

Application of NCO Conceptual Framework to US/UK Coalition Combat Operations during Operation Iraqi Freedom

Command and Control Research and Technology Symposium 2004

Greg Boehmer and Ian McDougall

PA Consulting Group, Inc.

June 15, 2004





Scope of brief

- **Research objectives**
- **Case study background**
- **Research process and method**
- **Overview of findings**
- **Findings and insights**
- **Interpretation of findings**
- **Comparative US/UK results**
- **Summary**



Research objectives

- **Assess the effectiveness of a networked force relative to a non-networked comparator *utilizing the NCO Conceptual Framework as the vehicle for research***
- **Identify levels of effectiveness related to the degree of networking**
- **Evaluate the following hypothesis:**

During Operation TELIC/IRAQI FREEDOM, the direct accessibility to network centric operations (NCO) capabilities by UK and US units provided:

- *Improved individual sense-making*
- *Enhanced the quality of interactions*
- *Improved shared sense-making*
- *Increased mission effectiveness*

... relative to previous operations and training without NCO capabilities

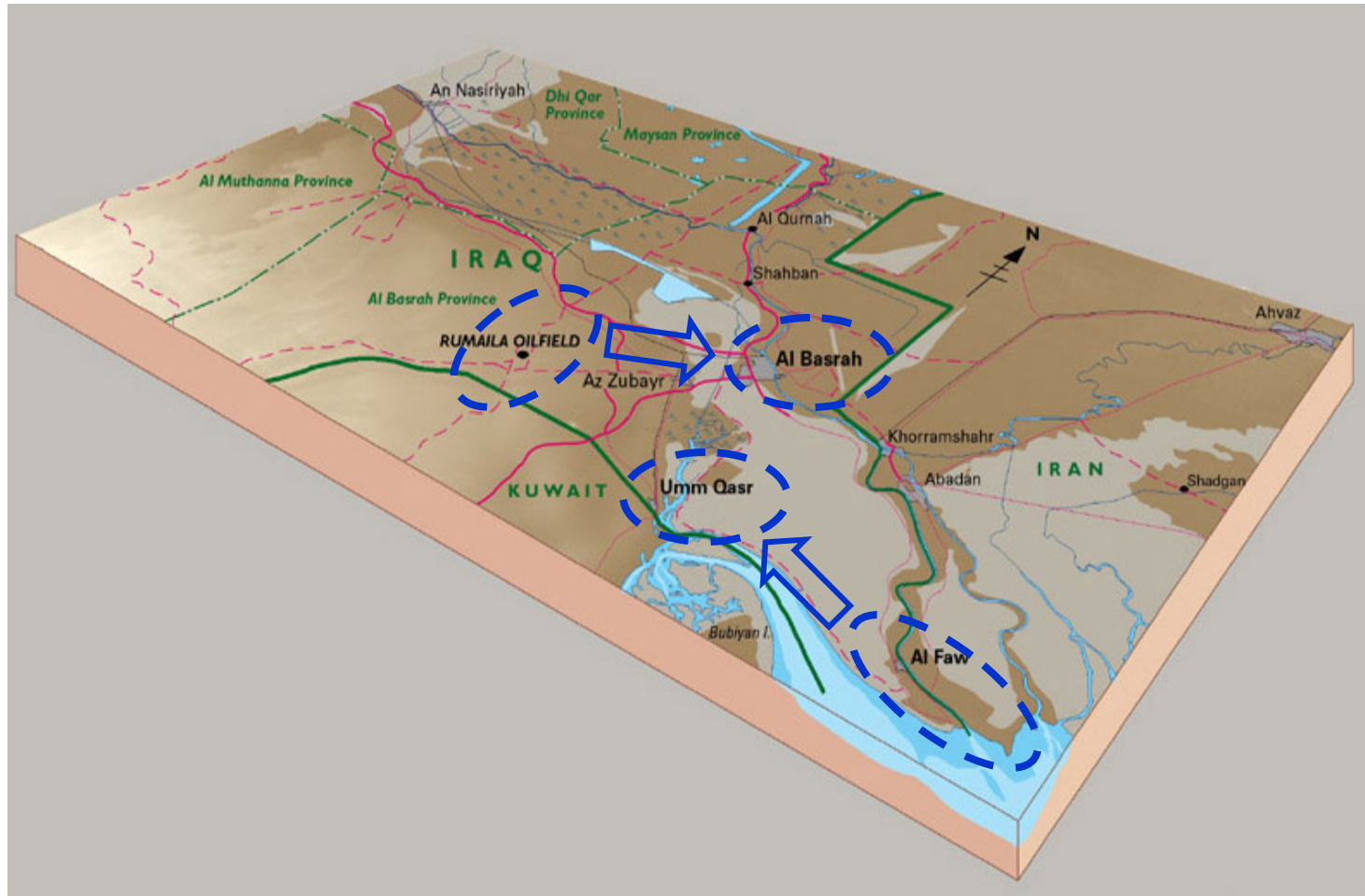


Potential focus of case study coalition combat operations





Initial focus of case study: 1 UK combat ops in Southern Iraq



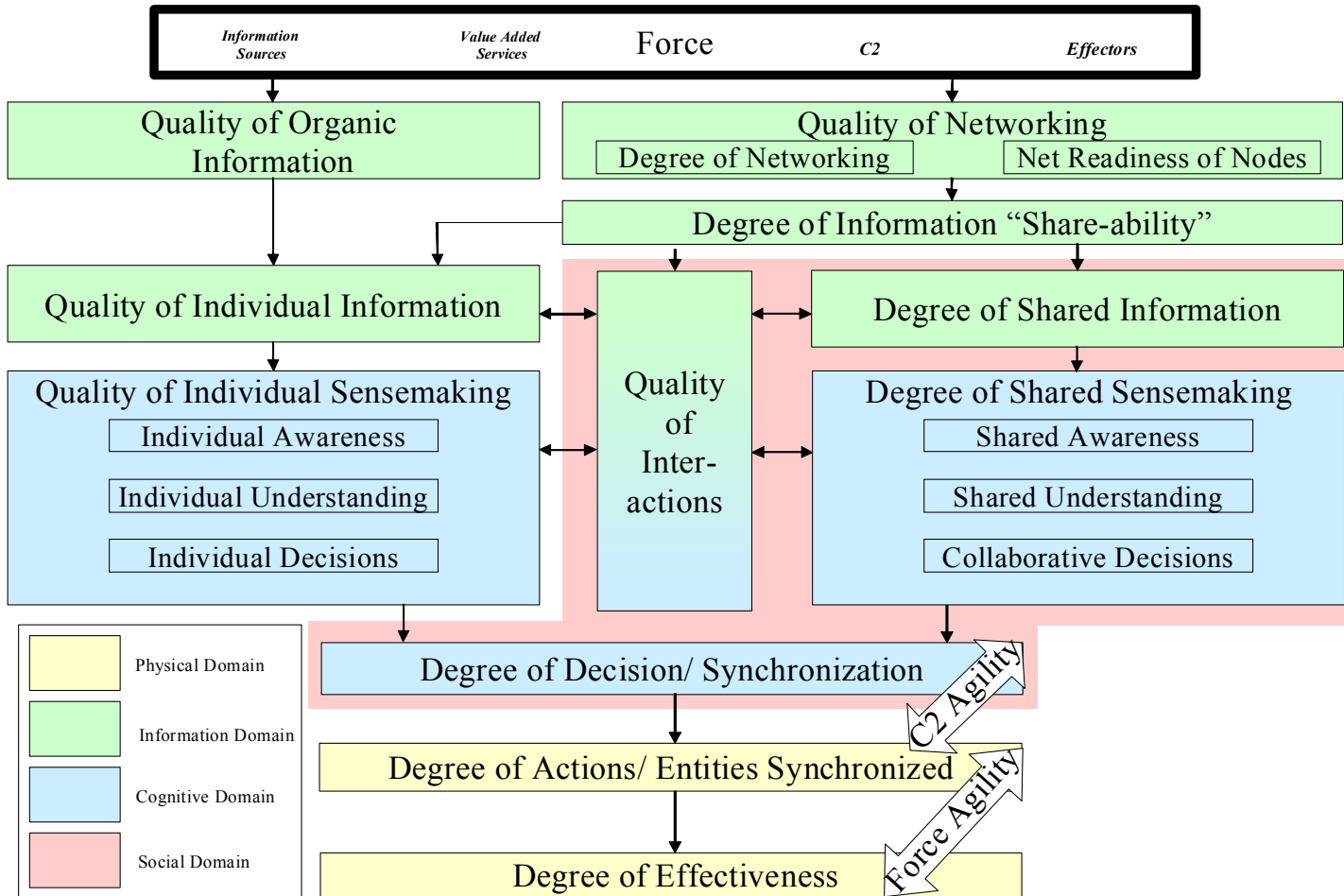


Additional focus of case study: 3ID 1BCT combat operations





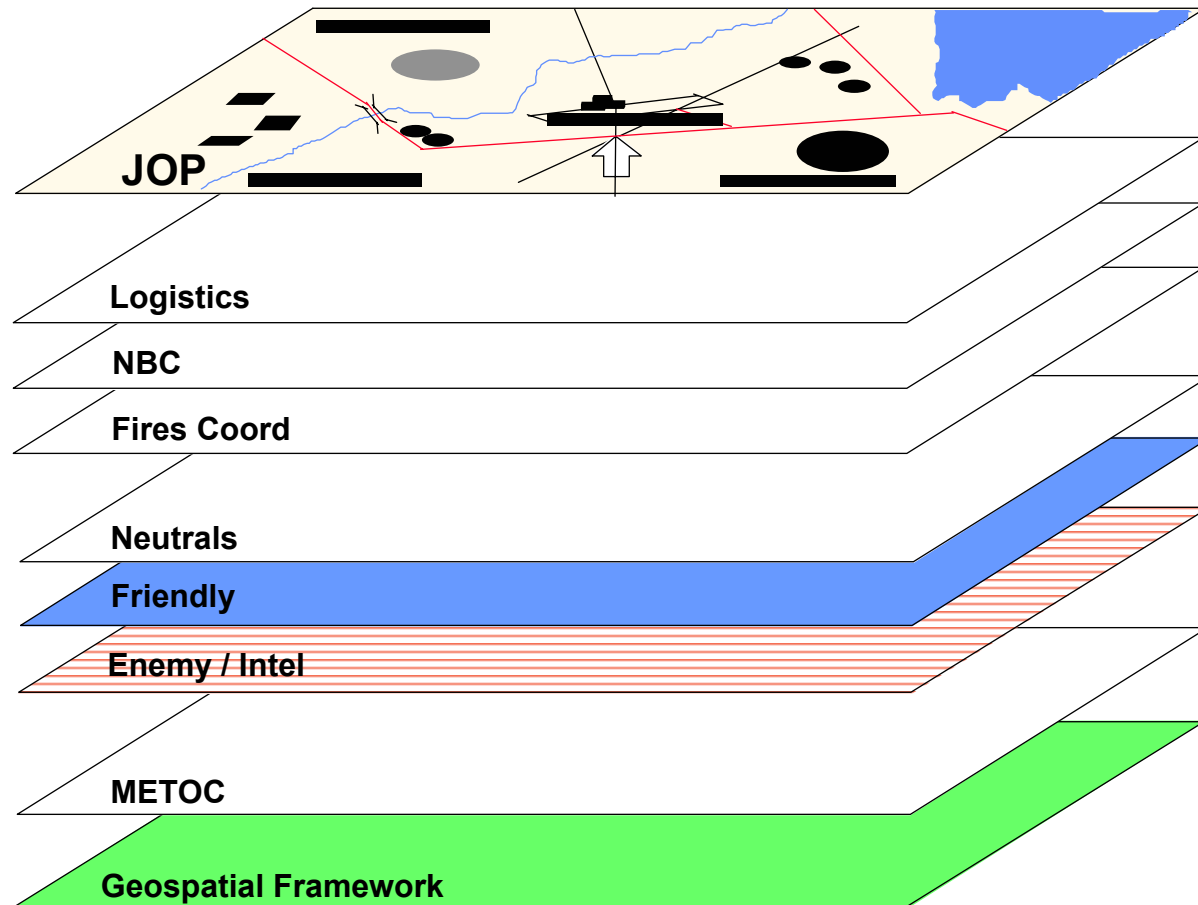
The NCO conceptual framework





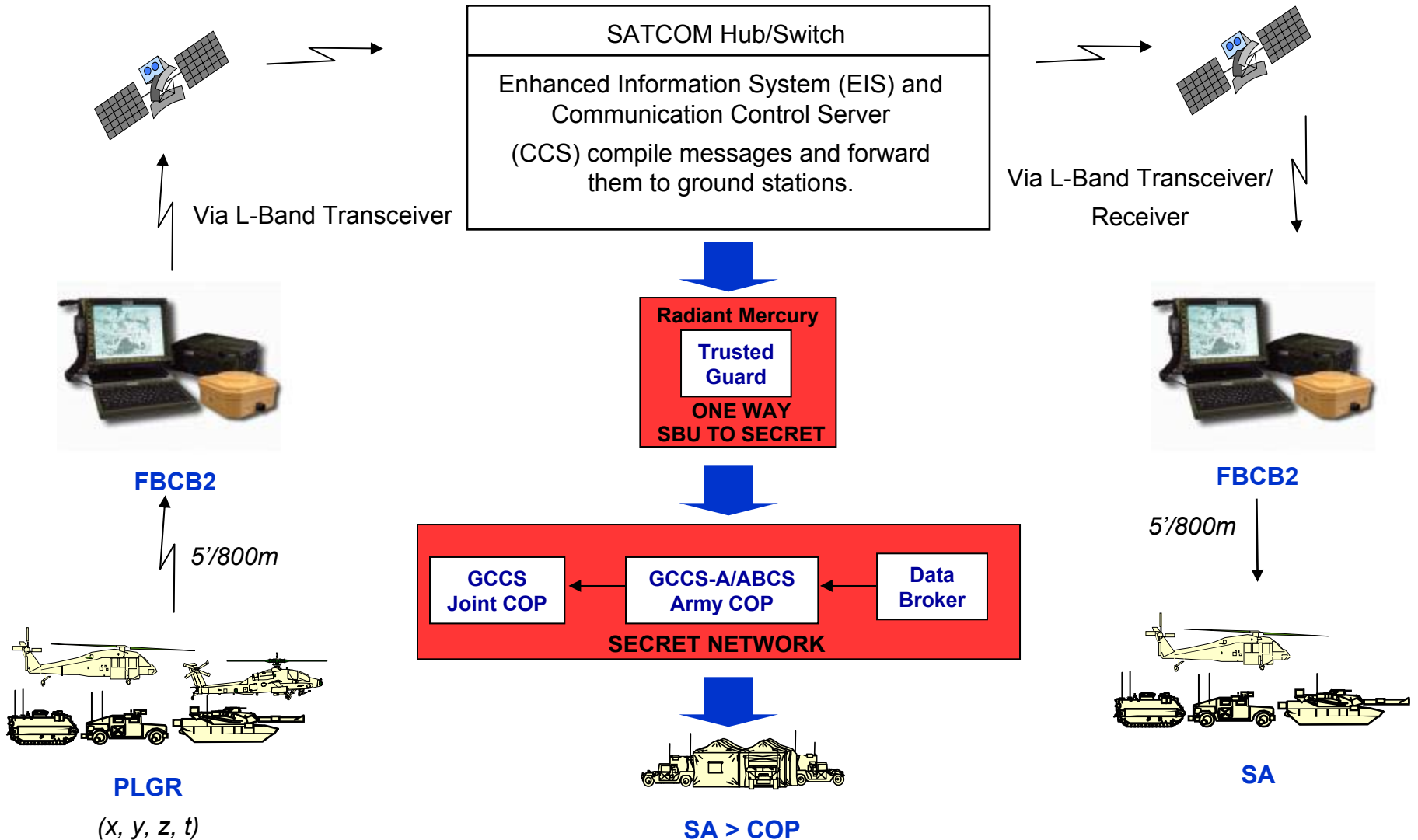
FBCB2 functionality

- Absolute and relative positional information on blue forces
- Raster data
 - Mapping
 - Imagery
- Graphical overlay creation and distribution facility
- Text messaging between users
- “Terrain analysis” tools:
Line of sight



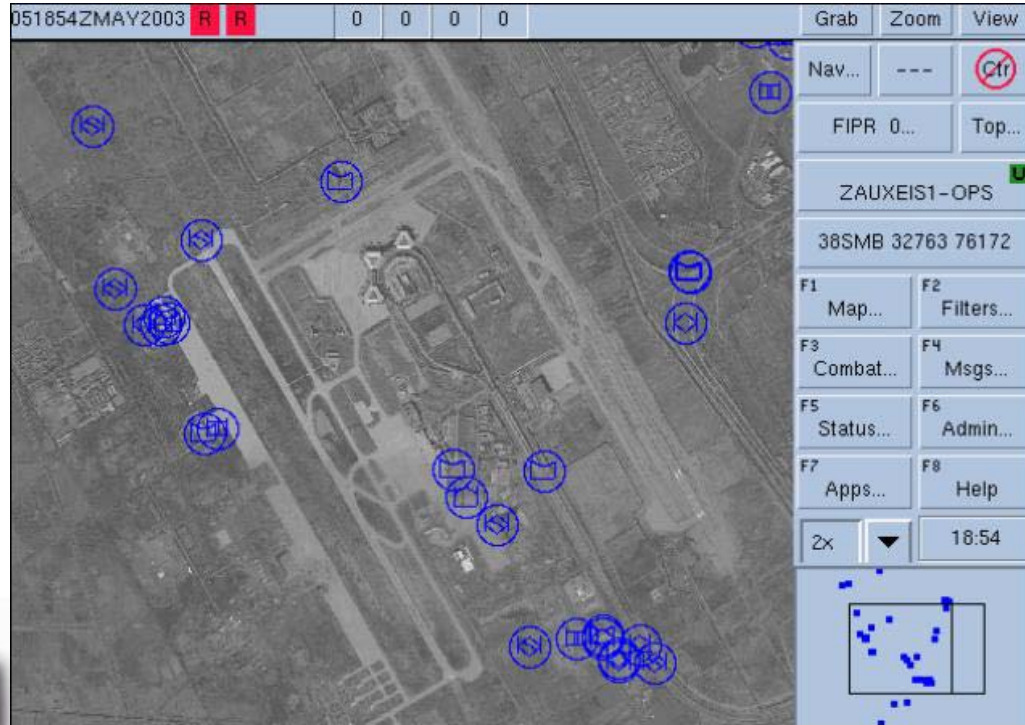


What is FBCB2/BFT?



