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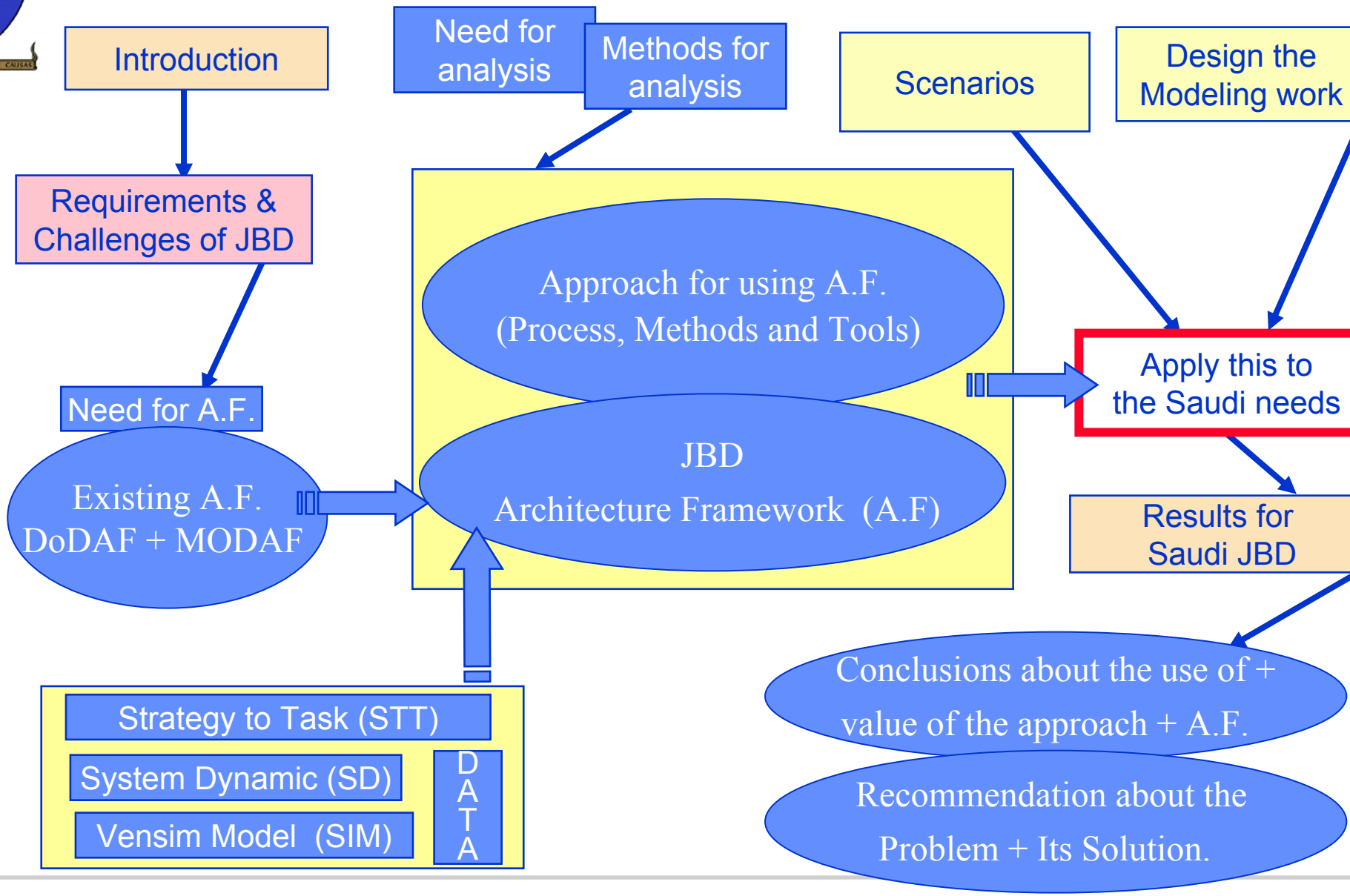
Naif M. Al-Duwaish

Engineering Systems Department
Cranfield University, Shrivenham, UK

Using Assessment Methods & Tools to Understand Joint Battle space Digitisation (JBD)

Scope of the Work



Introduction

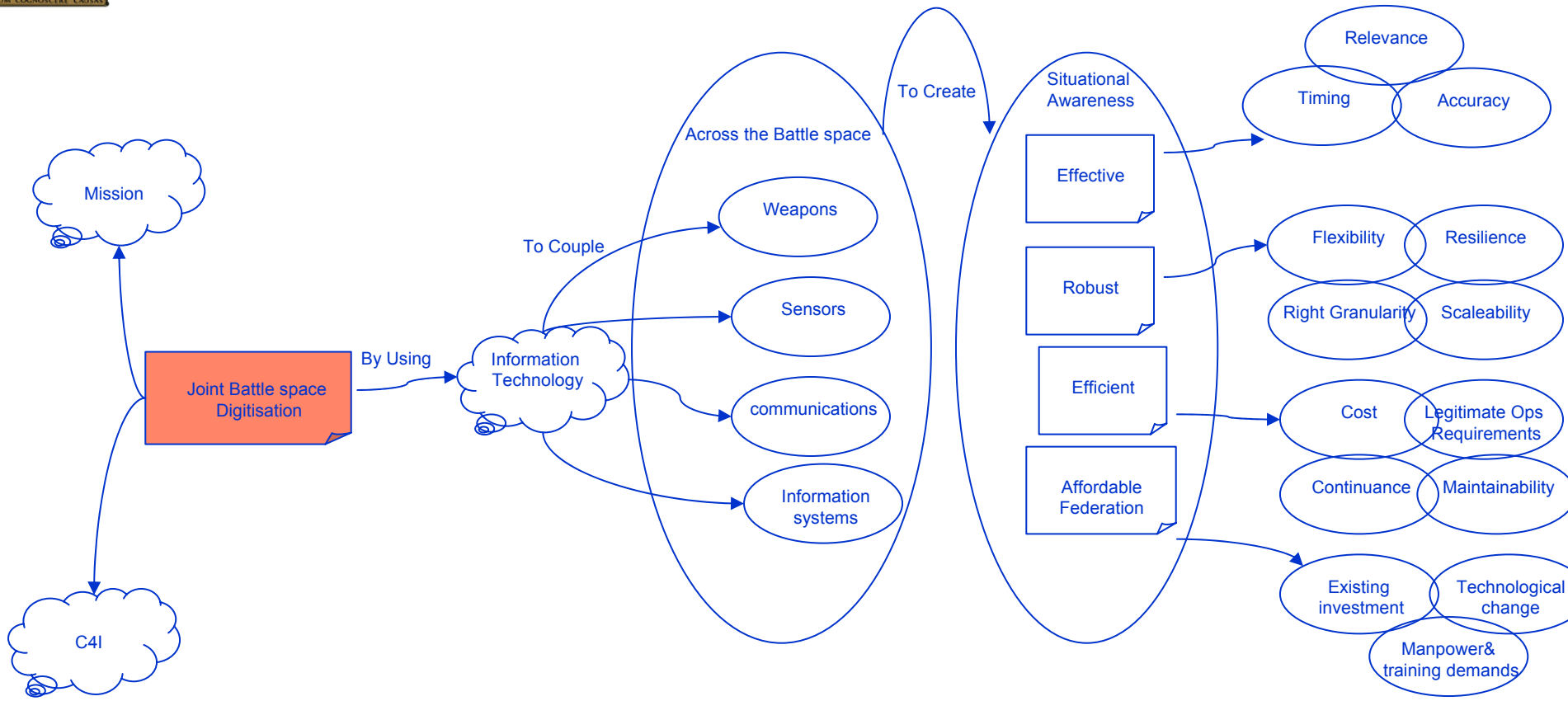
The system is increasing the complex and there is not a comprehensive methodology to aid the systems engineering or even the end user to analyse its characteristics.

