



OR : Making an Impact in a Systems Engineering Environment

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Setting the Scene

- MBDA is a leading global world-wide missiles and missile systems prime contractor
- 45 products in service
- 30 products in development
- Extensive experience of international programmes e.g. Storm Shadow/SCALP, PAAMS, Meteor
- Team of 14 – OA related activities
- Industrial Environment - Part of a systems engineering culture



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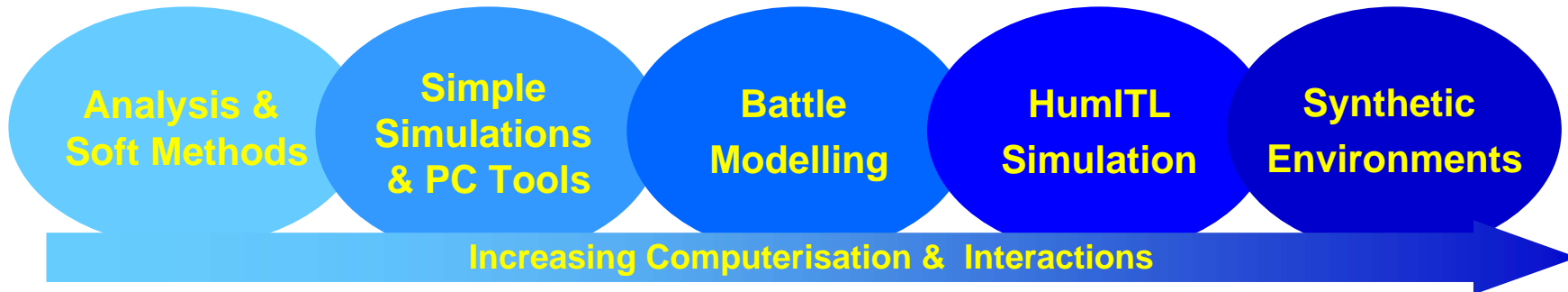


MBDA
MISSILE SYSTEMS

Typical Tasks

- Analysis and capture of User Requirements
 - *What does the User need the system to do ?*
- Defining System Architectures (MODAF Operational Views)
 - *Logically, how will the system work ?*
 - *How will the system interact with other entities ?*
 - *How will it be commanded ? Who makes the decisions ?*
- Concept of Employment (CONEMP)
 - *How will the system be used ?*
- Evaluation of Operational Effectiveness
 - *How good will the system be in operational use (quantitative and qualitative measures) ?...compared to other options and competitors ?*
 - *How could we refine the system design ?*
- Cost-Effectiveness studies and support to Business Cases
 - *Is it a cost-effective system ?*
 - *What is the balance of investment compared to other types of system ?*

