JTCW and System Engineering

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Army Product Director JTCW
PdM MCS, PM GCC2
This process must also be rationalized with and respond to the JCIDS, PPBS and Acquisition processes.
Purpose

• Provide my personal experience of applying the Systems Engineering Process in the Department Of Defense’s Acquisition Policy by concentrating on problem definition and requirements analysis.
Agenda

• Background
• Current Process
• Using the SEP
• Recurring problems and Issues
Army/Marine Corps JROCM 161-03 Path

• 13 Aug 03 - JROCM 161-03 issued
  – USMC and Army converge to a single BFT capability:
    • Focus on ground forces for near term.
    • Facilitate interoperability with Air Force, Navy and Coalition by putting Army, Marines and select SOF on one baseline.
    • Not just BFT – C2 and SA.

• 28 Jan 04 - Battalion and Above (BAA) convergence methodology approved by 3-Star AMCB.

• 12 Mar 04 - USJFCOM has lead for 161-03 Security and URN Issues resolution, at request of Council of Colonels.

• 30 Apr 04 – Brigade and Below (BAB) convergence methodology approved by 3-Star AMCB.

• 14 Jun 04 – Joint Capabilities Board endorses/approves USA/USMC BFT Convergence Initiative.

• 30 Aug 04 – JROC approves USA/USMC Convergence Strategy – JROCM 163-04.

• 01 Dec 04 – AMCB approves USA/USMC PLI security policy and DOTMLPF impact recommendations.

• 27 Jan 05 – 2-Star AMCB requests revised BAA/BAB program plans

USMC lead for BAA/USA lead for BAB
The Simple JROCM Equation

• Defined “the What”
  – JROCM defined the end state – The Army and Marine Corps will achieve convergence by developing and using one, joint C2 system in order to share common C2 SA

• Defined “the How”
  – Army
    • Migrate from current C2 tactical system – MCS to JTCW and follow USMC’s lead by loading sw onto USMC’s baseline
    • Lead platform effort and develop a joint system that satisfies both Army and USMC requirements
  – USMC
    • Migrate from current platform SA system – DACT to JCR and follow Army’s lead
    • Lead C2 tactical system effort and help Army integrate sw onto current C2PC baseline
JTCW

• JTCW software serves as a common C2 foundation for Army and Marine Corps…now and in the future
  – Used in Combat Posts (stationary and mounted) from Battalion to Corps
  – Common system to exchange and manage situational awareness and C2 information and functions
  – “Injectors” are added to span functional areas through specific suites of capability
  – Integrates with FBCB2 for continuous C2 from platform to JFC

• Used extensively throughout services (USN, USAF, Homeland Defense, Coast Guard)
Joint Tactical COP Workstation Defined

<table>
<thead>
<tr>
<th>Joint Tactical COP Workstation</th>
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<tbody>
<tr>
<td><strong>Army Injectors</strong></td>
</tr>
<tr>
<td>Ground Planning (CAPES),</td>
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<tr>
<td>Engineering (Joint Eng. App),</td>
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<tr>
<td>Coalition Interoperability (MIP)</td>
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<tr>
<td><strong>USMC/Joint Injectors</strong></td>
</tr>
<tr>
<td>Intel (Intel Office), Logistics (CLC2S), Fires (EMT, WEEMC, TSA), NBC (JWARN), Amphibious Planning (EDSS)</td>
</tr>
<tr>
<td><strong>Core C2PC 7.0</strong></td>
</tr>
<tr>
<td>Tracks, Overlays, Routes, Alerts, Air Picture (Links), Terrain Analysis, CJMTK, Comms</td>
</tr>
<tr>
<td><strong>COTS Apps</strong></td>
</tr>
<tr>
<td><strong>Windows XP</strong></td>
</tr>
<tr>
<td><strong>Target Hardware</strong></td>
</tr>
</tbody>
</table>

- JTCW = C2PC 7.0 + USMC/ Joint 3rd Party Injectors + Army Injectors + COTS Applications + Windows XP + Hardware

- **Scope:**
  - Marine Corps – JTCW is a multiple Battlefield Functional Area (BFA) workstation, covering the areas of Maneuver, Intelligence, Fires, and Logistics
  - Army – JTCW effort is focused on GCCS-A Client and MCS requirements.
    - Separately, Army PM FATDS (Fires) is adopting the use of C2PC with the Effects Management Tool (EMT) (AFATDS Client)
  - All JTCW activities must support both perspectives
Provides executive level oversight of the overall JROCM ensuring

Provides joint program management oversight for the JTCW

Reviews & determines new requirements for the JTCW

Multi service control board to review requirements for priority & implementation to C2PC software. JT

Monitors and guides system and technical activities of the sub-IPTS and injector developers

Review new req’s for tech feasibility for a given build and recommend to JCCB for implementation to core.