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.

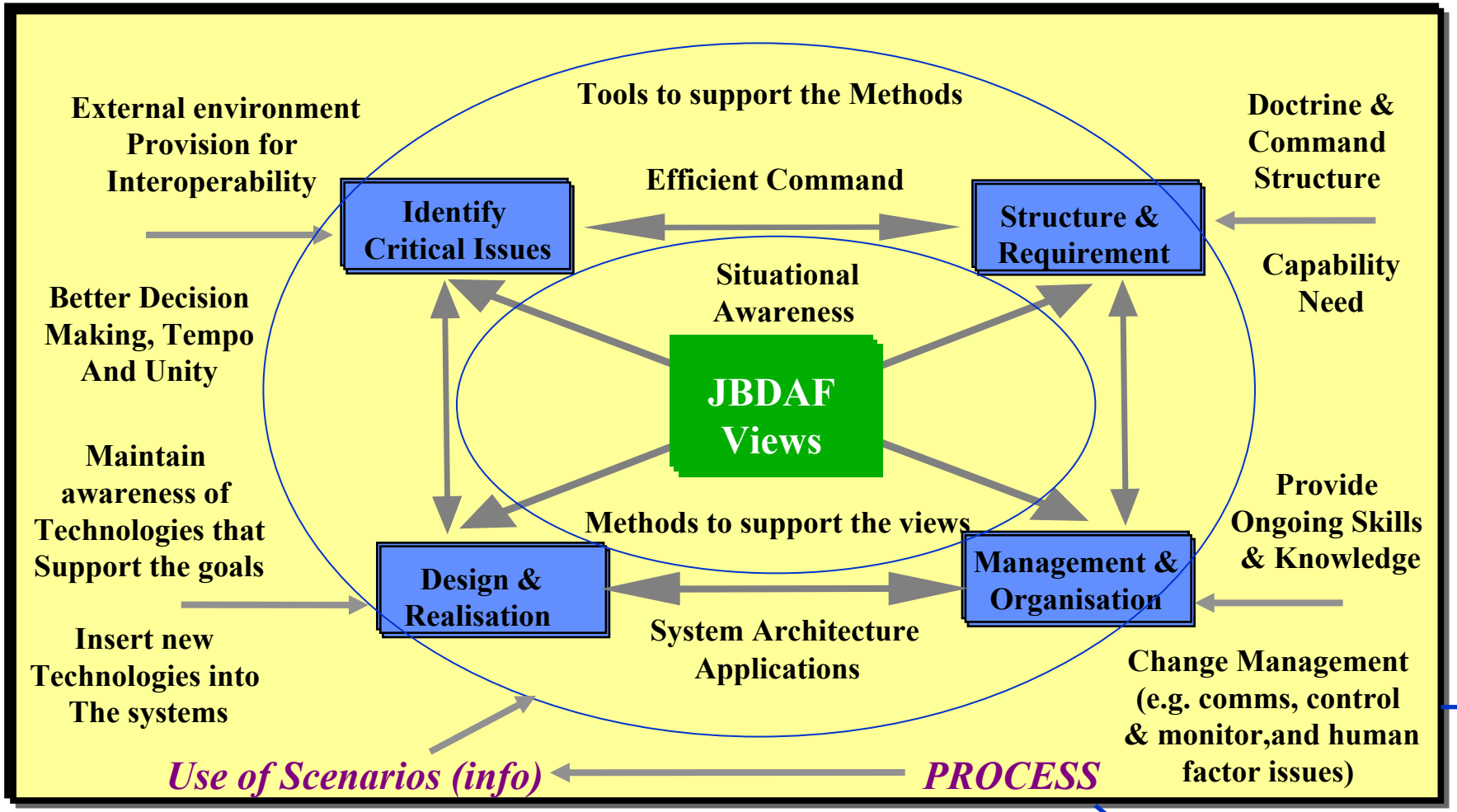
There are several methods being developed that are potentially useful for analyzing Joint Battlespace Digitisation (JBD) but they are not adequate to cope with complexity and emergent behavior of different level of complex systems