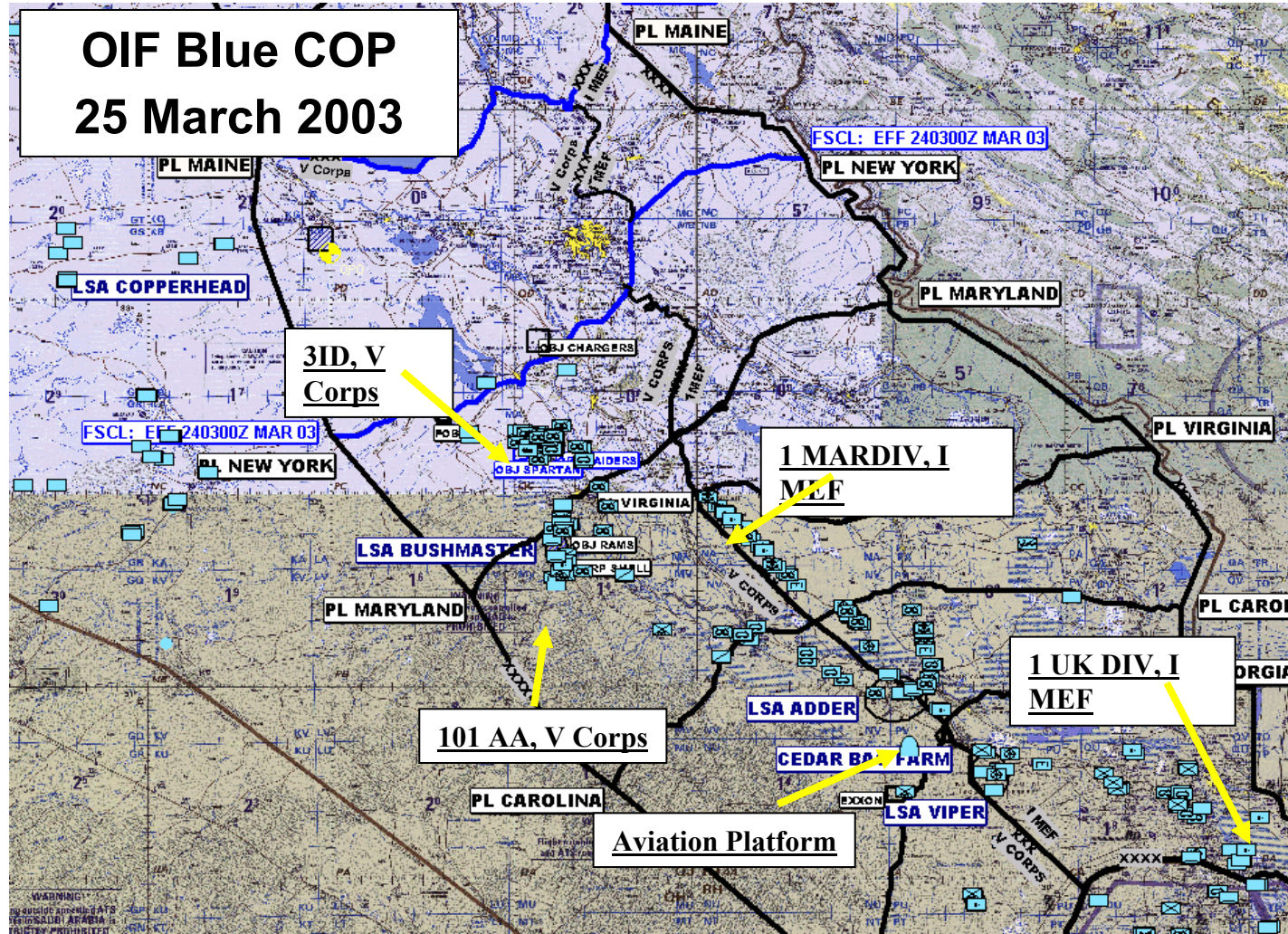


What the operator sees ...





C2PC picture with FBCB2/BFT generated icons



C2PC Picture with FBCB2-BFT generated icons.



FBCB2/BFT Installations (UK)



Wolf Land Rover - Antenna



Warrior - Installation



Pinzgauer – Data Terminal



Challenger 2 – Equipment Tray



Rationale for the deployment of FBCB2/BFT

- **Perceived weakness in combat identification in the Land Component, Air and Maritime were thought to be adequately resourced**
- **CFLCC had mandated that “he wanted to know where his forces were” ...**
- **There needed to be consistency between the Coalition partners, hence, UK followed the US concept of operations**
- **Approximately 900 systems were deployed overall**
 - **1 (UK) Armd Div received 47**
 - **3 (US) ID received 150**



Research process and method

- **Requirement was to assess the operational effectiveness of a networked force in high intensity conflict**
- **Aspiration to analyse coalition exploitation of networking at the lower operational and tactical levels**
- **Operation IRAQI FREEDOM**
 - **February – April 2003**
 - **Joint Coalition context**
 - **Initial focus on UK Land contingent, supporting evidence from 3ID**
- **Base Line (B) and Treatment (T):**
 - **Pre-deployment (B): VHF/FM line of sight and limited HF communications**
 - **Post-deployment (T): Augmentation by FBCB2/BFT using L-Band (satellite)**

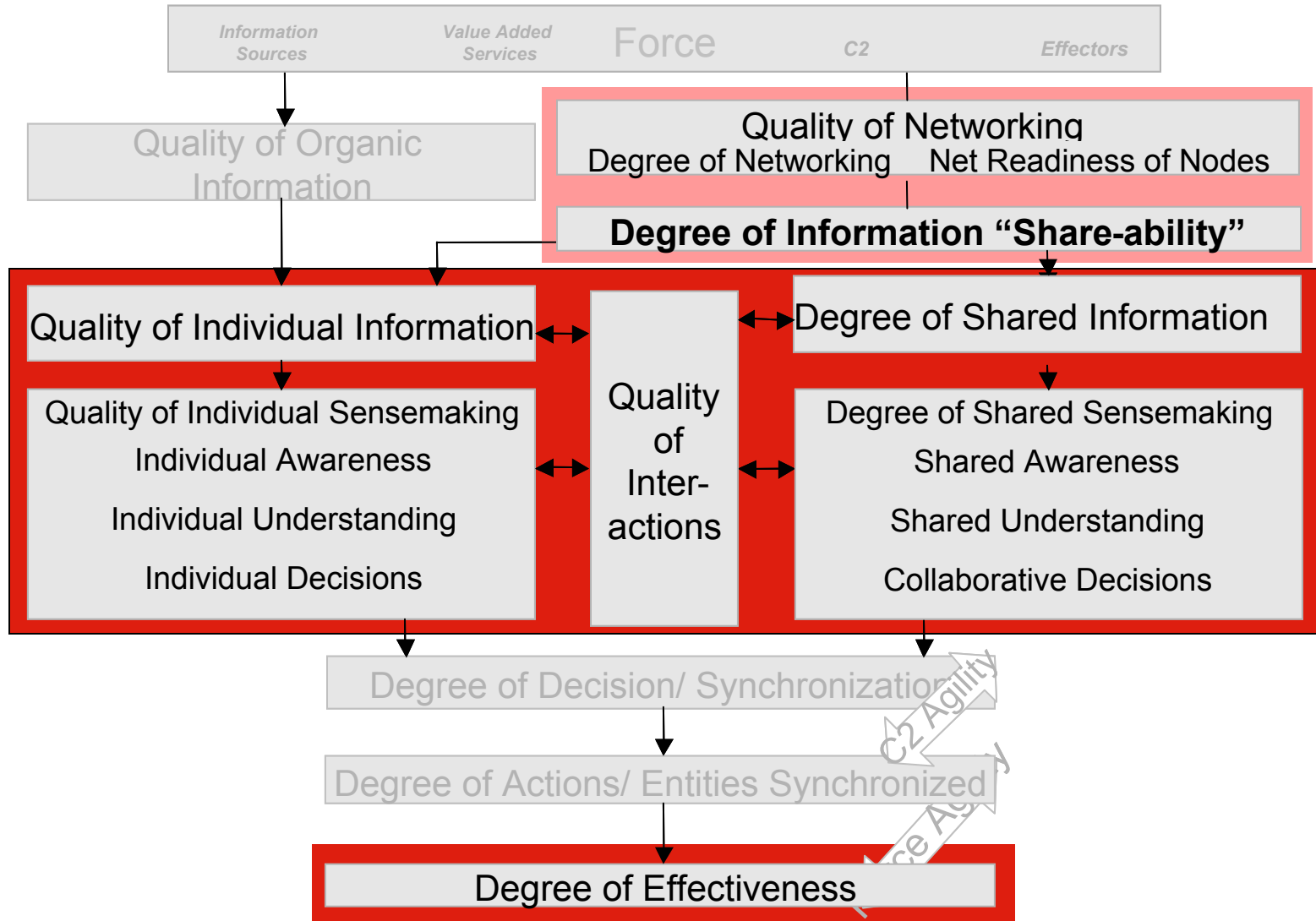


Research method

- **Focus was to elicit experiences of the war-fighters and assess the impact of the deployment of FBCB2/BFT**
 - **High quality of response and findings from subject matter expert interviewees**
 - **Ascertain the effectiveness of networking at the “working level”**
- **Research was augmented by:**
 - **Engagement with wider Defence community, UK and US**
 - **Analysis of after-action review media**
- **Limited direct interaction due to resource constraints**



The NCO conceptual framework and research foci





Research process

Interviews

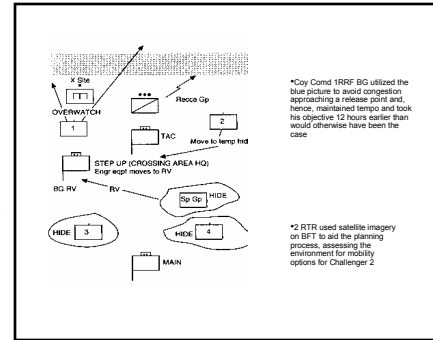
OBJECTIVE MEASURES

These questions are designed to consider some objective measures in order that we may identify some trends associated with the deployment of FBCSI/BFT. In most cases we are attempting to identify measures in effectiveness between the operational deployment of the system and the way you operated prior to the Operation in training in BATUS or Poland. You will be shown a number of scales to quantify a particular attribute, please take your time to give the question due consideration and assess the response scales. Do you have any questions?

- Information Currency: (AI)
 - How current did you need information to be in your role?
(Quantification of fixed time period)
2 hours
 - How long was the time lag between events occurring and you, equipped with FBCSI/BFT, becoming aware of the event? eg. blue and red force movements and the distribution of tactical information.
(Time period)
5 minutes
 - Can you quantify the time lag between events occurring and staff knowing of such events when you operated on previous combined arms and field training exercises?
(Time period)
30 mins to 3 hours
- Information Currency: (BA)
 - How current did your unit and others need information to be?
(Time period)
 - Can you assess the time lag associated between an event occurring and the FBCSI/BFT equipped units becoming aware of the event? eg. blue and red force movements and the distribution of tactical information.
(Time period)
 - Can you assess the time lag in understanding when your unit and others operated on previous combined arms and field training exercises?
(Time period)

12 of 19

Vignettes



Collate Issues by Category

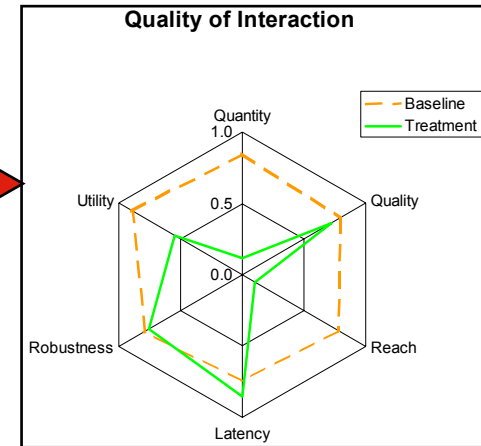
Red situational awareness

- There was a limited red picture at H hour but as centre of mass of US forces moved these disappeared
- Nobody knew of the mechanism for UK forces to enter and distribute red icons in UK areas of action
- Effectively, there was no red picture