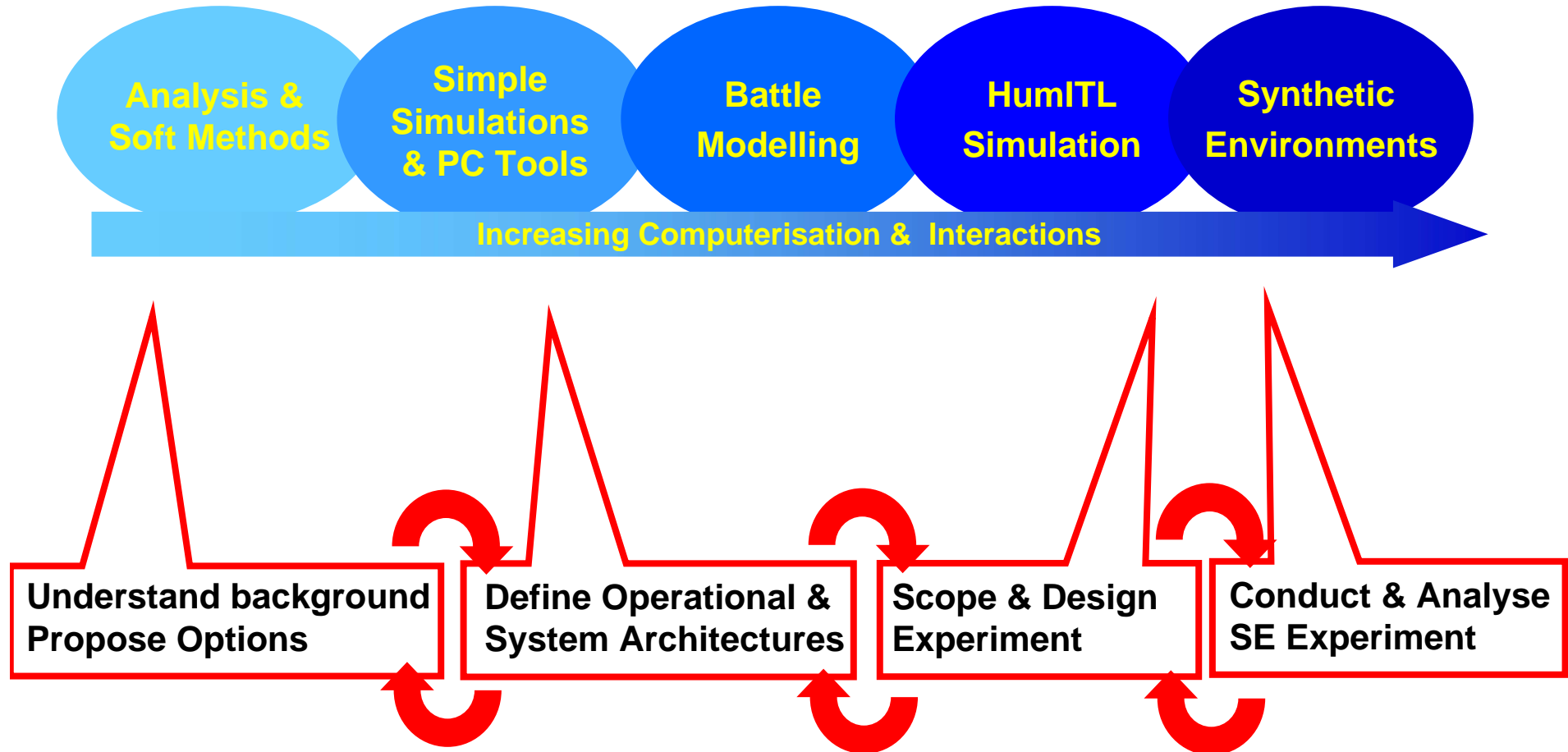
Scope of Tools and Techniques



Examples:

- Problem structuring
- Application of Doctrine
- Decision making methodologies
- MODAF, DODAF
- N2
- QFD
- Strategy to Task
- Excel
- Popkin System Architect
- EXTEND™
- **FLAMES**
- BACMOT
- TEMPO
- **FOX-SE**
- Viewers / Analysis Tools
- MMI
- FOX-SE + SEAPI + L16
- FLAMES + F-SEAPI
- Viewers / Analysis Tools
- MMI
- Etc....