JBD Aim

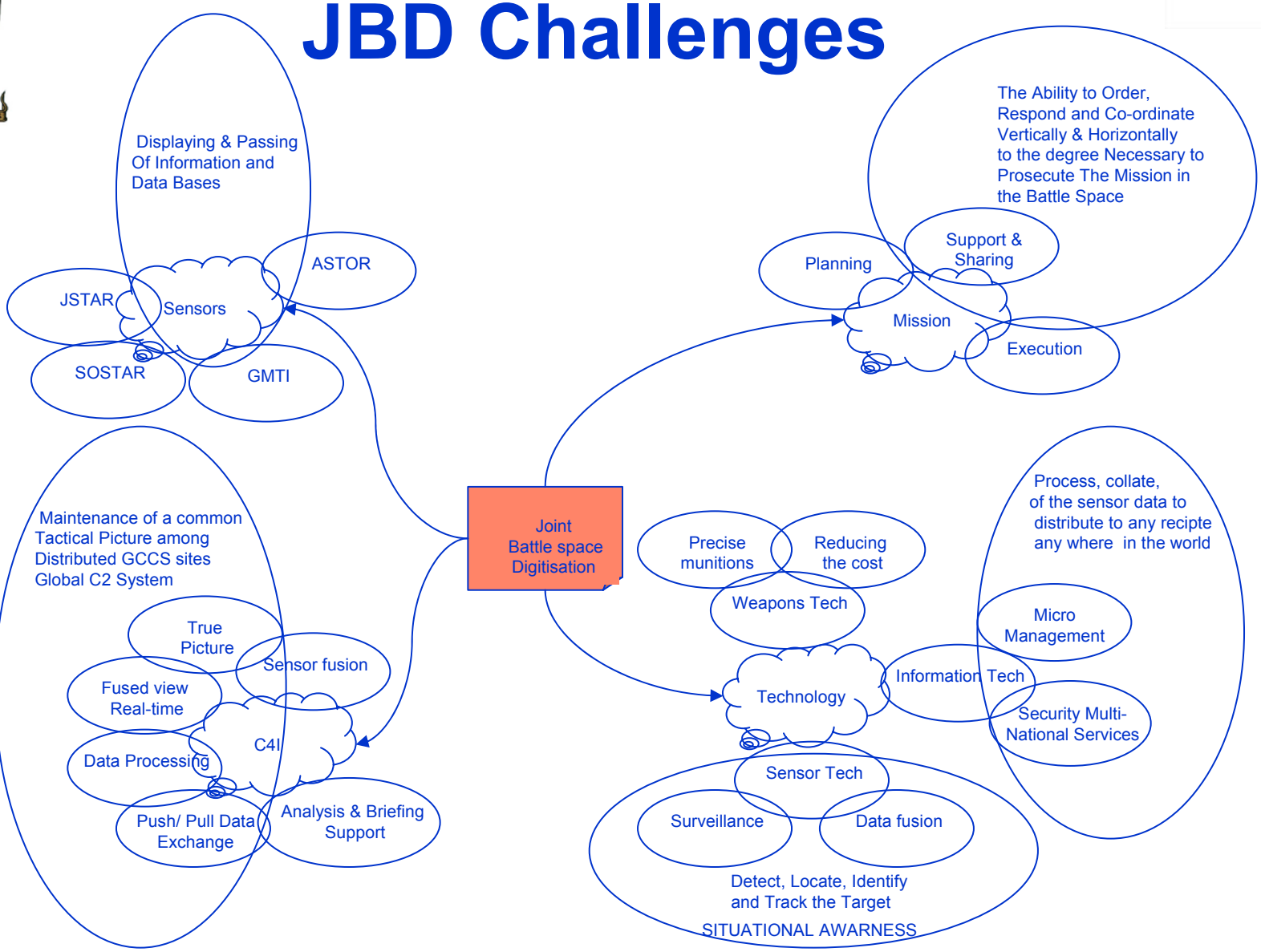
The Joint Battlespace Digitisation (JBD) programme **aims** to enhance the operational effectiveness of Saudi Arabia forces in Joint and Combined operations by using modern information technology to couple weapons, sensors, communications and information systems (CIS) across the battlespace and thus to create an effective, robust, efficient and affordable federation of systems.


Mission
Joint Battle space Digitisation
C4I
By Using
Information Technology
To Couple
Across the Battle space
Weapons
Sensors
communications
Information systems
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



JBD Challenges



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.

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Command Structure

– must be compatible with the information flow requirements and decision hierarchy (it must facilitate & support the same).

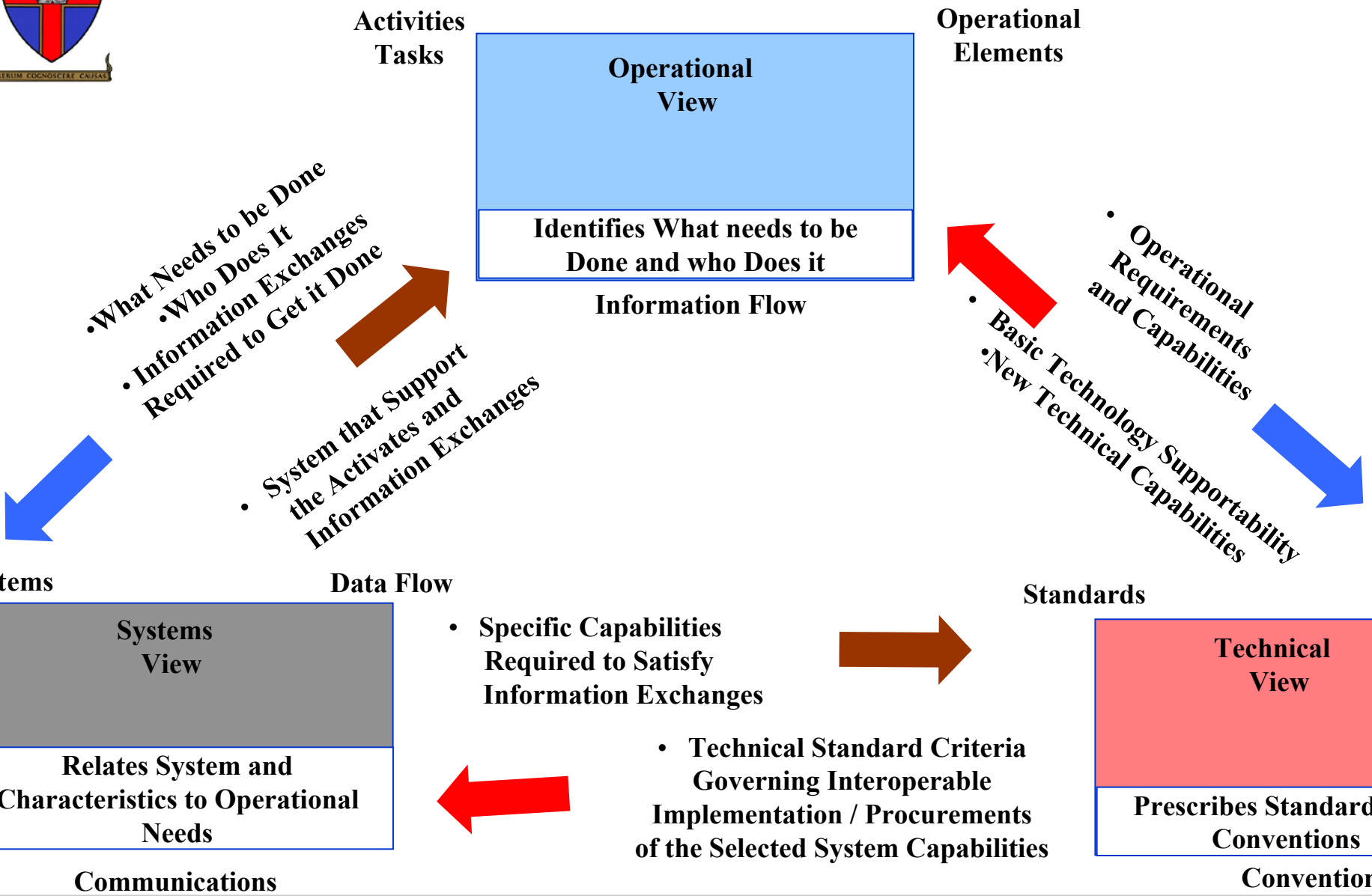
Recruitment & Training

– 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)