Quantitative Data Capture

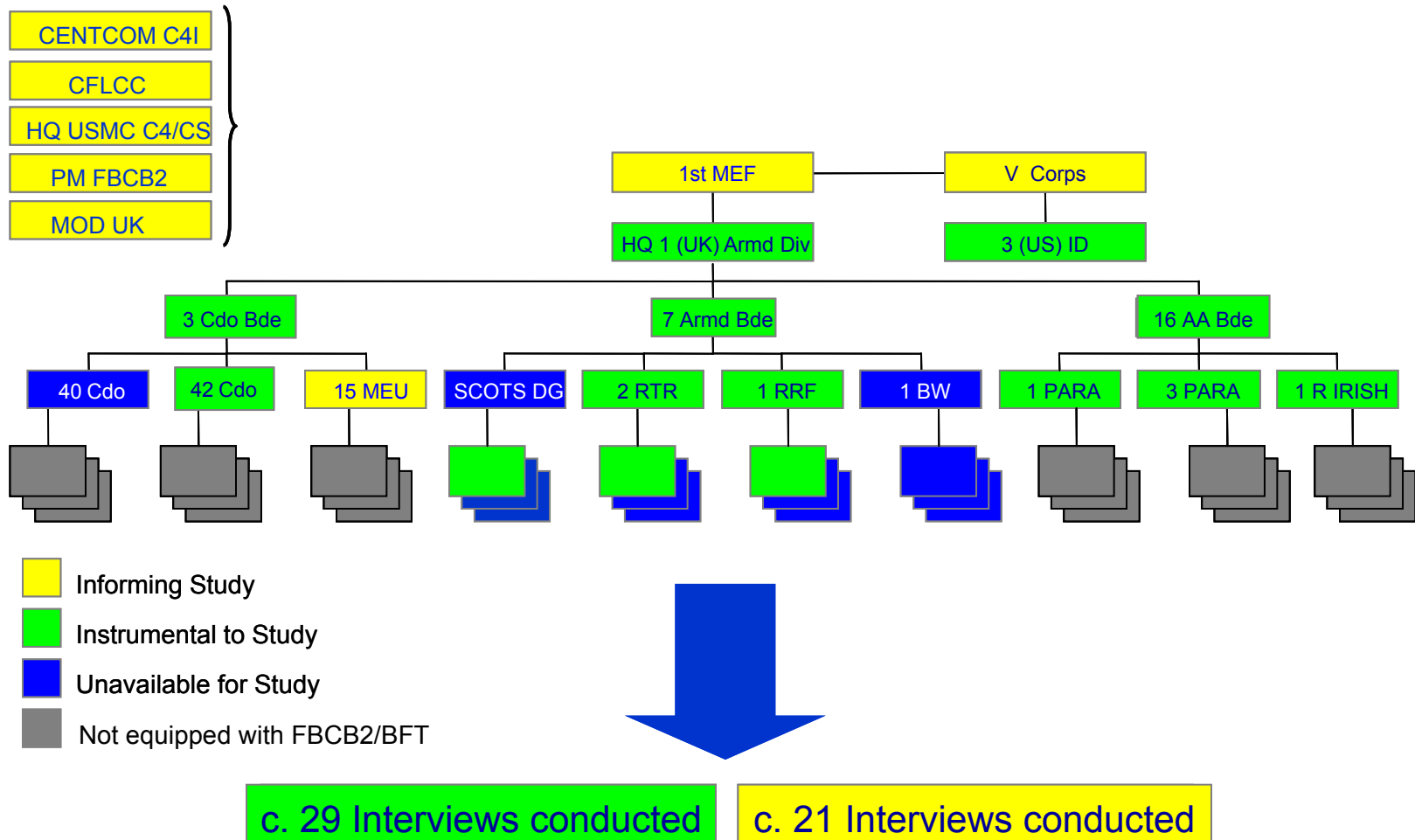
PA Qu.	CF Ref	CF Area	Attribute/Metric	Scale	1	2	3	4
			Qty	% of info	90	90	96	100
7 (b)			Quality of Interactions	Quality	5 pt	5	4	5
7 (e)			Quality of Interactions	Reach	% of units	80	50	100
11 (b)			Quality of Interactions	Latency	10 pt	9	6.5	7.5
13 (b)			Quality of Interactions	Robustness	5 pt	5	4	5
14 (b)			Quality of Interactions	Utility	5 pt	5	4	5
15 (b)						3		3

Plot Statistics



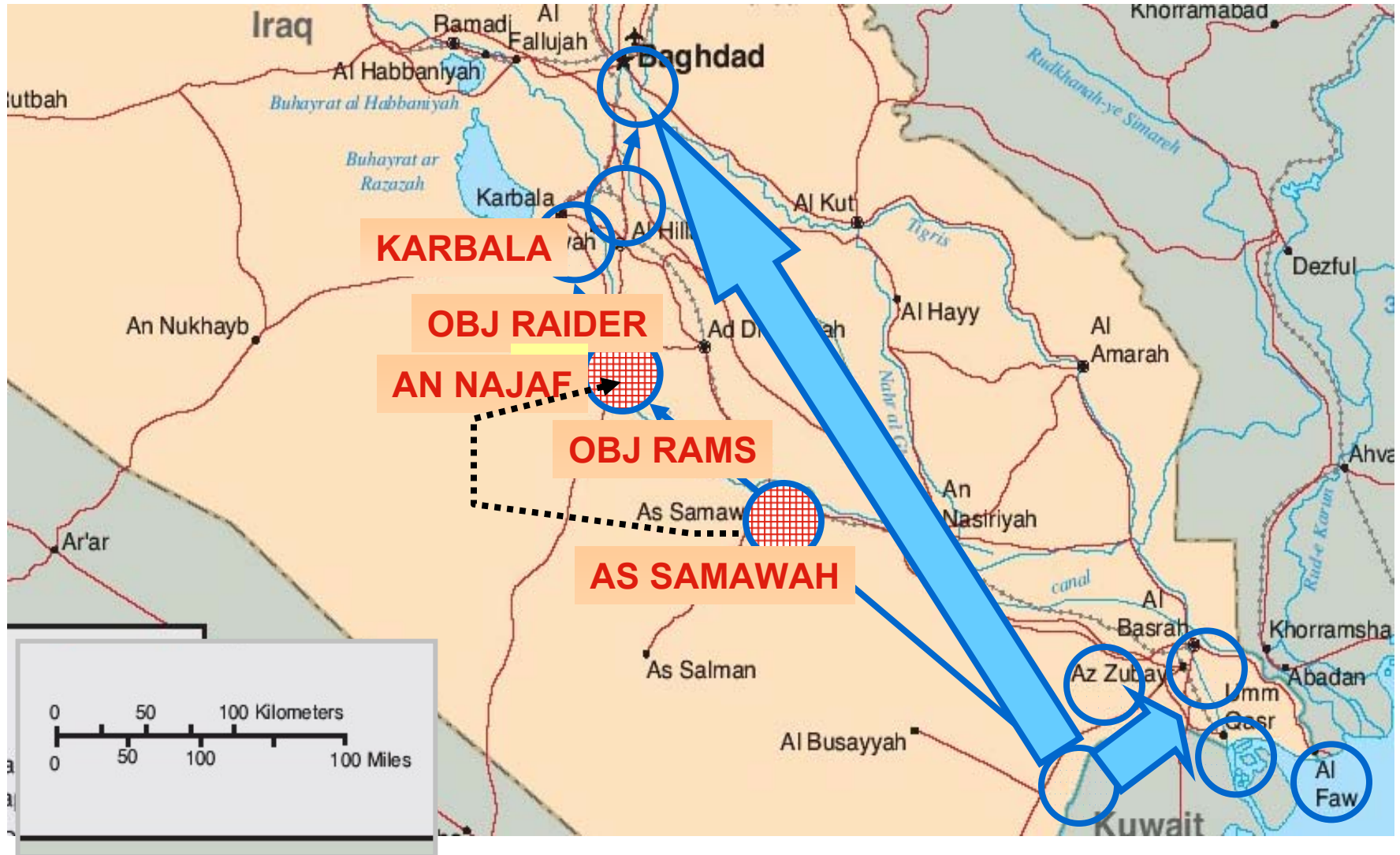


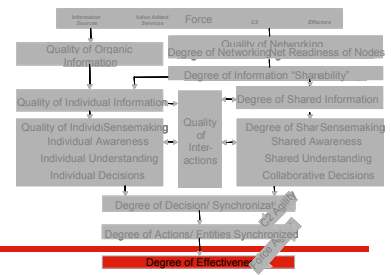
Focus for interviews



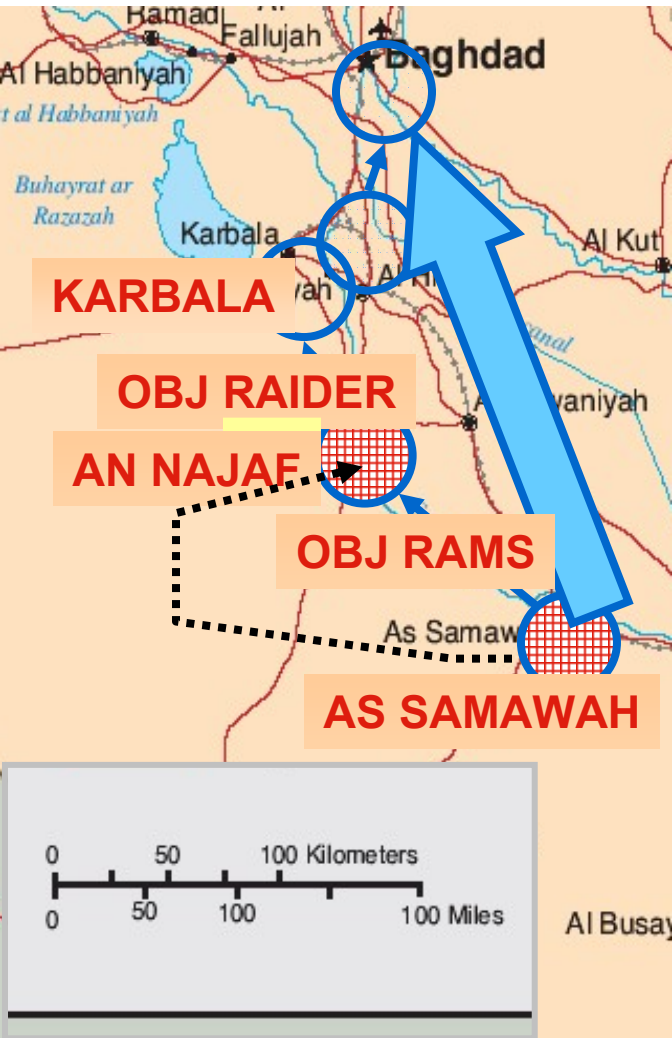


Vignette – use of FBCB2/BFT by Commander 1BCT





Vignette – use of FBCB2/BFT by Commander 1BCT





Overview of findings

- **FBCB2/BFT provided tactical commanders and principal staff with enhanced situational awareness relative to that they had experienced in previous operations and in training for high intensity conflict**
- **FBCB2/BFT provided a significant amount of information on friendly forces and the environment but limited information on enemy forces**
- **FBCB2/BFT contributed to:**
 - **Improved planning**
 - **More agile command and control**
 - **An ability to generate and maintain tempo**
 - **Improved synchronization**
- **Full potential of the system was never exploited due to limitations in the lines of development**

