Using Assessment Methods & Tools to Understand Joint Battle space Digitisation (JBD)
Scope of the Work

Introduction

Requirements & Challenges of JBD

Need for A.F.

Existing A.F.
DoDAF + MODAF

Approach for using A.F.
(Process, Methods and Tools)

JBD Architecture Framework (A.F.)

Methods for analysis

Scenarios

Design the Modeling work

Apply this to the Saudi needs

Results for Saudi JBD

Conclusions about the use of + value of the approach + A.F.

Recommendation about the Problem + Its Solution.
Introduction

The system is increasing the complex and there is not a comprehensive methodology to aid the systems engineering or even the end user to analyse its characteristics.

Quick movement of land, sea and air forces are necessary in battle timely communication and processing of this information, and ensuring its availability to all level of decision making authorities plays a decisive role in success.

There are several methods being developed that are potentially useful for analyzing Joint Battlespace Digitisation (JBD) but they are not adequate to cope with complexity and emergent behavior of different level of complex systems.
The Joint Battlespace Digitisation (JBD) programme aims to enhance the operational effectiveness of Saudi Arabia forces in Joint and Combined operations by using modern information technology to couple weapons, sensors, communications and information systems (CIS) across the battlespace and thus to create an effective, robust, efficient and affordable federation of systems.
Joint Battle space Digitisation

Across the Battle space

To Couple

By Using Information Technology

Mission

C4I

To Create

Situational Awareness

Effective

Robust

Efficient

Affordable Federation

Relevance

Timing

Accuracy

Flexibility

Resilience

Right Granularity

Scaleability

Cost

Legitimate Ops Requirements

Continuance

Maintainability

Existing investment

Technological change

Manpower & training demands
JBD Architecture Framework Process

**PROCESS**

- **Management & Organisation**
- **Structure & Requirement**
- **Efficient Command**
- **Situational Awareness**

**Methods to support the views**

**Tools to support the Methods**

**Use of Scenarios (info)**

**External environment**
- Provision for Interoperability
- Better Decision Making, Tempo And Unity
- Maintain awareness of Technologies that Support the goals
- Insert new Technologies into The systems

**Doctrine & Command Structure**
- Capability Need
- Provide Ongoing Skills & Knowledge
- Change Management (e.g. comms, control & monitor, and human factor issues)

**System Architecture Applications**

**Design & Realisation**

**Identify Critical Issues**

**JBDAF Views**
JBD Challenges

Displaying & Passing Of Information and Data Bases

Joint Battle space Digitisation

Situational Awareness

Information Tech

Micro Management

Security Multi-National Services

Process, collate, of the sensor data to distribute to any recipient anywhere in the world

Support & Sharing

Planning

Mission

Execution

The Ability to Order, Respond and Co-ordinate Vertically & Horizontally to the degree Necessary to Prosecute The Mission in the Battle Space

Maintenance of a common Tactical Picture among Distributed GCCS sites Global C2 System

JBD Challenges

True Picture

Sensors

ASTOR

JSTAR

SOSTAR

GMI

Fused view

Real-time

Data Processing

C4I

Analysis & Briefing Support

Precise munitions

Reducing the cost

Weapons Tech

Technology

Sensor Tech

Surveillance

Data fusion

Detect, Locate, Identify and Track the Target

SITUATIONAL AWARENESS

SOSTAR

JSTAR

ASTOR

The Ability to Order, Respond and Co-ordinate Vertically & Horizontally to the degree Necessary to Prosecute The Mission in the Battle Space
Provision for Interoperability
– ensure compatibility of systems, processes or procedures.

Command micro-management
– deal with reduced command delegation, increased command chain and destruction from the overall picture/objectives.

Information reliance
– guard against reduced confidence/ reluctance in decision making missed point of opportunities due to required levels of information completeness.
Command Structure
– must be compatible with the information flow requirements and decision hierarchy (it must facilitate & support the same).

Recruitment & Training
– must personnel are matched with skills required (it must provide development & maintenance of the same).

Reduced Manning
– deal with insufficient manpower for reversionary modes of operation.
DoD Architecture Framework (DoDAF)

**Operational View**
- Identifies What needs to be Done and who Does it
- Information Flow

**Technical View**
- Specific Capabilities Required to Satisfy Information Exchanges

**Systems View**
- Relates System and Characteristics to Operational Needs

**Communications**
- System that Support the Activates and Information Exchanges

**Activities**
- What Needs to be Done
- Who Does It
- Information Exchanges Required to Get it Done

**Operational Elements**
- Operational Requirements and Capabilities
- Basic Technology Supportability
- New Technical Capabilities

**Standards**
- Technical Standard Criteria Governing Interoperable Implementation / Procurements of the Selected System Capabilities

**Rules**
- Prescribes Standards and Conventions

**SOURCE:** DoDAF- Overview Dr. Fatma Dandashi Oct 2003
MOD Architecture Framework (MODAF)

Operational View
Identifies Warfighters Relationships, processes and information needs

Acquisition View
Highlights interdependencies and integration across Capability Elements

Systems View
Describes how System Capabilities Satisfy Operational Requirements

Technical View
Prescribes Policy, Standards, Guidance and Constraints

Capability View
Provides Comprehensive Capability Management Information

SOURCE: MODAF-M03-001, Draft 0.3 27 Sep 2004
DoDAF

Operational tasks, elements and information flows required to accomplish military operation

Op Node Connectivity
Op Info Exchange
Op Concept
Op Rules
Activity Model

Systems and interconnections providing for or supporting military operation

Sys Tech
Sys Performance
Sys Interface
Sys Functionality
Sys Rules
Physical model