SOURCE: DoDAF- Overview Dr. Fatma Dandashi Oct 2003

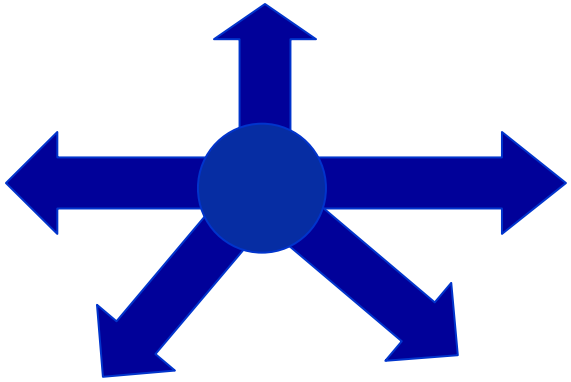
MOD Architecture Framework (MODAF)

Operational View

Identifies Warfighters Relationships, processes and information needs

Systems View

Describes how System Capabilities Satisfy Operational Requirements



Technical View

Prescribes Policy, Standards, Guidance and Constraints

Acquisition View

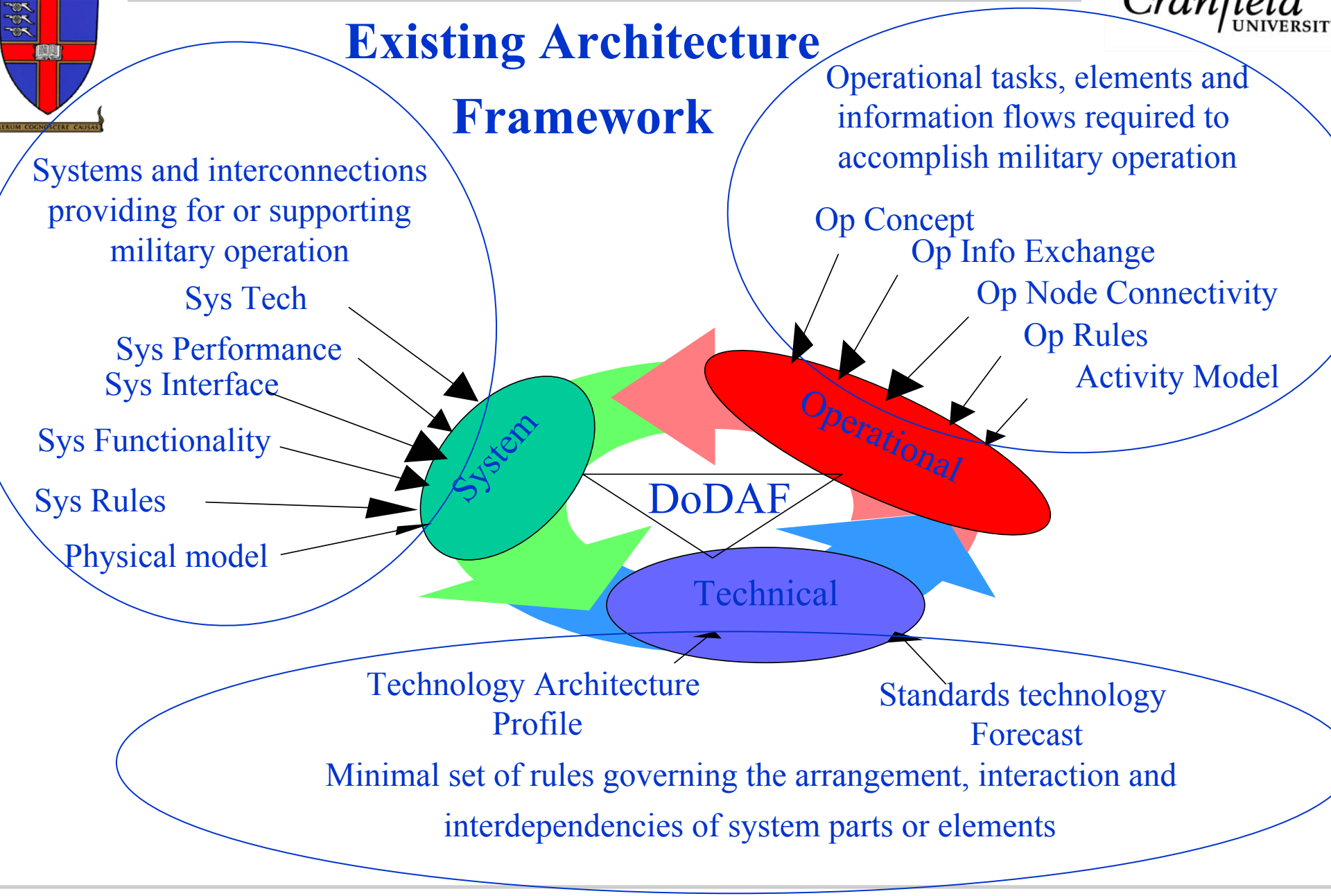
Highlights interdependencies and integration across Capability Elements

Capability View

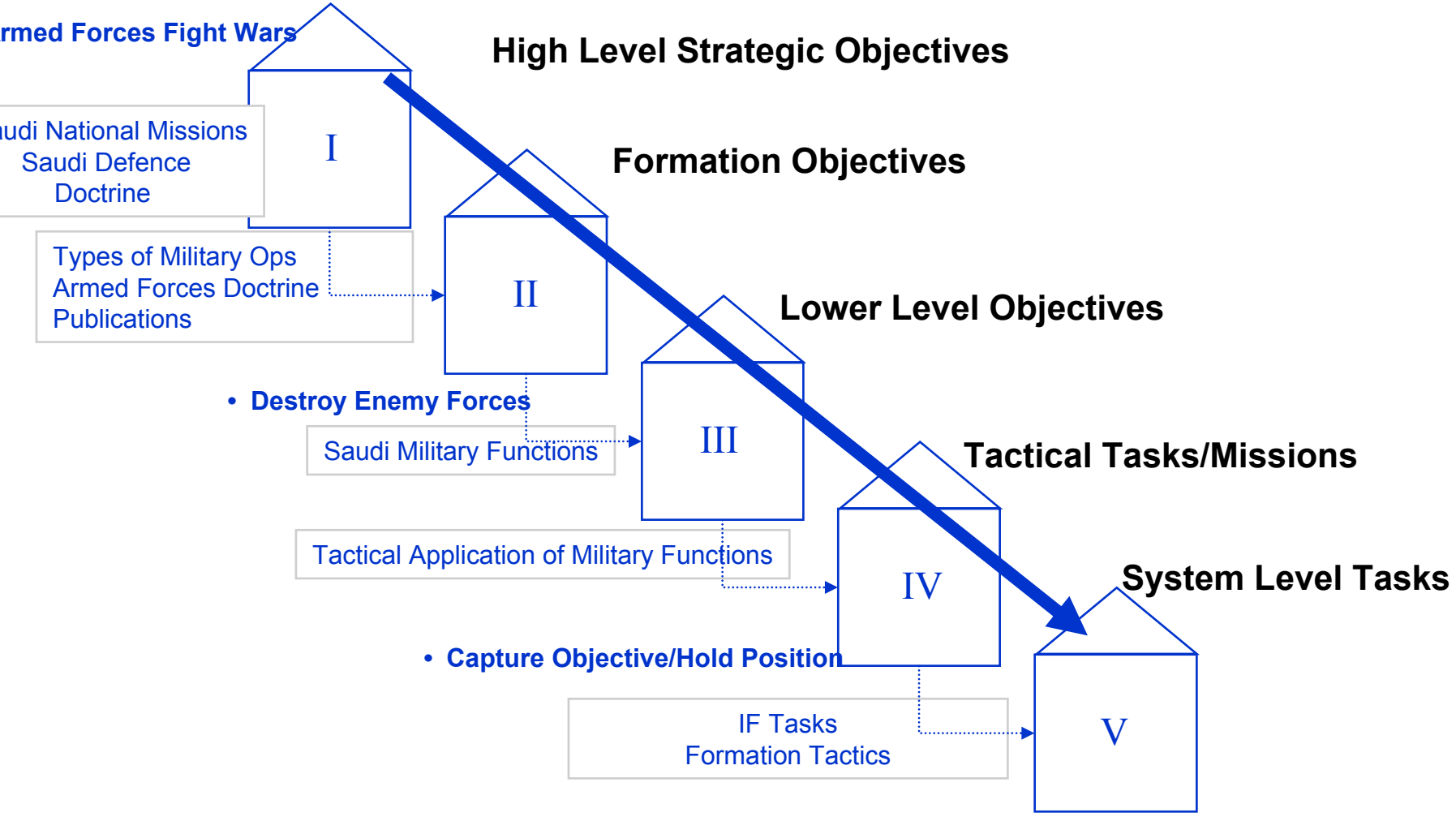
Provides Comprehensive Capability Management Information