Example : Developing a Concept of Employment



Typical Tasks

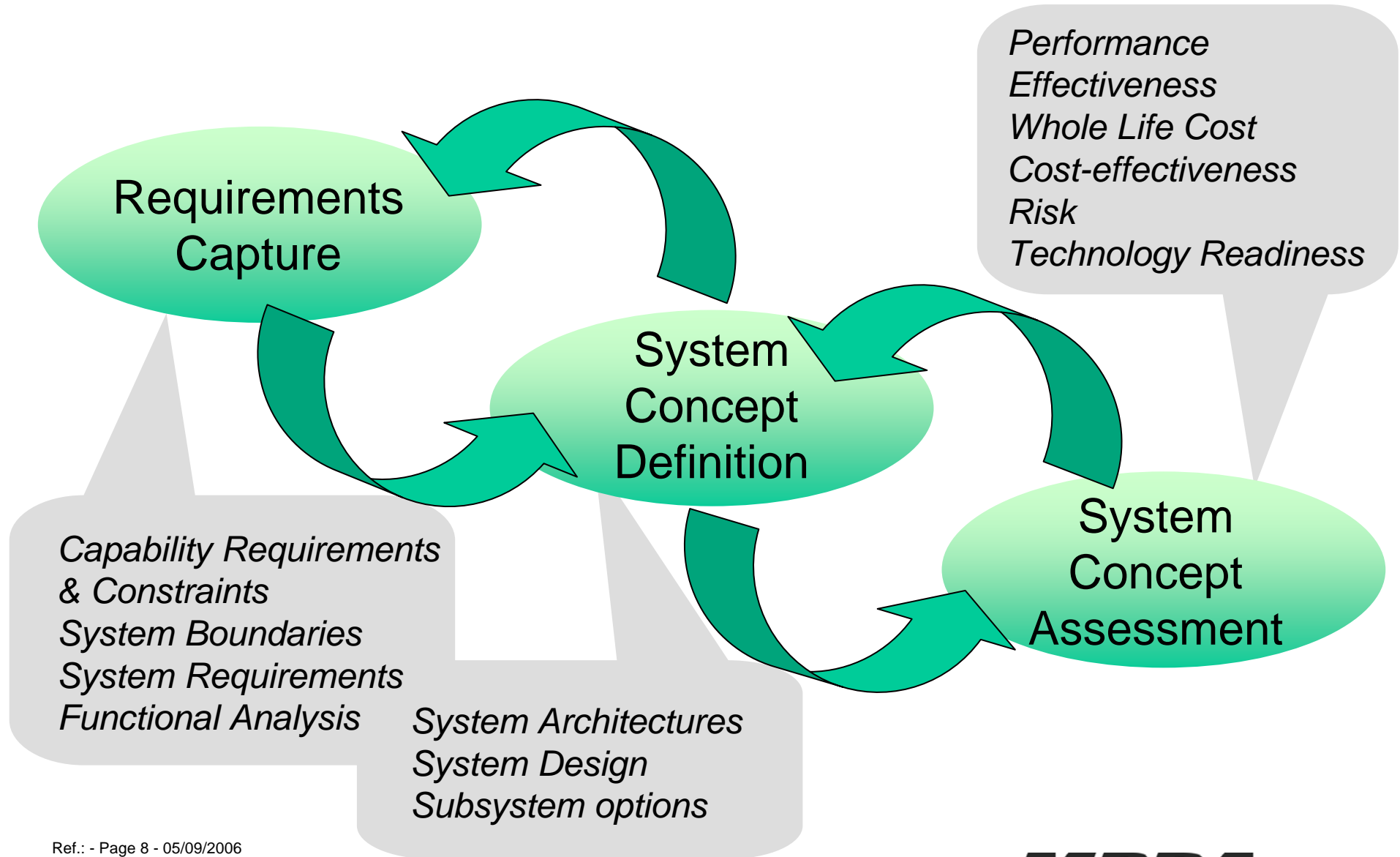
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Typical Concept Study



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Generic Weapon System Boundary


Defence Lines of Development:

<i>Training</i>	<i>Equipment</i>	<i>Personnel</i>	<i>Information</i>	<i>Doctrine & Concepts</i>	<i>Logistics</i>	<i>Infrastructure</i>	<i>Organisation</i>
Joint & Multi-National Exercises	C3 Systems C4ISTAR Assets Air transport & refuelling	C4ISTAR Staff	Plans & orders e.g. ATO, ACO BDA Threat Information	Future Capabilities Paper(s) Doctrine	ILS Organisation	GPS Provision Operating Base(s)	UK/Coalition C4I Organisation e.g. JFHQ, JFACC
Mission Simulators	Platform Mission Planning System Ground Support Equipment Launch Platform	Platform Maintainers, Armourers, Trainers Platform Operators	Target Databases Targeting Info from Organic Sensors & Third Party Sensors BDI	CONEMP	Platform Logistics Chain Materiel e.g. Fuel	Weapon Storage Facility	Agile Mission Group
Training Equipment	Bespoke Mission Planning System Bespoke C3 Systems Unique GSE Launcher Equipment WEAPON		TYPICAL ACQUISITION BOUNDARY		Weapon Logistic Container		