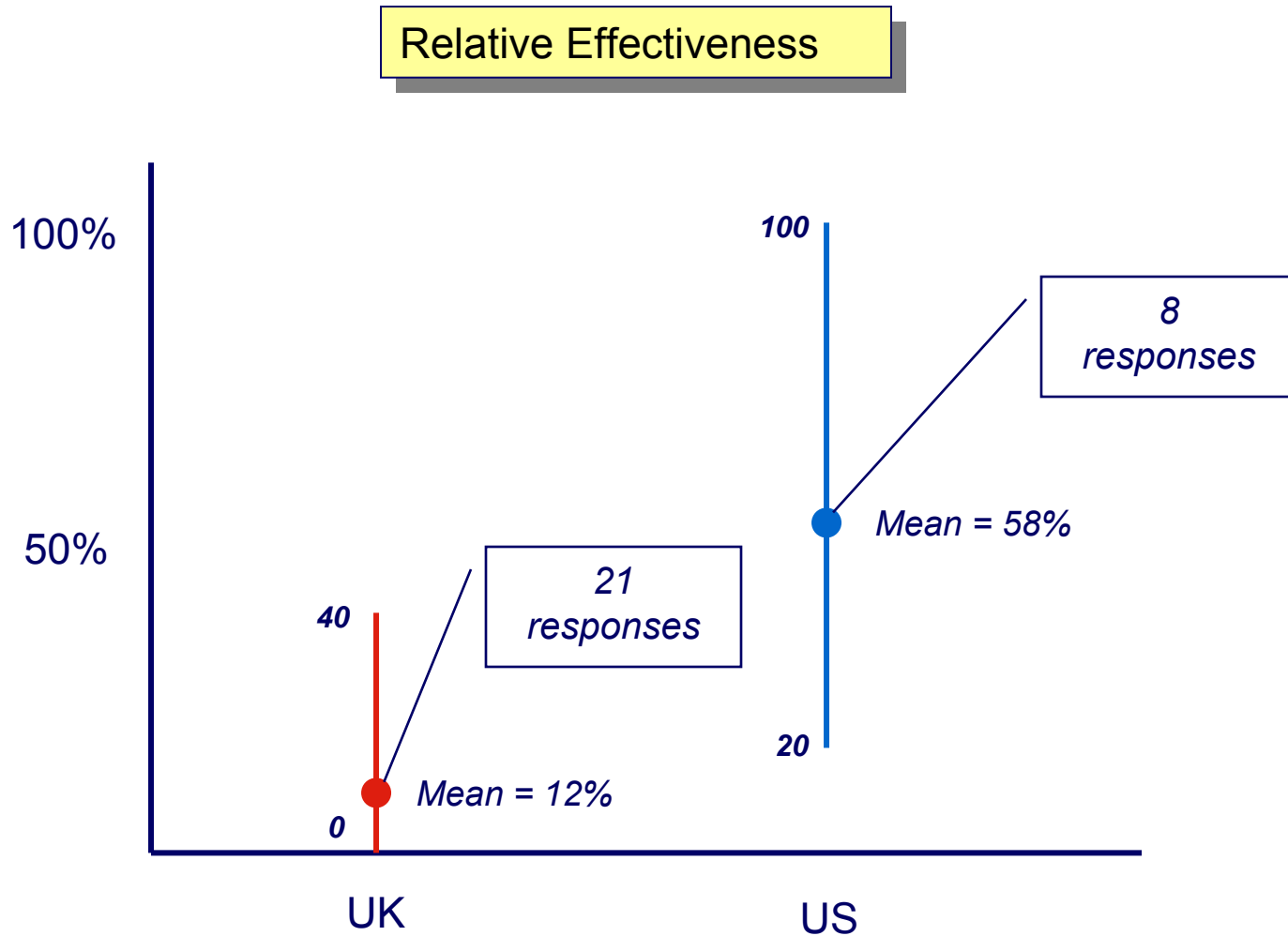


Coalition operations

- **FBCB2/BFT provided an incremental improvement in coalition operations by providing units situational awareness of one another**
- **The limited deployment, training, usage and operation of FBCB2 with UK units limited the contribution to overall situational awareness**
- **Perception of non-usage of FBCB2 by US forces on the part of the UK forces further discouraged its use**
- **Anecdotally, the greater benefits appeared to be at the higher levels of command (CFLCC, CENTCOM, etc)**

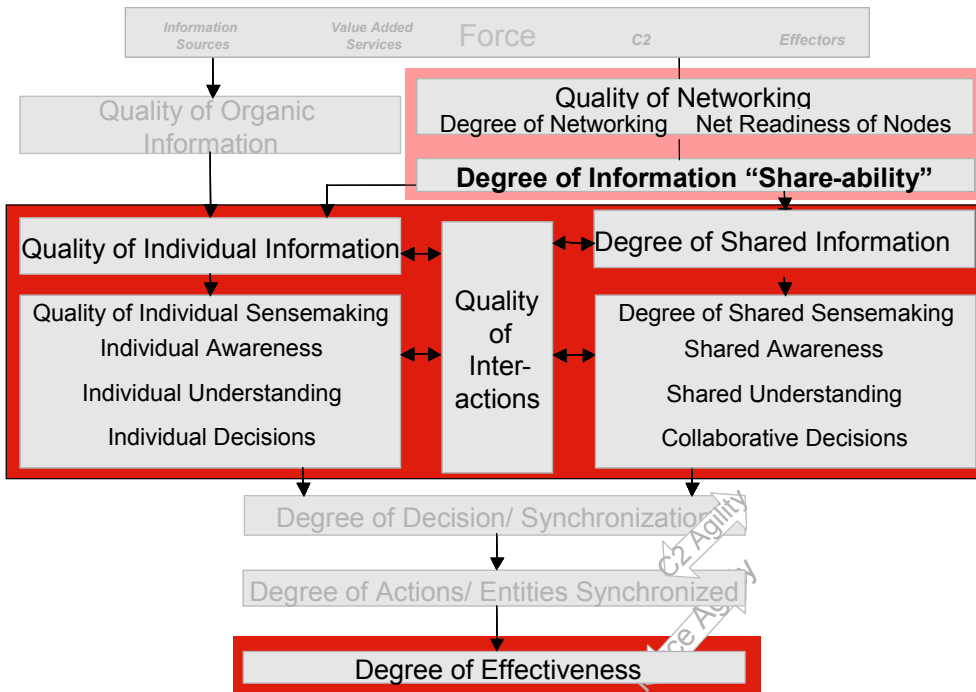


There were significant US / UK differences



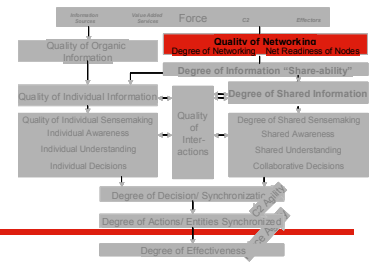


Interpretation and analysis of findings



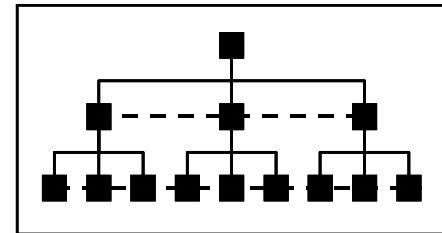
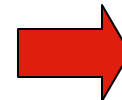
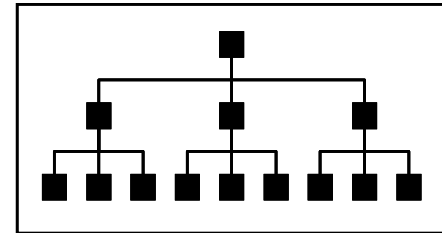
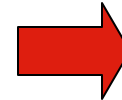
- Networks
- Individual and shared information
- Individual sensemaking*
- Shared information*
- Quality of interactions
- Degree of effectiveness*

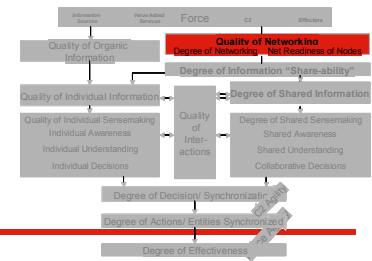
- * Supported by operational vignettes



Networks #1

- UK before FBCB2/BFT
- A series of discrete (insecure) VHF and HF radio nets that are vertically structured
- Provision of voice LOS communications
- Sharing information “horizontally” routinely was difficult
- UK after FBCB2/BFT
- As above plus the potential to see and communicate through data across the battlespace
- Impact
- The potential to communicate beyond LOS
- The potential to communicate “horizontally” and share information more widely

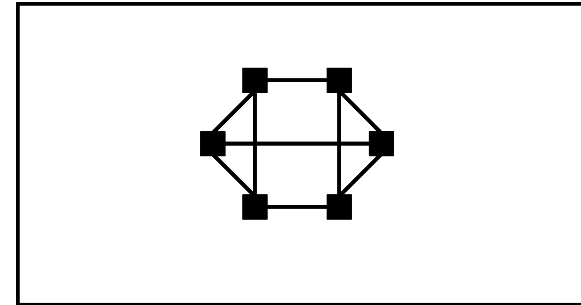
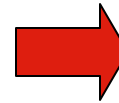




Networks #2

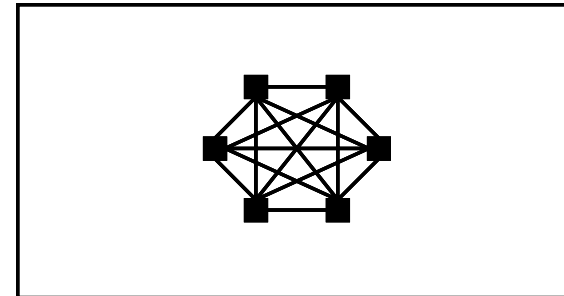
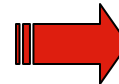
• US before FBCB2/BFT