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

Existing Architecture Framework



The STT structured cascading mechanism



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

Very Important Contributor:	9
Important Contributor:	3
High Contributor:	1
Low or Not a Contributor:	

Source Saudi Doctorine and JETL Grand Strategic Level Tasks

Saudi Defence Missions	Initial Weight	Responses from Saudi Doctrine: Information Superiority	Interoperability	Dominant Maneuver	Precision Engagement	Focused Logistics	Full Dimension Protection	Joint Command & Control
Peacetime Security	0.14286	9	3	1			3	1
Defence Diplomacy	0.14286	1	1				1	1
Support to Wider Saudi Interests	0.14286	1	1	3	1	1	1	1
Peace Support	0.14286	1	3	3	1	1	3	3
Regional Conflict outside GCC	0.14286	3	3	3	3	9	3	9
Regional Conflict Inside GCC	0.14286	3	3	9	3	9	3	9
Strategic Attack on GCC	0.14286	3	9	9	3	9	9	9

Raw Technical Importance		3.0	3.3	4.0	1.6	4.1	3.3	4.7	24.0 Sum of Raw Technical Importance
Normalized Technical Importance		0.1250	0.1369	0.1667	0.0655	0.1726	0.1369	0.1964	1.0000

Sum of Initial Weights	1.0000

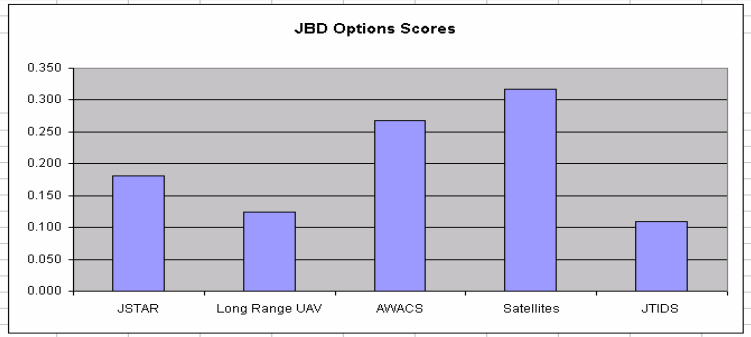
STT with different Sub-Systems options

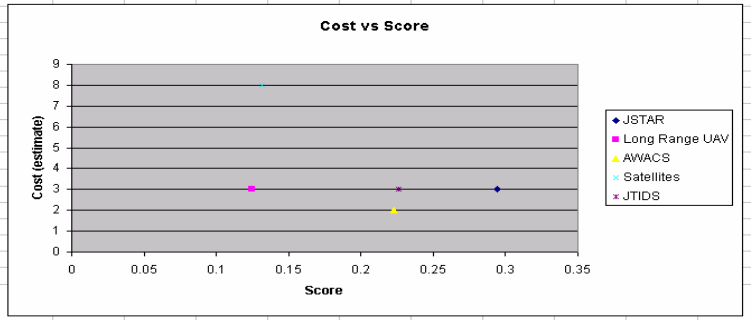
Very Important Contributor:	9	Directly equatable in the text
Important Contributor:	3	Mentioned in the text body
High Contributor:	1	Mentioned in the Sidebar Concepts/Enablers/Technologies (only)
Low or Not a Contributor:		Not mentioned at all

Percent Filled #DIV/0!

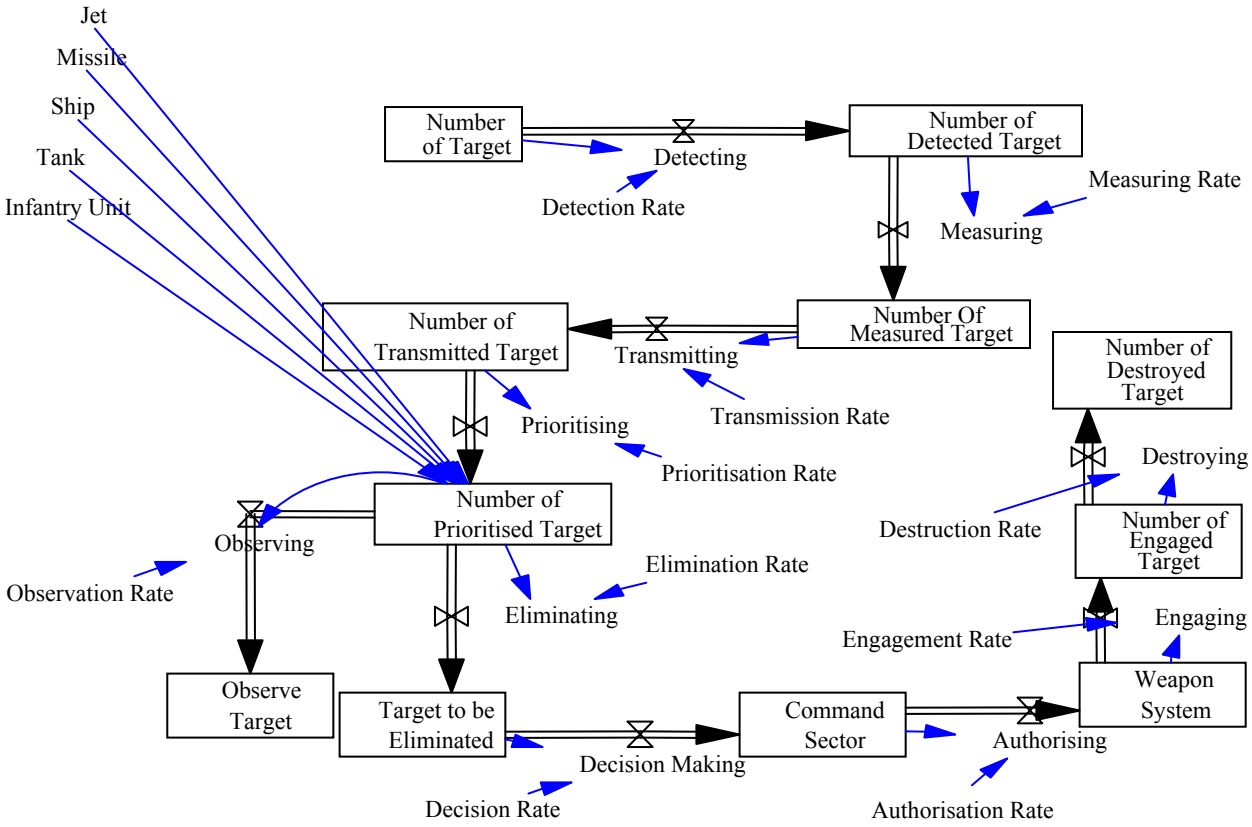
WHATS - OPERATIONS ADP Vol1 — JBD Options