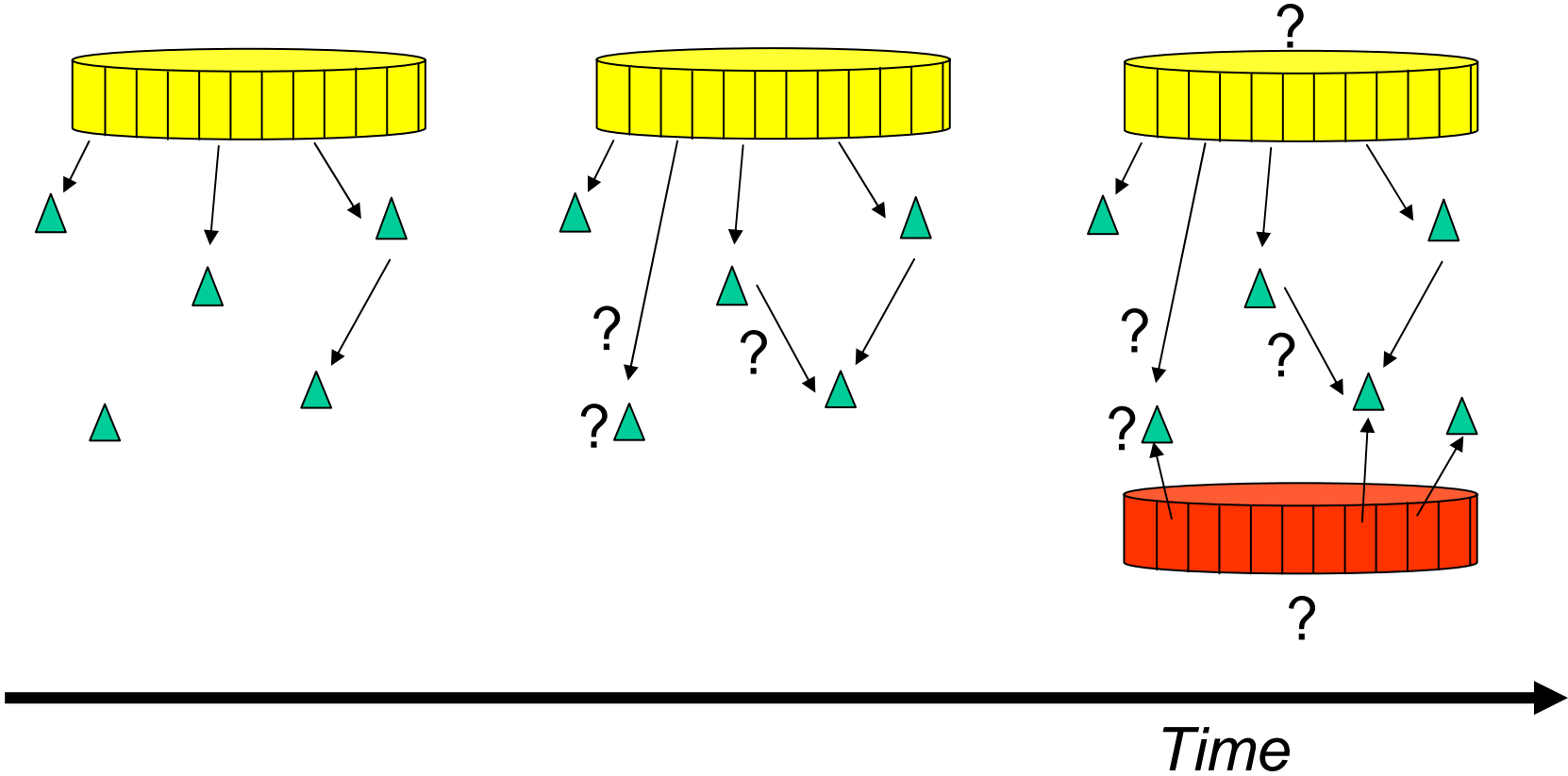
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