- SINGARS provided secure communications up, down and sideways
- Provision of voice LOS communications



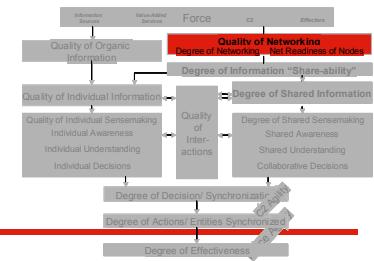
• US after FBCB2/BFT

- As above plus the potential to see and communicate through data across the battlespace



• Impact

- The potential to communicate beyond LOS
- The potential to communicate “horizontally” and share information more widely

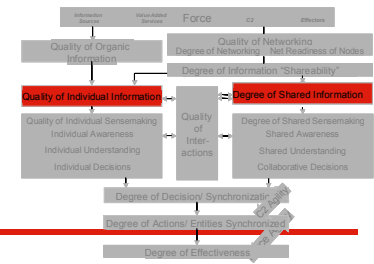


Quality of networking with FBCB2/BFT

Attribute	UK (1**)	US (3**)
Reach	Provision of "horizontal" links Potential for greater reach; not fully utilised	Situation demanded alternate means from LOS voice FBCB2/BFT provided the means
Connectivity	Limited connectivity BG (TF) level in 3 & 16 Bdes Sub-unit level in 7 Armd Bde	Better connectivity than UK All manoeuvre sub-units had system
Quality of Service	Similar assurance to CNR due to ranges operated Quality impacted by serviceability Utility impacted by ConOps	Only means of communication over LOS Very good serviceability record Fully exploited



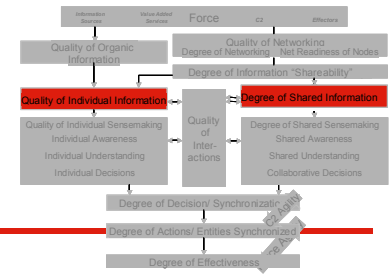
Individual and shared information

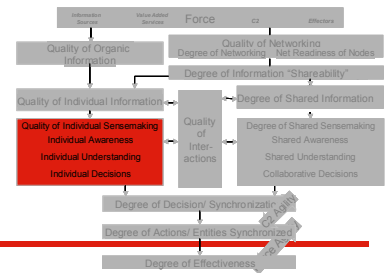


Baseline	Added with FBCB2/BFT
Near real-time warnings	Real time information on own position (+/- 10m)
Routine reporting 1~2 hours	Blue asset update within 5 mins / 800m
	Multi-scale mapping and imagery



Information perception



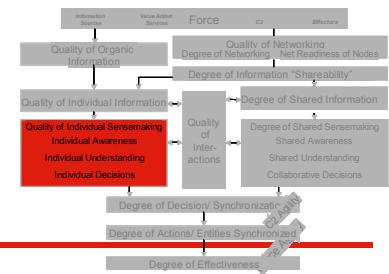


Individual sensemaking #1

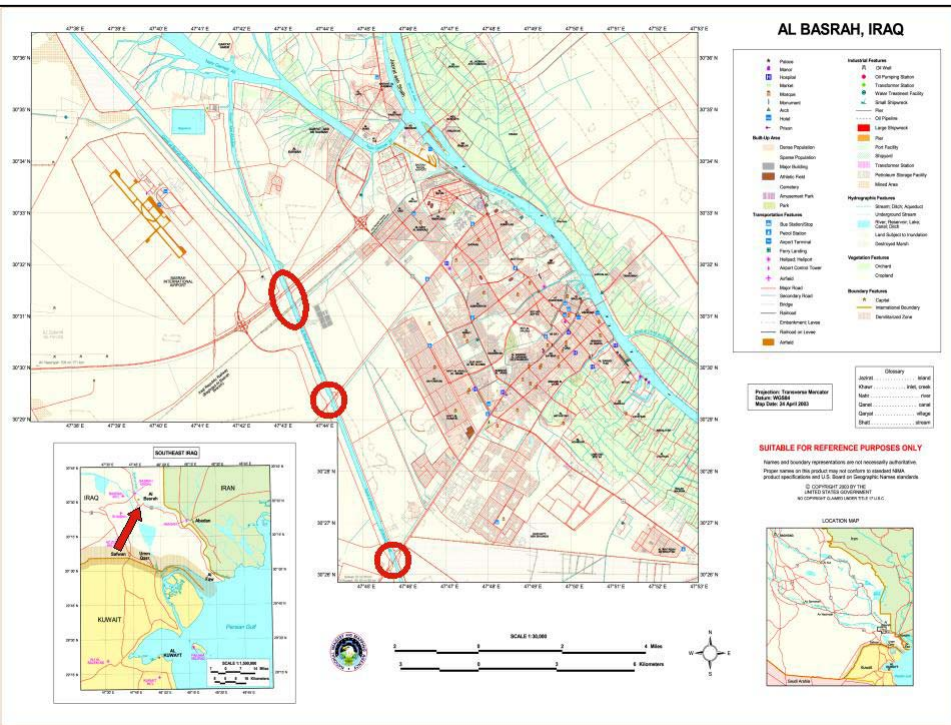
- There were a number of examples of 2 RTR battlegroup exploiting the imagery in FBCB2/BFT
 - Planning from small to large scale, highlighting relevant areas of operation
 - More detailed ground analysis to ascertain:
 - Routes for Challenger Main Battle Tank
 - Impact of obstacles on movements eg. berms, wadis etc
 - Identifying targets for urban raids, specifically, insurgent operating bases
 - Locate the building(s) on the imagery
 - Navigate with confidence to the precise building using PLGR
 - Impact: Unimpeded movement to target and minimisation of collateral damage

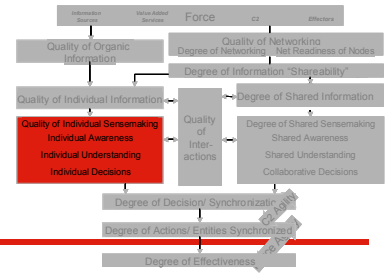


Individual sensemaking #2



- Coy Comd in 1 RRF battlegroup exploiting the ability to de-conflict his sub-unit's movements
- Situation was extremely complicated following the advance into SE Iraq, there was significant Coalition activity and movement
- 1 RRF BG were to advance north-east to seize 4 crossings on the Al Basrah Canal
- Company group had to manoeuvre across a significant main supply route (MSR) that was being trafficked by vehicles supporting the US advance north-west
- Using FBCB2/BFT the Coy Comd analysed the traffic movement and timed the crossing of the MSR to avoid US movement
- The affect was that he was able to conduct his attack 12 hours prior to other sub-unit groups who were delayed due the MSR vehicle movement

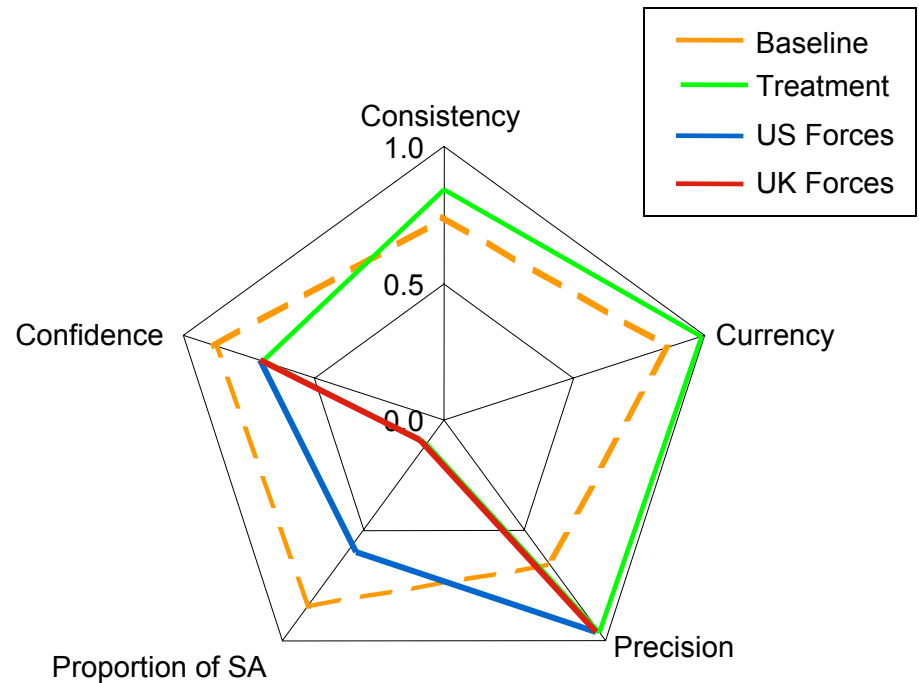




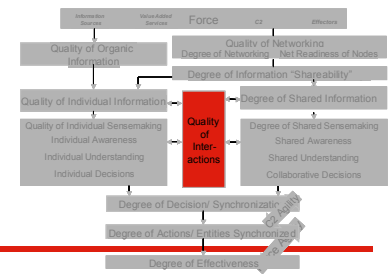
Individual sensemaking – Quantitative analysis

- Results from UK and US forces were broadly similar
- FBCB2/BFT outscored baseline in currency, consistency and precision – where automated blue force picture was expected to excel
- FBCB2/BFT contributed c. 10% of SA to UK forces and c. 60% to US
- There was greater confidence in FBCB2/BFT in US forces relative to UK forces
- US commanders exploited FBCB2/BFT more; UK forces relied upon previous methods
- *The latter 2 points will be explained later*