LEVEL 1: *Strategy-to-Task Analysis*	Initial Weight	JSTAR	Long Range UAV	AWACS	Satellites	JTIDS
Situational Awarness	0.0481	3	3	9	9	3
Own Force Location	0.0305	3	3	3	3	1
Enemy Force Location	0.0337	3	1	3	3	1
Force Protection	0.0337	1	1	9	3	
Interdiction of Enemy's Forces	0.0318	3	3	3	3	3
Blockade	0.0102	3		3		
Containment	0.0160			1	1	
Exclusion Zones	0.0072	3	3	3	3	3
Barrier Operations	0.0160		3			
Layered Defence	0.0160	1	1	1	1	1
Enemy Force Intent	0.0115		1	3	9	
Strategic Air Lift	0.0195	1		3	3	
Tactical Air Lift	0.0265	1				1
Sea Lift	0.0217					
Strategic Nuclear Deterrence	0.0265			3	9	
Presence	0.0158	1	1	3	3	1
Sympolic Use	0.0195	3	3	3	3	3
Coercion	0.0166					
NonCombattant Evacuation Operations	0.0366	1	1	1	1	1
Combat Operations vs Land	0.0324	9	3		3	
Combat Operations vs Air	0.0310			9	3	1
Combat operations vs Navy	0.0160	1	1	3	3	
Combat Operations vs National Guard	0.0160	3		3	3	3
Amphibious Operations	0.0299	1	1	1	3	1
Support to Joint Operations	0.0337	9	3	9	9	3
Strategic Air Offensive	0.0299	1	1	9	9	3
Counter Air	0.0299		1	9	3	1
AntiSurface Force Land	0.0543	3	3	1	3	1
AntiSurface Force Navy	0.0516	3	1	1	3	3
Land Target Attack	0.0217	3	1		3	1
Fire Support	0.0559	1	1		3	1
Intelligence Gathering	0.0238	3	3	3	9	3
Area Surveillance	0.0307	3	3	3	3	
Comms Provision	0.0086			3	9	3
Logistic Support Provision	0.0086				1	
Protection of Joint Forces	0.0134	1	1	1	3	1
Economic Sanctions	0.0193					
Disaster Relief	0.0134				3	
SAR	0.0104					
Amphibious Forces	0.0064	1	1	1	3	1
Real-time Target Data	0.0064	1	1	3	9	1
Peace Ops	0.0064	1	1	1	3	1
Raw Technical Importance		2.0	1.4	3.0	3.6	1.2
Percent Technical Importance		0.182	0.124	0.268	0.318	0.109
Sum of Initial Weights	0.9872					
Cost (Relative estimate)		3	3	2	8	3
Risk (relative estimate)		2	3	4	5	1
		0.294	0.125	0.2231	0.1318	0.2262
		JSTAR	Long Range UAV	AWACS	Satellites	JTIDS



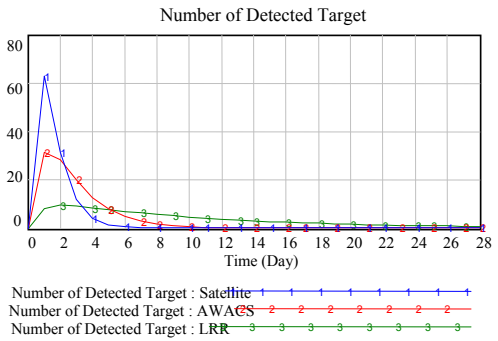


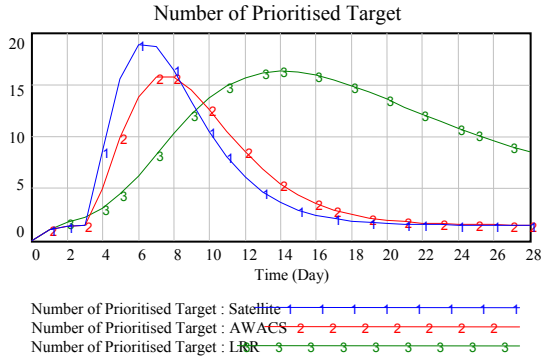
System Dynamic (Vensim Model)



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.

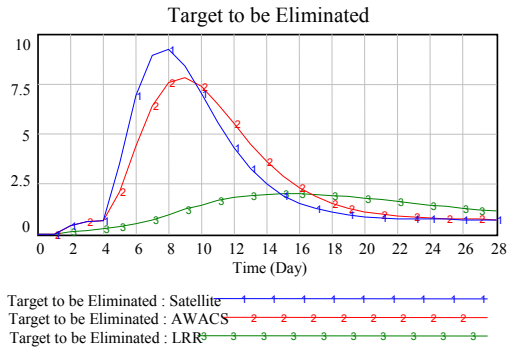


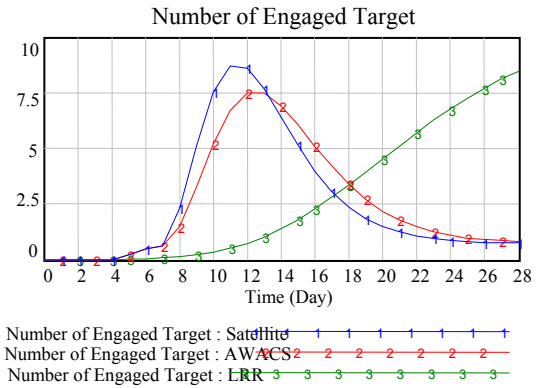


The simulations begin by specifying a number of hostile targets. Depending on the options in place, the targets are detected and prioritised as shown in graphs