Injectors that are monitored by JTCW report to the SE-IPT to ensure they are meeting capabilities and schedule relative to the JTCW capabilities deliver schedule.

*Sub-IPT composition is made of USMC and USA SMEs for their appropriate area. From an Army perspective this will also include SMEs from various BFAs.
JTCW

ABCS

JC2
Old Requirements Analysis

- No joint requirements database
- No link between requirements database and testing database – how do we measure success?
Old Requirements Nightmare

Operational Requirements

Functional Requirements

Derived Requirements

Constraints
- Budget
- Schedule

NCES-DOD Requirement

Architectural migrating Requirements

JTCW Design
Old Fix

• C2PC Joint Configuration Control Board (JCCB) was only forum in which to vet joint requirements. No JTCW CCB.
• Everything went into service-unique Requirements Database, no prioritization, categories, etc.
Problems in the Old SEP

• Define the Problem
  – JTCW was formed for political reasons, not operational, or technical
  – MOA binding Marine Corps and Army is not followed by the Army
  – Marines are schedule driven, the Army is performance driven
  – JTCW builds upon 2 existing DOD PORs – doesn’t follow Acquisition Process
    • Uses outdated requirements
    • Continuous Requirements Creep
Old Systems Engineering and Design

- No software architecture
  - Individual injectors were developing towards an unknown interface
This process must also be rationalized with and respond to the JCIDS, PPBS and Acquisition processes.
Army Migration Plan Key Drivers and Goals

**Goals**

- Lower lifecycle cost
- Smaller footprint
- Common User Interface
- Reduced training and cognitive burden
- Fewer soldiers needed to run/maintain the System of Systems

**Drivers**

- Army at War
- Joint
- ABCS Sustainment
- Technology Insertions
- NetCentricity
- Modularity
• Re-defined the problem
  – New technologies and DOD requirements toward a net centric and service-oriented architecture would not allow JTCW in its present sense to be fruitful
  – Will obtain the JROCM “what,” but will execute differently than the JROCM defined “how”
  – Will converge on the Gateway to obtain and provide a Blue Force Tracking picture, but will not converge on a workstation
Requirements Analysis

• Process of translating customer needs into a system functional and performance requirements.
  – Why do we need the system?
• Vital to justify development and its ability to satisfy those requirements via testing

• 9 Tasks
  1. Customer Expectations
  2. Constraints
  3. Operational Scenarios
  4. MOEs
  5. Interfaces
  6. Life Cycle Process
  7. Functional Reqs
  8. Design Characteristics
  9. Humans Systems Integration
Requirements Definitions

• Operational – Very high-level and are described as statements of fact or assumptions that define the expectations of the system in terms of mission, environment, constraints, and MOE

• Functional – Sub set of operations requirements that define the task, action or activity that must be able accomplished in order for the system’s mission to be successful

• Design – Specify the “build to,” “code to,” and “buy to” requirements for product development

• Derived – More granulated requirement that defines the userability-needs of the system
Requirements Analysis Input

• Constraints/Controls
  – Organizational policies and procedures
  – Technical Architecture guidance
  – Utilization environments

• Enablers

• Documentation
  – ICD, CDD, MOEs
Requirements Analysis Outputs

• Operational Concept Document
  – Operational Need Definition
  – System operational analysis
  – Operational scenarios
  – Conditional events

• Requirements Database
  – Operational, Functional, Design, and Derived requirements listed, prioritized, assigned, and categorized
  – Budget, schedule and status maintained
  – MOE/MOPs via testing threads have been developed
JTCW Requirements Process

- PdM Reqmts Manager Review, Categorize & Document
  - Ops
  - Army derived
  - Joint derived
  - RICK ST CLAIR

- Coordinate with Developer as required for implementation analysis – Build Plan / Schedule (buckets of money) BARTELS DEANNE VAN WICKLE