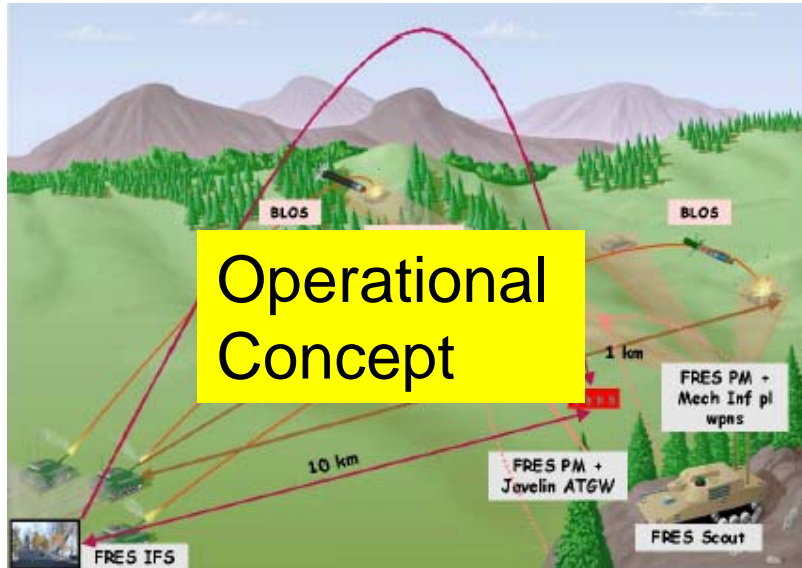
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Increasing uncertainty with time....