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

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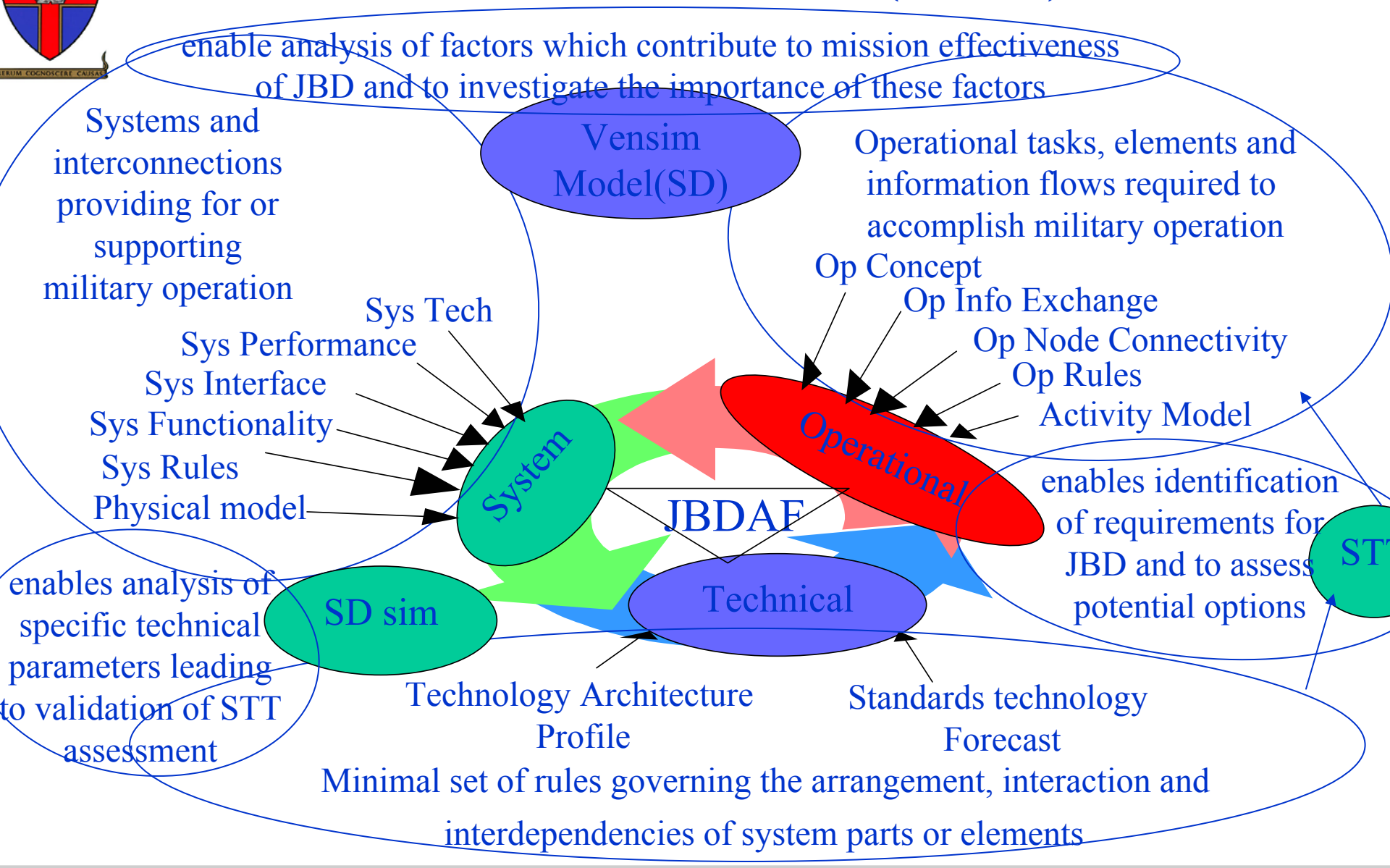
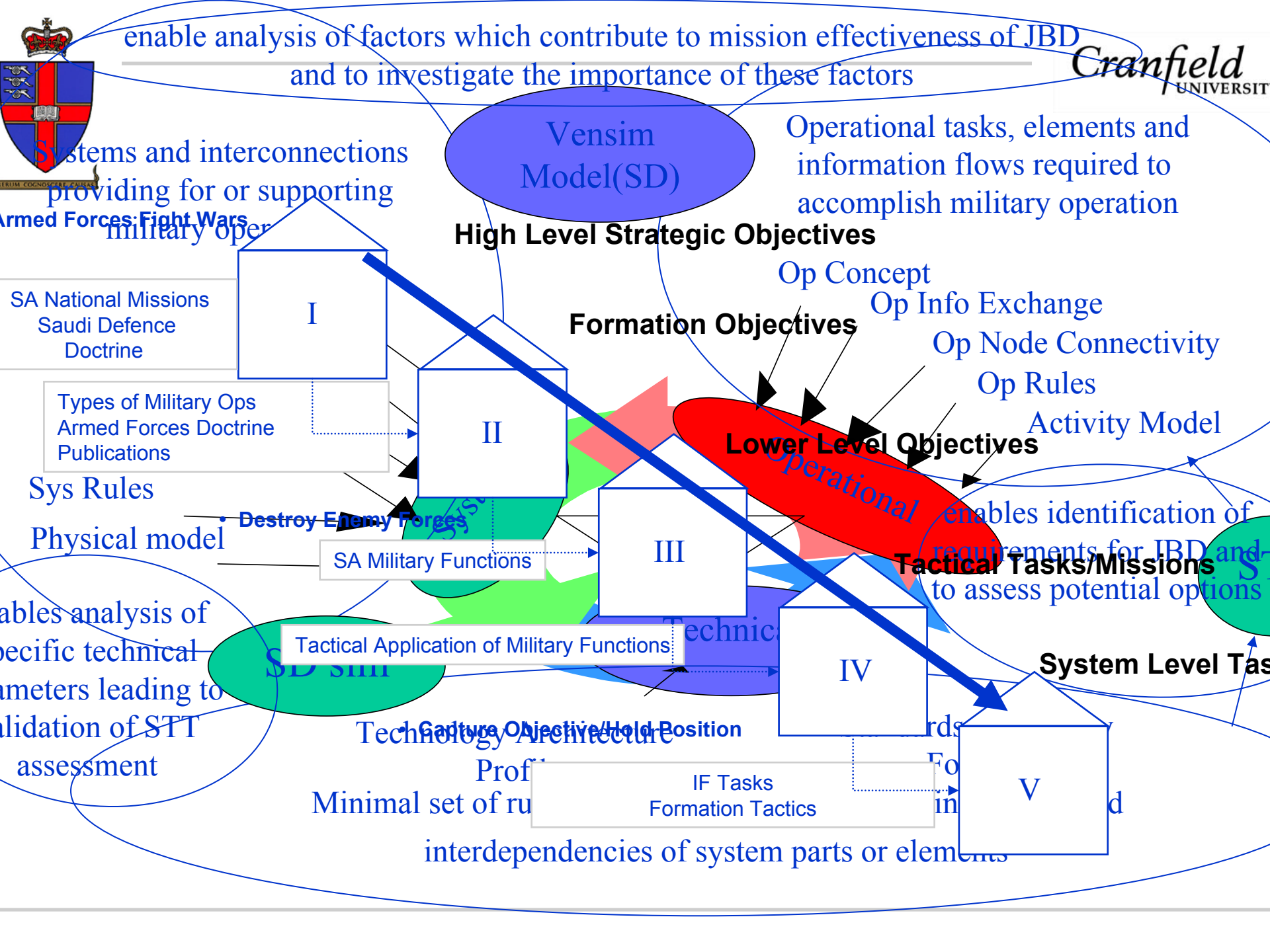
Evolution Area