- Enter Req’t into Army Req’ts DB SKIRKANISH

- PdM APPROVES?/ Feasibility KAYS
  - Yes
  - No

- TSM Approval Needed? MALTO
  - Yes
  - No

- PdM Prioritizes & Develops (Update RQT DB) KAYS/ ST. CLAIR/PRODUCT LEADS

- Test in Lab, CTSF, Field

- Deliver in next patch

- New Army Requirements Request

  - CDD / ORD - EXISTING Capability
  - FIELD
    - Unit Input
    - Beta Sites
    - Other users
    - Operational Needs
  - TEST
    - OA/OT
    - DT
  - Standards
    - DoD Mandates
    - SWBing
  - Technology Insertion
  - Joint Requests

- Originator Revises Req’t or Provides Additional Info

- More Info Needed from Originator? ST. CLAIR
  - Yes
  - No

- Reqmt/ Solution Approved MALTO /ST. CLAIR

- Joint Concurrence needed? MALTO /ST. CLAIR

- Send to TSM for DTLOML-PF MALTO

- Army CCB Assign Priority and Forwards to ORWB. Annotate Actions in Army Req’ts DB BOYER/MALTO/S T. CLAIR
Conclusion

• SEP is necessary and applicable
• Problem definition and Requirements Analysis are the paramount for SE to work for you
Questions?
Back Ups
COA 2: PASS/NRTS and Injectors – Threshold

External Services
External services need to be accessible to the client/gateway, but can be hosted on any machine.

Legend:
- Army Development
- Marine Development
- Unchanged
- Web Service
- COTS/GOTS

Coalition LAN

MIP Gateway (2 LAN cards)

JTCW Gateway
Gateway includes Client (one per CP)

JTCW Client

Injectors
- Contains decision logic for routing PASS data to the appropriate injector and visa versa.

Messaging Services (Core)
- C2PC Communications API
- Address Book API
- Message Router
- CMP
- Address Book

Mapping (Core)
- 3D JBV
- C/JMTK
- API
- Map Engine
- ATLAS

APIs

Data Stores (Oracle)

Web Service
- COTS/GOTS

XML

Security, Authentication, Authorization

Discovery Agency

TMFDB (Eng) Database

Eng Server

Web Server

WebLogic

Eng App Server

Position Reports & Overlays thru NRTS to PASS, GW

To C2R

Pass Data

C2PC Gateway Server

3.x and 4.x tracks

Address Book

Overlays

Omnitracks

C2EDM (Oracle)

MIP

NRTS Data Providers

NRTS Server (Core)

EZ Pass Server

C2R Server & Planner

Internal Services

Unchanged

Army Development

Marine Development

Web Service

COTS/GOTS

Legend:
- Pass
- Security, Authentication, Authorization

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# JTCW Client Functional Block Description