Individual Sensemaking

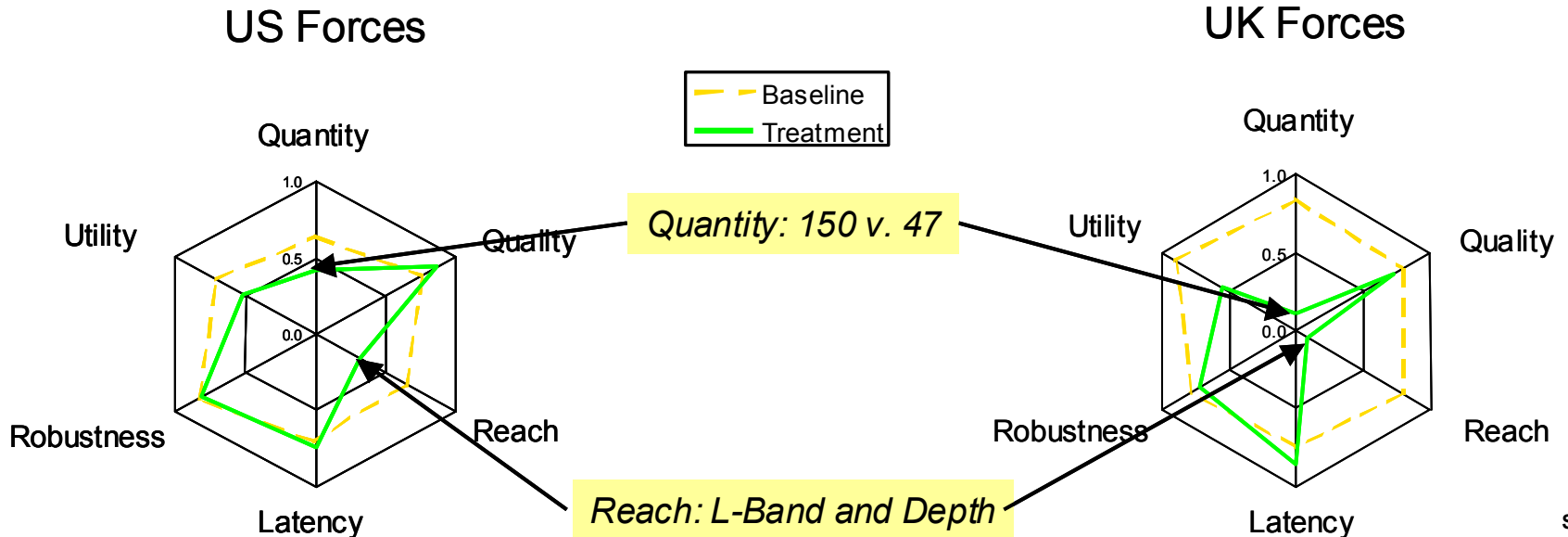


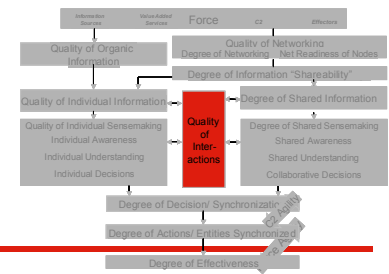
Aggregated results based on 29 interviews



Quality of interactions

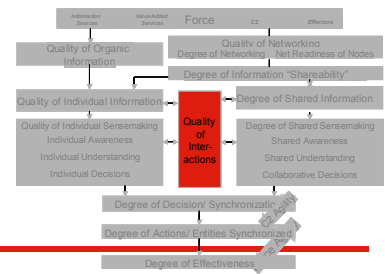
- The provision of another network improved the quality of interaction by either:
 - Augmenting the existing radio networks
 - Providing a network when the radio networks became unworkable
- FBCB2/BFT provided the potential for better quality of interactions:
 - This was fully exploited by the US forces who embraced the capabilities of the system
 - The potential was rarely exploited by the UK





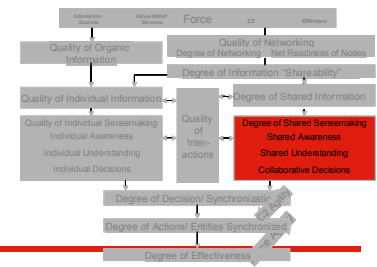
Quality of interaction attributes #1

- Quantity
 - 150 nodes provided to 3ID proved of significantly greater utility than the 47 provided to 1 (UK) Armd Div
 - There is a “critical mass” of systems between 47 and 150
- Quality
 - The information quality through FBCB2/BFT was good, dependent on the motivation to populate the data (reports, overlays etc)
 - The lack of opportunity by UK units to exploit the system resulted in only automated positioning information being provided by the system
- Reach
 - Physically, the reach of the L-Band system out-performed the LOS communication systems deployed at the lower operational and tactical levels
 - The reach into the respective chains of command differed significantly with the UK deployment being relatively shallow



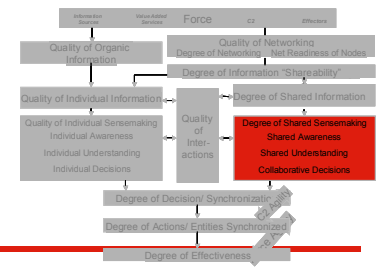
Quality of interaction attributes #2

- Latency
 - The latency of the baseline and treatment were broadly similar through the analysis conducted
 - FBCB2/BFT updated positional information every 800m/5 mins but messaging could be delayed
 - Command nets still proved most effective for instant messaging such as contact reports
- Robustness
 - Both the radio and FBCB2/BFT networks were physically robust and operational circumstances were such that the networks were not interfered
- Utility
 - In terms of usefulness, the utility of the FBCB2/BFT network to the US was greater than that to the UK; this is largely to do with the number of systems and that one UK formation was provided 2 TacSat channels that provided the backbone to their command and control



Shared sensemaking

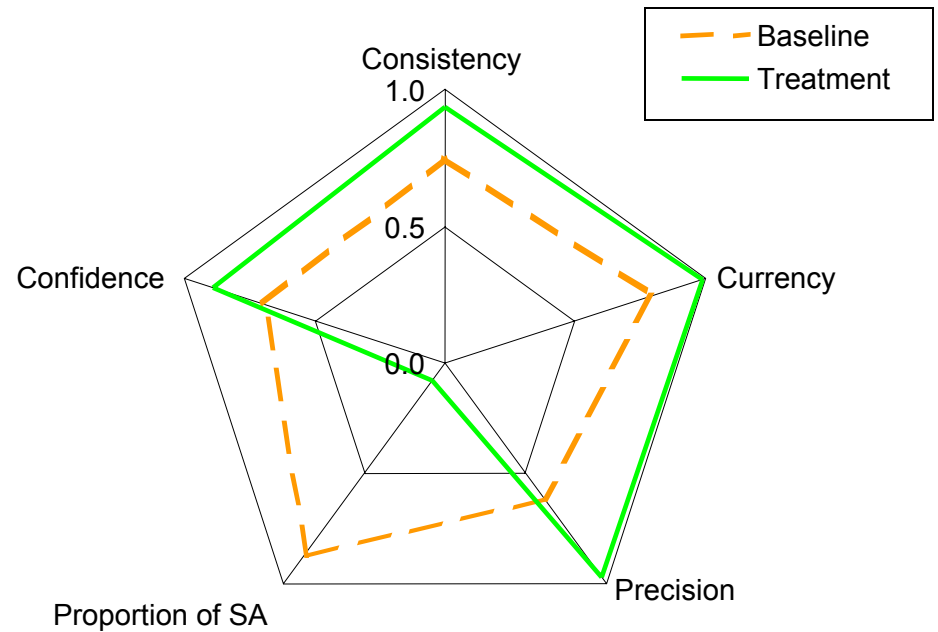
- FBCB2/BFT was relaying a picture of the battlespace to all equipped platforms simultaneously providing all with an identical synthesised picture
- 3 PARA used FBCB2/BFT for patrol briefing and de-briefing
 - The imagery could be used to analyse patrol routes with patrol members present and “actions-on” could be discussed within a common context
 - De-briefing was also conducted in a similar manner, using the maps and imagery to highlight relevant areas of detail
- 3ID used FBCB2/BFT extensively for the dissemination of fragmentary orders (FRAGOs) that allowed command and control on the move
- The ability to exploit and share graphical information (tactical schematics) provided a method for the collective perception of information – *but this was not exploited by UK forces*



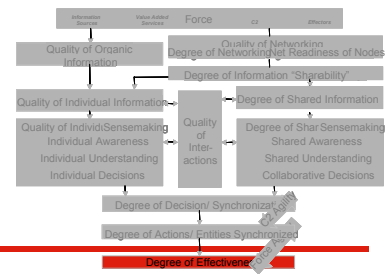
Shared sensemaking – Quantitative analysis

- Majority of interviewees said FBCB2/BFT had significant potential or made a significant contribution to shared sensemaking and SA
- Currency, precision and consistency of FBCB2/BFT all score significantly higher than the baseline – as for individual sensemaking
- Confidence scored higher in the US forces relative to the UK

Shared Sensemaking

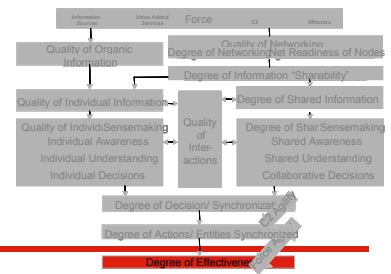


Aggregated results based on 29 interviews



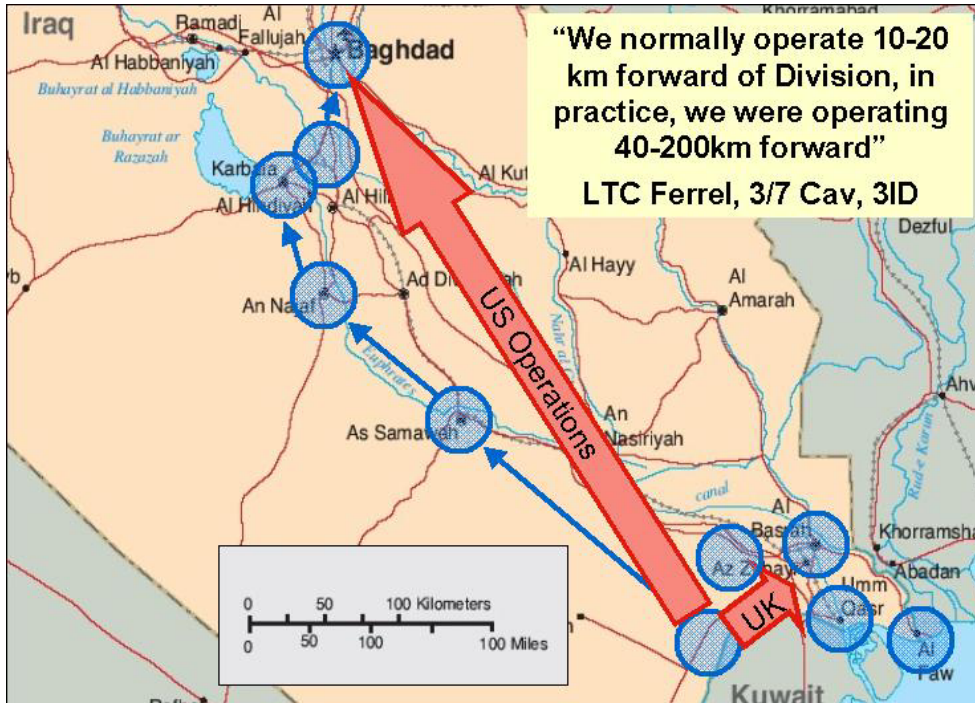
Degree of effectiveness

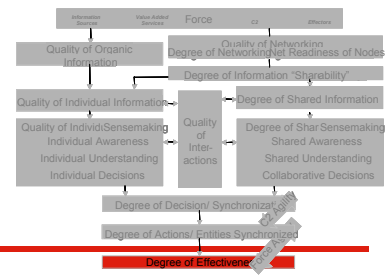
- **Given the relative differences in deployment densities it is more straightforward to demonstrate the degree of effectiveness using 1 BCT as an example**
- **The following criteria have been analysed to discern the improvement in effectiveness generated by FBCB2/BFT:**
 - **Tempo**
 - **Command and control agility**
 - **Synchronization**