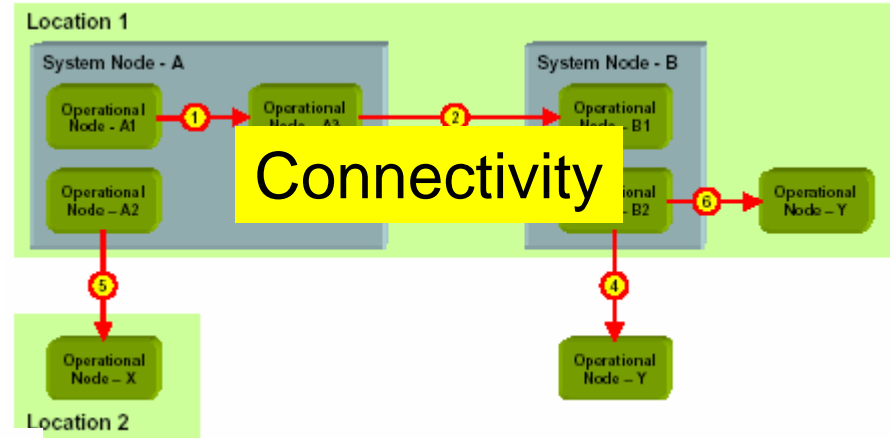


MODAF and DODAF

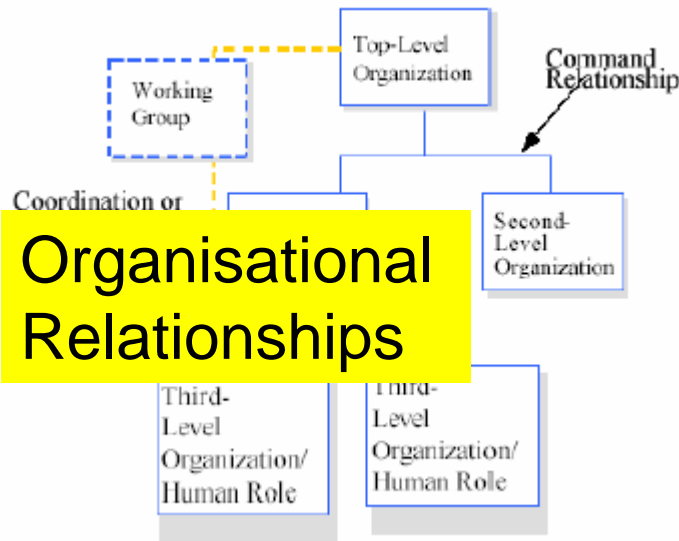


Operational Concept

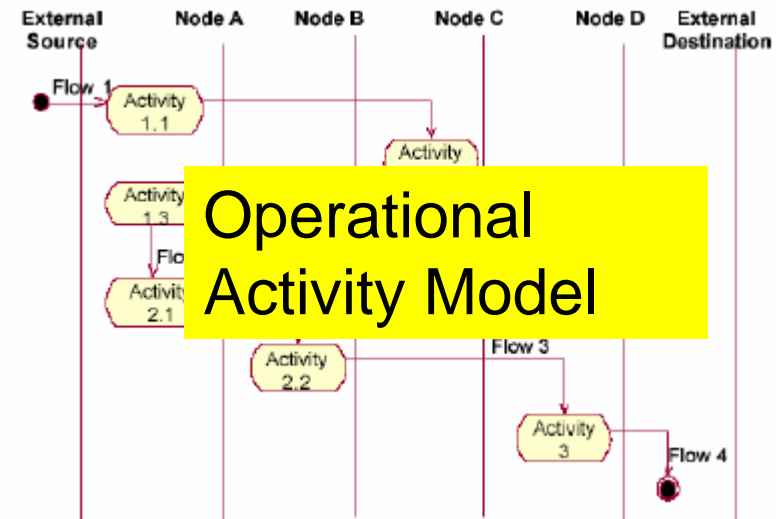
Figures extracted from MOD Architectural Framework Handbook Volume 2, www.modaf.com