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<thead>
<tr>
<th>Injector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trackplot Injector</strong></td>
<td>Displays Common Operational/Tactical Picture (CTP/COP) tracks – units, platforms, ELINT, missile, facilities, etc. Attribute filtering, to include &quot;staleness&quot; of tracks</td>
</tr>
<tr>
<td><strong>Overlays Injector</strong></td>
<td>Displays overlays - collection of Mil-Std 2525B objects, text, images, embedded documents, and primitive graphics. Can convert between GCCS 3.x and 4.x, C2PC, VMF, and FalconView graphics</td>
</tr>
<tr>
<td><strong>Routes Injector</strong></td>
<td>Display routes that can be used for steer-to functionality (mobile C2). Convert routes to VMF.</td>
</tr>
<tr>
<td><strong>SA Injector</strong></td>
<td>Display data feeds from NRTS (PASS, FBCB2, AMDWS, AFATDS), C2 Msgs (e.g. NBC-1), and VMF PosReps and Entity Data msgs.</td>
</tr>
<tr>
<td><strong>NRT Client/Data Handler</strong></td>
<td>Takes NRT Server data, and sends it to the appropriate Injector (graphics go to Overlays Injector, unit/platforms go to SA Injector, etc.)</td>
</tr>
<tr>
<td><strong>DSTB Injector</strong></td>
<td>Conducts terrain analysis – go/no go terrain, mobility corridors, weapon range fans</td>
</tr>
</tbody>
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<td>MOE Injector</td>
<td>Execution Management – oversees information quality and does alerting – units going in or out of an area, crossing an LOD on time, etc.</td>
</tr>
<tr>
<td>AODB Injector</td>
<td>Dynamic and graphical view of air mission data from TBMCS</td>
</tr>
<tr>
<td>LDMS Injector</td>
<td>Allows direct connection to a Link 16 network to view the real-time air picture, and pass selected group tracks to aircraft</td>
</tr>
<tr>
<td>EMT Injector</td>
<td>AFATDS Client. Conduct fire missions, monitor mission and firing unit status, show range fans and exchange track and battlefield geometries between GCCS and AFATDS</td>
</tr>
<tr>
<td>WEEMC Injector</td>
<td>ADOCS mission managers</td>
</tr>
<tr>
<td>Target SA Injector</td>
<td>Provide a web service, mines and displays target data from a variety of systems, and manages target data</td>
</tr>
<tr>
<td>FPSM Injector</td>
<td>Fire Plan Sketch Manager – generates and aggregates fire plan sketches. Shows direct fire weapon coverages, dead space, etc.</td>
</tr>
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<td>JTCW Client Functional Block Description</td>
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<tr>
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</tr>
<tr>
<td><strong>Explorer Map Injector</strong></td>
<td>Puts an integrated web browser capability into C2PC, and link web data/pages (such as from TACWEB) to a specific map view.</td>
</tr>
<tr>
<td><strong>Logistics Injector</strong></td>
<td>Ties to Marine Corps Common Logistics C2 System (CLC2S) – mines log data from various log systems, to include TC-AIMS II.</td>
</tr>
<tr>
<td><strong>MarineLink Injector</strong></td>
<td>Search and selection of maps, overlays, routes, imagery, etc. from hard drives and web sources.</td>
</tr>
<tr>
<td><strong>Joint Eng. App Injector</strong></td>
<td>Combat engineer functionality put into web services. An evolution of MCS-Engineer.</td>
</tr>
<tr>
<td><strong>TBMD Injector</strong></td>
<td>Ties into GCCS alerts of missile threats, with graphical display and audio/visual alerts. Can send or receive alerts automatically using VMF Threat Warning.</td>
</tr>
<tr>
<td><strong>AMDWS Injector</strong></td>
<td>Receive PASS or direct AMDWS information on air tracks, sensor/weapon coverage areas, etc.</td>
</tr>
<tr>
<td><strong>Alerts Server</strong></td>
<td>Provides a mechanism for a user or a program to set up and view different kinds of alerts, both audio and visual.</td>
</tr>
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<tr>
<td>Oracle RDBMS</td>
<td>Provides a common database engine for the various separate databases being used by various injectors.</td>
</tr>
<tr>
<td>ATLAS</td>
<td>ATLAS provide for a common application framework and tactical graphics rendering on various map views</td>
</tr>
<tr>
<td>CJMTK</td>
<td>CJMTK provides map rendering of all NIMA data, querying of map data, and the ability to add mapping functions through “extensions”</td>
</tr>
<tr>
<td>3-D Viewer</td>
<td>Based on CJMTK. Will display 3-D terrain with CADRG and drapping, track position, and overlay objects</td>
</tr>
<tr>
<td>CIIL</td>
<td>Allows the use of ICSF/GCCS applications on C2PC, such as viewing UAV video via JIVE</td>
</tr>
<tr>
<td>XIL</td>
<td>Allows the use of XIS applications on C2PC – GCCS and GCCS-A tools.</td>
</tr>
<tr>
<td>UCP Configuration</td>
<td>GCCS FoS required function for servers to communicate.</td>
</tr>
<tr>
<td>CST Configuration</td>
<td>GCCS FoS required function for servers to filter and distribute information.</td>
</tr>
<tr>
<td>JTCW Client Functional Block Description</td>
<td>Intel Shop-O Injector</td>
</tr>
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</tr>
<tr>
<td>SPEED Injector</td>
<td>Provides for comm planning, line of sight terrain analysis, and links predictive comm link status with current or planed unit locations</td>
</tr>
<tr>
<td>Planning Injector</td>
<td>Based on CAPES, provides mission rehearsal, collaboration, future UTO, and current to planned mission comparison</td>
</tr>
<tr>
<td>Message Router</td>
<td>Message viewing, composition, logging, and alerting. Message summary can be seen in the main display by precedence. Individual VMF message can be pre-set for precedence, addressee, ack requirement, etc.</td>
</tr>
<tr>
<td>CMP</td>
<td>COE Message Processor. Used to validate VMF and USMTF messages, as well as generate VMF messages for which there is not a specific GUI.</td>
</tr>
<tr>
<td>Address Book</td>
<td>Contains unit, billet and platform information needed for communications, generating tracks, and show current UTO. Synchronizes via Gateway</td>
</tr>
</tbody>
</table>
## JTCW Client Functional Block Description