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
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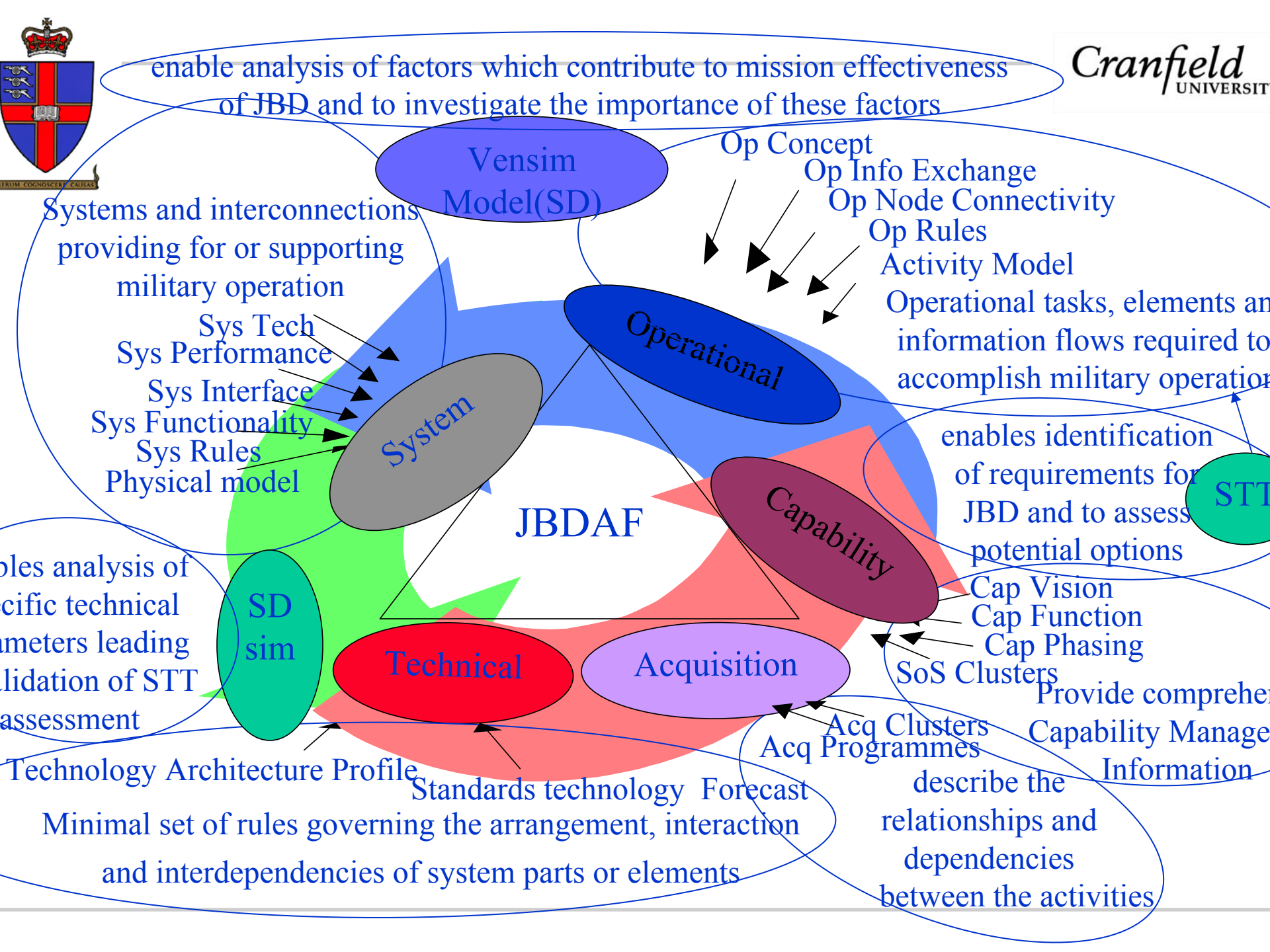
Vensim Model(SD)
Systems and interconnections providing for or supporting military oper
Armed Forces:Fight Wars
Operational tasks, elements and information flows required to accomplish military operation
High Level Strategic Objectives
Op Concept
Op Info Exchange
Op Node Connectivity
Op Rules
Activity Model
Formation Objectives
Lower Level Objectives
Operational
SA National Missions
Saudi Defence Doctrine
Types of Military Ops
Armed Forces Doctrine
Publications
I
II
III
IV
V
Sys Rules
Physical model
• Destroy Enemy Forces
SA Military Functions
Tactical Application of Military Functions
• Capture Objective/Hold Position
IF Tasks
Formation Tactics
enables identification of requirements for JBD and to assess potential options
Tactical Tasks/Missions
System Level Tas
ables analysis of
pecific technical
ameters leading to
alidation of STT
assessment
Technology Architecture
Minimal set of ru
interdependencies of system parts or elements


enable analysis of factors which contribute to mission effectiveness of JBD and to investigate the importance of these factors
Vensim Model(SD)
Op Concept
Op Info Exchange
Op Node Connectivity
Op Rules
Activity Model
Systems and interconnections providing for or supporting military operation
Operational tasks, elements an information flows required to accomplish military operation
Sys Tech
Sys Performance
Sys Interface
Sys Functionality
Sys Rules
Physical model
Operational
System
JBDAF
Capability
enables identification of requirements for JBD and to assess potential options
STT
Cap Vision
Cap Function
Cap Phasing
SoS Clusters
ples analysis of ecific technical ameters leading lidation of STT assessment
SD sim
Technical
Acquisition
Provide comprehe Capability Manage Information
Acq Clusters
Acq Programmes
Technology Architecture Profile
Standards technology Forecast
describe the relationships and dependencies between the activities
Minimal set of rules governing the arrangement, interaction and interdependencies of system parts or elements

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 involve 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.