Graphic TIRs
- CTSF Configuration Management database of software deliveries: date and purpose of deliveries
- Battle Command Integration Directorate (BCID) SWB 2 Product Change Request (PCR) Master Log:
Requirements Changed

- Suspense date for TCM & PM certification of threads was 18 Sept 06.
- Start of TFT to Dec 08, 216 approved PCR changes (count after removing PCR duplicates, archived Threads, and denied PCRs)
- 38% of PCRs occurred during AIC 1
- Maneuver and Aviation PM/TCMs requested the majority of PCRs during AIC 1
- Majority of PCRs during Validation and AIC 2 were in response to Thread and SW TIRs
- High number of INTEL PCR changes during Regression due to DCGS-A replacing ASAS

**Approved Thread PCR Requests by BOS**

- 216 PCRs
- TFT: 6, 3
- AIC 1: 25, 14
- TIR Val: 129, 5
- AIC 2: 54, 1
- REG: 70

**PCRs vs. TIRs for SWB 2**

- 100%, 80%, 60%, 40%, 20%, 0%
- TFT: 10, 20
- AIC 1: 81, 20
- Validation: 41, 9
- AIC 2: 10, 3
- Regression: 74, 5

Changing Requirements Consume Resources
**SWB 2 TIRS by Categories**

- **SW Error**: Software failure that was fixed with a SW patch.
- **Thread**: System’s requirement not accurately depicted by the thread.
- **TIR Class Error**: A TIR that either should not have made it out of the DAG; post-score discovery issue was operator induced; or post-score discovery of an inaccurate assessment.
- **Admin Thread TIR**: TIRs levied against the thread proponent to ensure thread issue is corrected.
- **Requirements**: Change in requirements as directed from TCMs; for example, System A received TIR for inability to display graphic from System B, and TCM determined System A did not have a requirement to display graphic from System B.
- **Standards**: Conflict between two standards – for example USMTF & VMF.
- **Architecture**: Data product issues or missing systems from a particular echelon.
- **Hardware**: Hardware failures.

**Total TIRs**: 319

**Type**
- **TFT**
- **AIC 1**
- **Validation**
- **AIC 2**
- **Regression**
Total Level 1-3 TIRs for SWB 2

- Total of 319 LvL 1-3 TIRs
- 6.9% of TIRs were LvL 1
- 81.5% of TIRs were LvL 2
- 11.6% of TIRs were LvL 3
- 5 systems out of 31 Systems with TIRs accounted for 52% of TIRs
Unexpected Results of AIC & Regression Testing

- There was a only a 1.6% decrease in LvL 1-3 TIRs going from the TFT (117 TIRs) to the AIC 1 (112 TIRs)
- The TIR Validation Event was to validate PM SW patches corrected AIC 1 TIRs. In addition to closing TIRs, there was an additional 26 TIRs scored
- There was a .6% increase in TIRs from TIR Validation to AIC 2 (28 TIRs)
- There was a 2.5% increase in TIRs from AIC2 through Regression Windows (36 TIRs)
- Last 3 Windows averaged 30 TIRs per Test Window
10 LvL 1 TIRs during TFT were within expectations because it was first time systems evaluated within a robust integrated architecture.

7 LvL 1 TIRs for AIC 1 not expected and resulted in inability to fully test systems’ capability.

AIC 1 accounted for 39% of all LvL 2 TIRs.

The TIR Validation window had 20 new LvL 2 TIRs.

The 17 LvL 2 TIRs from AIC 2 were corrected during Regression, but an additional 16 TIRs were scored (NOTE: 4 OOC systems first test against SWB 2 accounted for an additional 7 LvL 2 TIRs).

LvL 3 TIRs actually increased during AIC 2 and Regression (NOTE: A LvL 3 TIR is a LvL 1 or 2 TIR that has been reduced to a LvL 3 with a valid Technical Bulletin.)
Swb2 had 108 Graphic related TIRs out of 319 TIRs

- Graphic Software Error TIRs accounted for 41% (80 out of 193) of all Software Error TIRs for Swb 2
- 74% of Graphic TIRs were software errors (80 out of 108) – Systems delivered software that fixed issue
- TIR Class Errors result of operators building incorrectly and systems configured incorrectly
- Graphic TIRs became a non-factor after AIC 1 window

Not a new issue – Swb 1 had two Graphic Summits to work graphics
Software Deliveries

- **43 Systems** turned in software or software patches after the TFT Window through the first week of AIC 1 Window.

- **16** of those systems contributed **88 LvL 1-3 TIRs** scored during AIC 1 Window.

- Fire Support systems and Aviation systems did not participate in the TFT event. **10 LvL 1-2 TIRs** are attributed to Aviation assets and issues with FBCB2 Operation Center (OPS CNTR) and Fire support.

- **45 software deliveries** to CTSF CM for inclusion in TIR Validation from Nov 07 thru 01 Feb 08. 12 of the SW deliveries were multiple drops from 6 systems. **7 of the systems** accounted for **23** out of the **26 TIRs**

- **16 systems** delivered software during AIC 2. **6 of the systems** accounted for **17 LvL 1-3 TIRs**

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SoS Maturation is required after systems deliver software
SoS vs. System TIRs

- 74% of LvL 1-3 Software TIRs were SoS TIRs
- 37% of LvL 1-3 Software TIRs found in AIC 1 were System TIRs.
- 9 of the systems, with AIC 1 TIRs delivered SW for the TIR Validation Test and received additional TIRs. 5 out of the 9 systems had TIRs that were System TIRs.

SoS Events find both SoS and system errors
Summary

SoS Interoperability development is a process that is dependent upon:

– Stable Requirements
– Software Maturity
– SoS Integration Capability

Goal is a disciplined and repeatable process