Connectivity

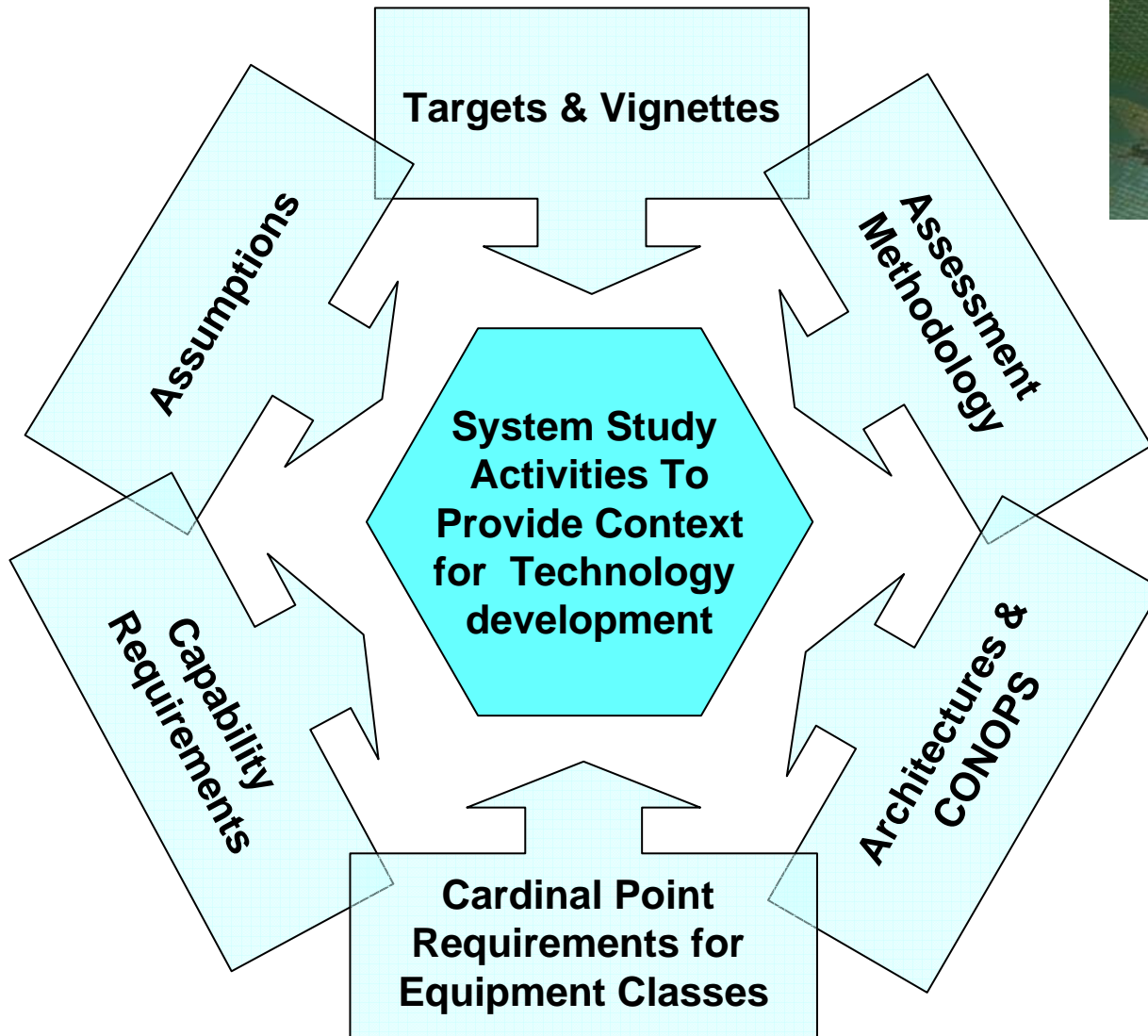


Organisational Relationships



Operational Activity Model

NEC Integrated Weapons Programme



BAE SYSTEMS

Cranfield
UNIVERSITY


LOCKHEED MARTIN

MBDA
MISSILE SYSTEMS

QinetiQ

 **SELEX**
Sensors and Airborne Systems

THALES
Missile Electronics

-
- 
- 2 Significant factors for NEC IW system architectures:

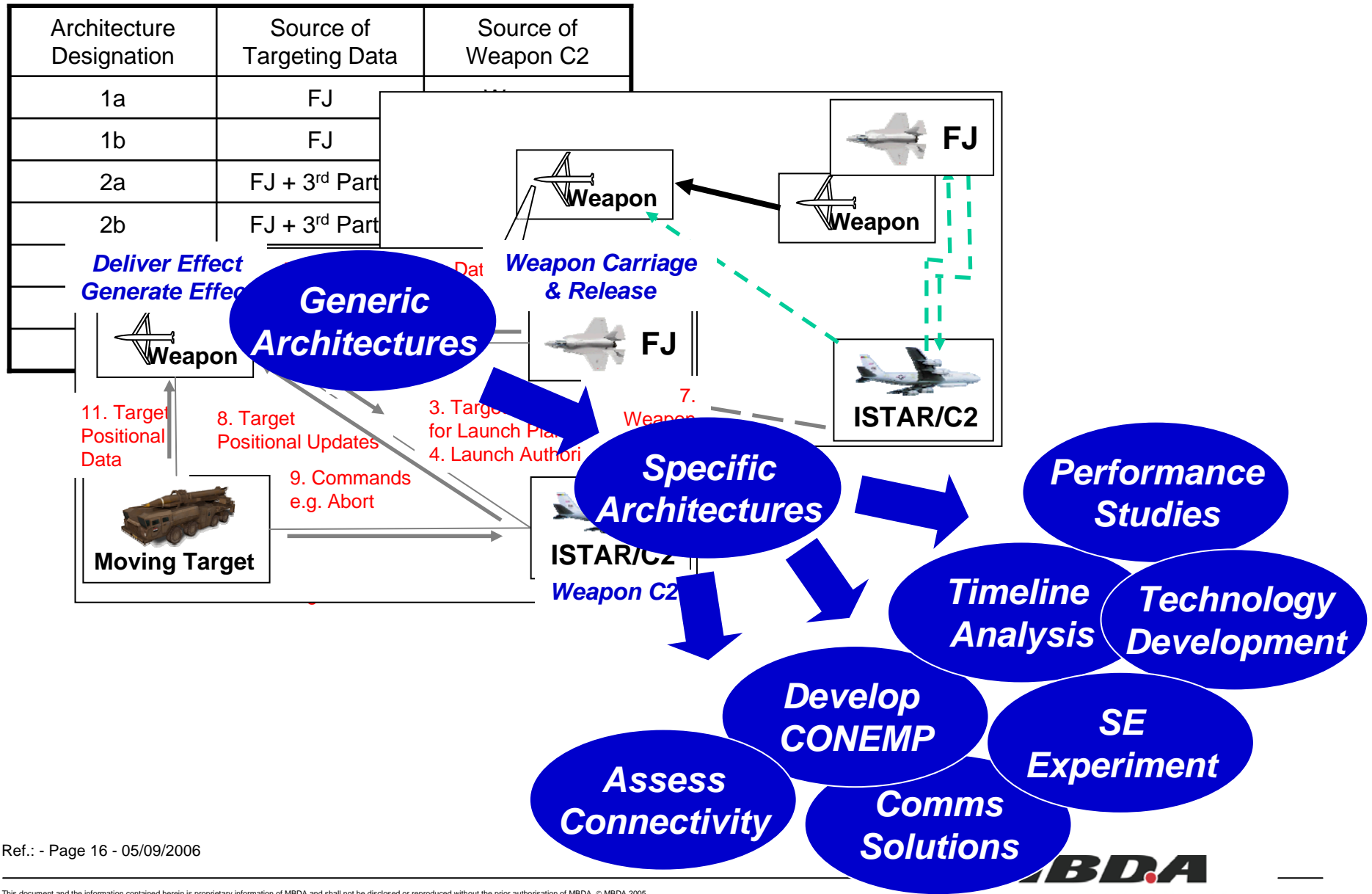
 - The way in which engagement quality targeting data is provided to the Fast Jet (FJ) launch platform:
 - From FJ organic sensors
 - From 3rd Party / ISTAR asset(s)
 - A combination of organic sensors and 3rd Party / ISTAR assets

 - The way in which weapon Command & Control is conducted:
 - The weapon is autonomous
 - Via a datalink from the launch aircraft
 - Via a datalink from a 3rd Party / ISTAR asset

Summary of NEC IW Architecture Options

Architecture Designation	Source of Targeting Data	Source of Weapon C2
1a	Fast Jet Organic sensors	Autonomous Weapon
1b	Fast Jet Organic sensors	Fast Jet
2a	FJ + 3 rd Party	Autonomous Weapon
2b	FJ + 3 rd Party	Fast Jet
2c	FJ + 3 rd Party	3 rd Party
3a	ISTAR	Weapon
3b	ISTAR	ISTAR

Development of Generic, then Specific Architectures



Conclusions

- There is a seamless relationship between OA activities and high level systems engineering
- OA has a role to play in all aspects of system concept engineering
 - Requirement Capture, Architecture Definition, Concept assessment
- Most impact is obtained by working as part of a multi-disciplinary team, where OA people are able to provide:
 - Broad operational thinking – provides context for technology development
 - Problem Structuring



Questions ?