<table>
<thead>
<tr>
<th>JIVE</th>
<th>View Predator and other streaming video, and displays UAV coverage area on the map. Uses CIIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDSS</td>
<td>Amphibious operations planning tool. Uses CIIL</td>
</tr>
<tr>
<td>GPS Service</td>
<td>Allows the generation of your “own track” that can be displayed. Updates location and transmits it to pre-set groups</td>
</tr>
<tr>
<td>Set Time Service</td>
<td>Used to set system time based on GPS feed</td>
</tr>
<tr>
<td>CoT/M2MT</td>
<td>Gives an interface to 50+ systems that use its XML schema to pass blue PLI, target, and other types of information</td>
</tr>
<tr>
<td>JWARN Injector</td>
<td>The JWARN injector will provide the capability to display NBC related graphics on JTCW maps, use the JTCW Track Plot Injector units database to determine NBC hazards to Units, and utilize the JTCW messaging system to transmit NBC related reports.</td>
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</tbody>
</table>
## JTCW Gateway Functional Block Description

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<tr>
<td><strong>EZ-PASS</strong></td>
<td>This provides a secondary PASS server capability in case the AIS Server fails. Also to be used in the USMC to get PASS data from Army AIS servers for interoperability</td>
</tr>
<tr>
<td><strong>NRTS</strong></td>
<td>Provides the core interface capability to ABCS systems via PASS and other mechanisms. PASS Provider gets PASS topics. FBCB2 Provider receives and translates SA data. AMDWS Provider translates AMDWS data. NRTS Provider can be used to communicate between NRTS’s</td>
</tr>
<tr>
<td><strong>C2PC Gateway</strong></td>
<td>Data distribution function that uses data subscription, data synchronization, correlation and persistent storage. Manages and distributes tracks from GCCS 3.x and 4.x, C2PC address book data, and overlay files. Omnitracks and SOCOM sensor data is also supported.</td>
</tr>
<tr>
<td><strong>Web Server (IIS)</strong></td>
<td>Provide webpages to users (TACWEB function)</td>
</tr>
<tr>
<td><strong>Web App Server</strong></td>
<td>Provides web-services functionality, such as WebCOP (view track, overlay, etc.) data via the web, as well as functional applets for WEEMC (ADOCS functionality)</td>
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</tr>
<tr>
<td><strong>ArcSME</strong></td>
<td>Provide map data via the web on a browser. Part of Joint WebCOP</td>
</tr>
<tr>
<td><strong>Oracle RDBMS</strong></td>
<td>Persistently store data from the C2PC gateway, CJMTK map information, etc.</td>
</tr>
<tr>
<td><strong>MIP Injector</strong></td>
<td>Provides Coalition interoperability and interface to the C2IEDM.</td>
</tr>
</tbody>
</table>
JTCW Critical Tasks

- JTCW Development Tasks
  - Deliver JTCW solution NLT SEP 05 for joint integration and test
  - Deploy JTCW a Software Block II solution for the ground tactical domain
  - Manage the migration of MCS Eng, CAPES, MIP (+ cross domain solution), to the JTCW baseline
  - Manage the migration of key foundation capability (PASS, NRTS, etc) as elements of the C2PC 7.0 foundation
  - Ensure the JTCW baseline maintains interoperability with ABCS
JTCW Injector Critical Tasks

• CAPES
  – Develop and enhance the JTCW mission planning and rehearsal tool for all echelons (from company up to corps), meeting GE requirements, while effectively integrating as a core injector for SW version 6.2.
  – Maintain interoperability amongst ABCS 6.4 systems.
  – Fulfill all necessary time, documentation, and performance criteria as a core injector.
JTCW Injector Critical Tasks

• JWARN
  – Develop the NBC software tool to meet GE requirements, while effectively integrating as a third party injector for SW version 7.0.
  – Establish a development plan, schedule, and MOE to monitor success.
JTCW Injector Critical Tasks

• ENG/JEA
  – Develop the ENG/JEA software tool to meet GE requirements while effectively integrating as a third party injector for SW version 6.2.
  – Establish a development plan, schedule, and MOE to monitor success.
JTCW Injector Critical Tasks

- MIP
  - Develop and enhance coalition data exchange tool, meeting GE requirements, while effectively integrating as a third party injector for SW version 6.2.
  - Maintain interoperability amongst ABCS 6.4 systems.
  - Fulfill all necessary time, documentation, and performance criteria as a third party injector.