Existing Architecture Framework

DoDAF

Technology Architecture Profile

Minimal set of rules governing the arrangement, interaction and interdependencies of system parts or elements
The STT structured cascading mechanism

I

Saudi National Missions
Saudi Defence
Doctrine

Types of Military Ops
Armed Forces Doctrine
Publications

II

III

IV

V

• Armed Forces Fight Wars

High Level Strategic Objectives

Formation Objectives

Lower Level Objectives

Tactical Tasks/Missions

System Level Tasks

• Destroy Enemy Forces

Saudi Military Functions

Tactical Application of Military Functions

• Capture Objective/Hold Position

IF Tasks
Formation Tactics

• Armed Forces Fight Wars

• Destroy Enemy Forces

• Capture Objective/Hold Position
The STT structured cascading mechanism

• The process, starts from expressions of high-level requirements and cascades through several structured layers to arrive at the lower-level tasks.

• Each box is a Quality Function Deployment (QFD) matrix where a set of requirements is mapped against a set of responses generated from reviews of the source material.
## STT at Strategy level

<table>
<thead>
<tr>
<th>Source Saudi Doctrine and JETL</th>
<th>Grand Strategic Level Tasks</th>
<th>Responses from Saudi Doctrine</th>
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<tbody>
<tr>
<td>Saudi Defence Missions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paccatime Security</td>
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<tr>
<td>Defence Diplomacy</td>
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<td>Peace Support</td>
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<td>Regional Conflict outside GCC</td>
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<td>3 3</td>
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<tr>
<td>Strategic Attack on GCC</td>
<td>0.14266</td>
<td>3 3</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Raw Technical Importance</th>
<th>3.0 3.3 4.0 1.6 4.1 3.3 4.7 24.0</th>
<th>Sum of Raw Technical Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalized Technical Importance</td>
<td>0.1250 0.1369 0.1667 0.0655 0.1726 0.1369 0.1964</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Sum of Initial Weights: 1.0000
STT with different Sub-Systems options
System Dynamic (Vensim Model)
Results from the Vensim Model

The Vensim model simulates a scenario of possible escalation of conflict. It attempts to incorporate all options in an escalating scenario that spans 28 days.

The simulations begin by specifying a number of hostile targets. Depending on the options in place, the targets are detected and prioritised as shown in graphs.
Results from the Vensim Model (2)

The effectiveness of JBD determines the threat assessment. This involves measuring target parameters, transmitting, and prioritizing them to command sector.

The targets can be chosen to be eliminated, at the operational level, authorization of target engagement as shown in Graphs. Eventual destruction is dependent upon the effectiveness of JBD.
Evolution Area

Use of Architectures to measure mission effectiveness (capabilities and measure of effectiveness) by using JBDAF
JBD Architecture Framework (JBDAF)

enable analysis of factors which contribute to mission effectiveness of JBD and to investigate the importance of these factors

Operational tasks, elements and information flows required to accomplish military operation

Op Concept
Op Info Exchange
Op Node Connectivity
Op Rules
Activity Model

enables identification of requirements for JBD and to assess potential options

Minimal set of rules governing the arrangement, interaction and interdependencies of system parts or elements

STT

Vensim Model(SD)

Technology Architecture Profile
Standards technology Forecast

enables analysis of specific technical parameters leading to validation of STT assessment

Systems and interconnections providing for or supporting military operation

Sys Tech
Sys Performance
Sys Interface
Sys Functionality
Sys Rules
Physical model

enables analysis of factors which contribute to mission effectiveness of JBD and to investigate the importance of these factors
enable analysis of factors which contribute to mission effectiveness of JBD and to investigate the importance of these factors.

Operational

- Op Concept
- Op Info Exchange
- Op Node Connectivity
- Op Rules
- Activity Model

Operational tasks, elements and information flows required to accomplish military operation.

Systems and interconnections providing for or supporting military operation.

- Sys Tech
- Sys Performance
- Sys Interface
- Sys Functionality
- Sys Rules
- Physical model

Technology Architecture Profile

Minimal set of rules governing the arrangement, interaction and interdependencies of system parts or elements.

STT

- enables identification of requirements for JBD and to assess potential options
- Cap Vision
- Cap Function
- Cap Phasing
- SoS Clusters

provide comprehensive information

SD sim

- enable analysis of specific technical parameters leading to validation of STT assessment
- Technology Architecture Profile
- Standards technology Forecast

JBDAF

- Cap Function
- Cap Phasing
- Acq Clusters
- Acq Programmes
- SoS Clusters

describe the relationships and dependencies between the activities.
Conclusion

• There are several significant shortfalls in MODA technical policy. The most significant of these relate to the policies for secure interconnection, message handling, messaging security, internetworking, data management and communications demand management.

• A key issue for JBD is how to pursue an evolutionary approach across a complex federation of systems in a competitive system acquisition regime.

• JBD capability is achieved by realising components of that capability in Component Systems.

• Actual JBD capability will become available to the user only as these enhancements to Component Systems are rolled out across the in-service platforms.
Conclusion (2)

- Use of the JBDAF provides the consistency and common language to enable the stakeholders (people involved in the JBD) to express the problem and to reach the solution.

- Having a STT will underpin the JBDAF providing the consistency of approach to architectural modeling and provide a good means for change management of the architecture framework. STT identifies the gaps in system available to meet operational needs.

- The system dynamic model is to monitor the effects of programmatic changes to a system on the overall SoS.

- We will know the impact on the performance, time and cost of other systems, which aids decision-making.