Effectiveness - Tempo

- The speed of manoeuvre experienced during Op IRAQI FREEDOM would not have been possible without the capability to exercise command and control on the move and to such geographically dispersed forces
- FBCB2 provided beyond line of sight communications and the ability to see dispersed assets throughout the battle space
 - Commanders were, therefore, relatively well informed to be able to exploit opportunity
 - There was the ability to know the relative positions of other units to synchronise manoeuvre and actions without the need for direct voice communication within the context of the command intent
 - Consequently, tempo could be generated and maintained





Effectiveness – C2 agility

- There is evidence that FBCB2/BFT improved C2 agility in:
 - Responsiveness
 - Flexibility
 - Innovation
 - Robustness
 - Adaption

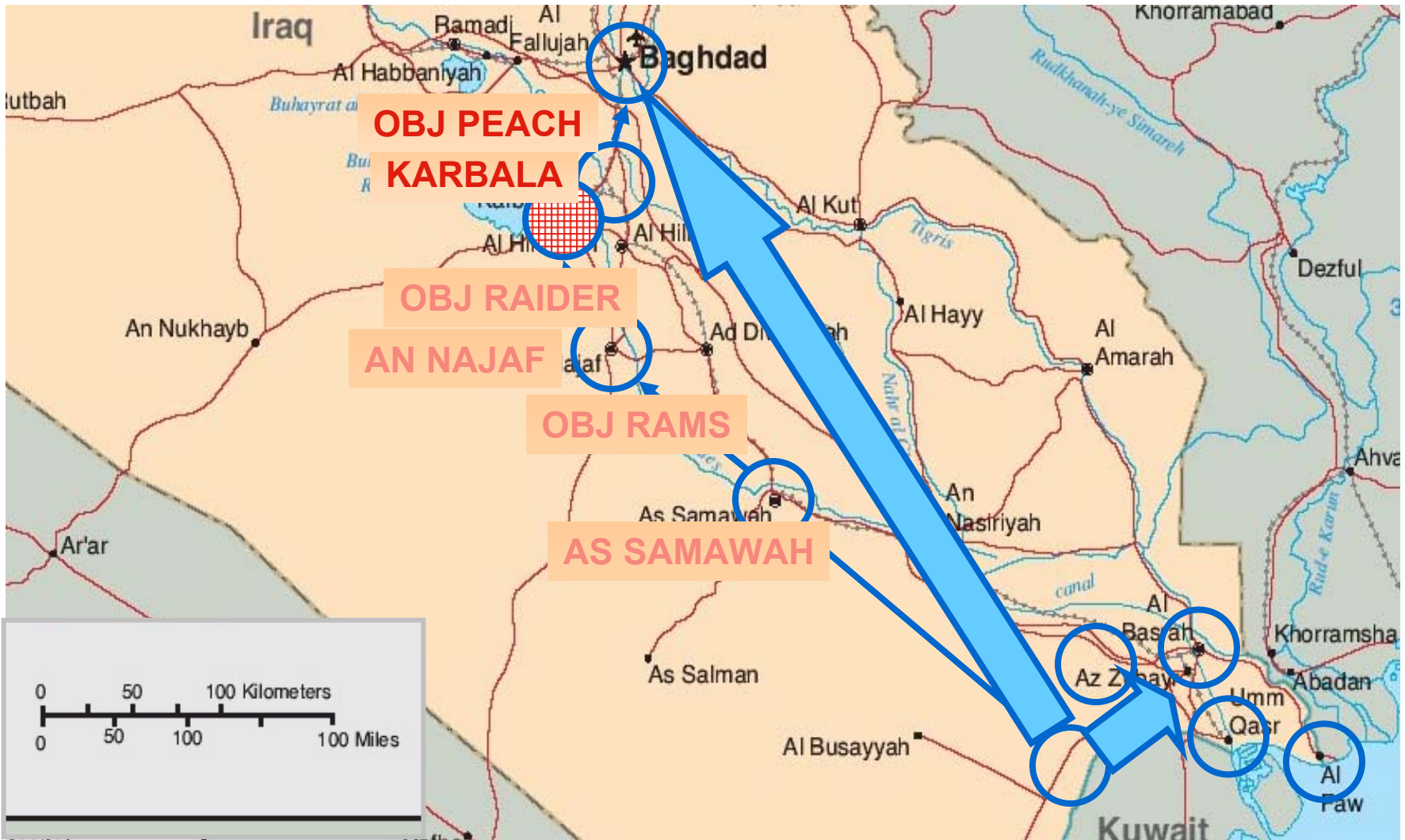
Company Commander 2/7 Inf could perceive depth and breadth of blue forces and see flanking units which, he believed, minimised the risk of fratricide

“The systems allowed me to make decisions quicker, give orders quicker and hence we could move quicker (sic)” ...

B Company Commander 3 PARA used the line of sight tool to site support weapons: arcs of fire for GPMG(SF), siting MILAN



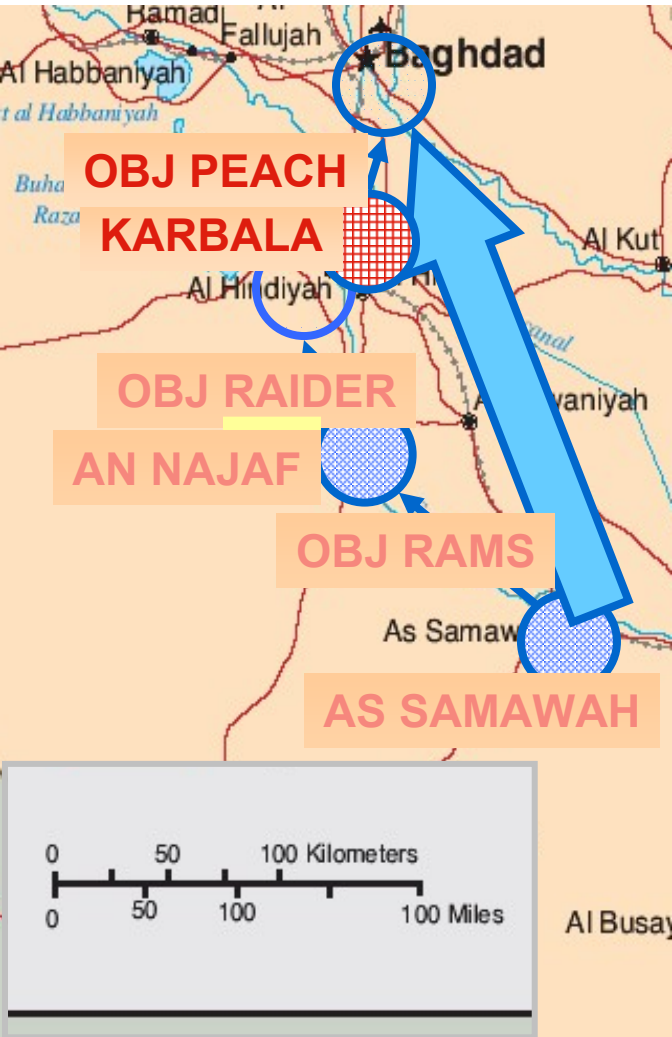
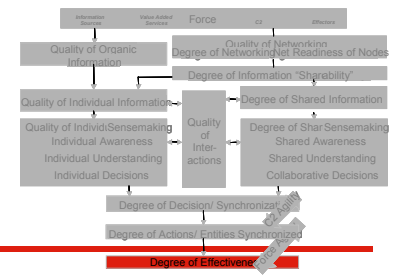
Vignette – use of FBCB2/BFT by 3/69





OFT
OASD/ NII

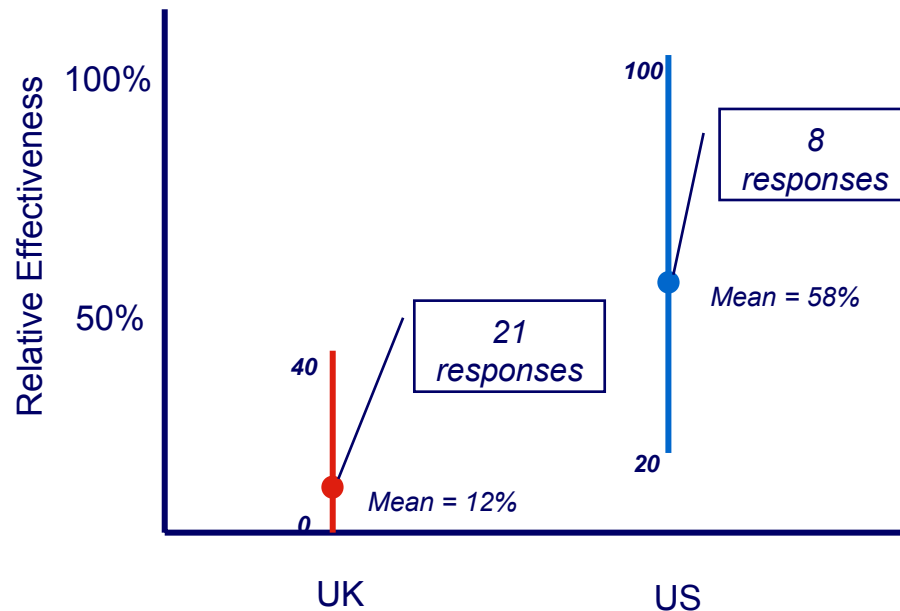
LTC Marccone – CO 3/69 Armored





Relative effectiveness results

Of all the new equipment and systems deployed on the operation, can you assess what percentage of improvement FBCB2/BFT directly contributed to?



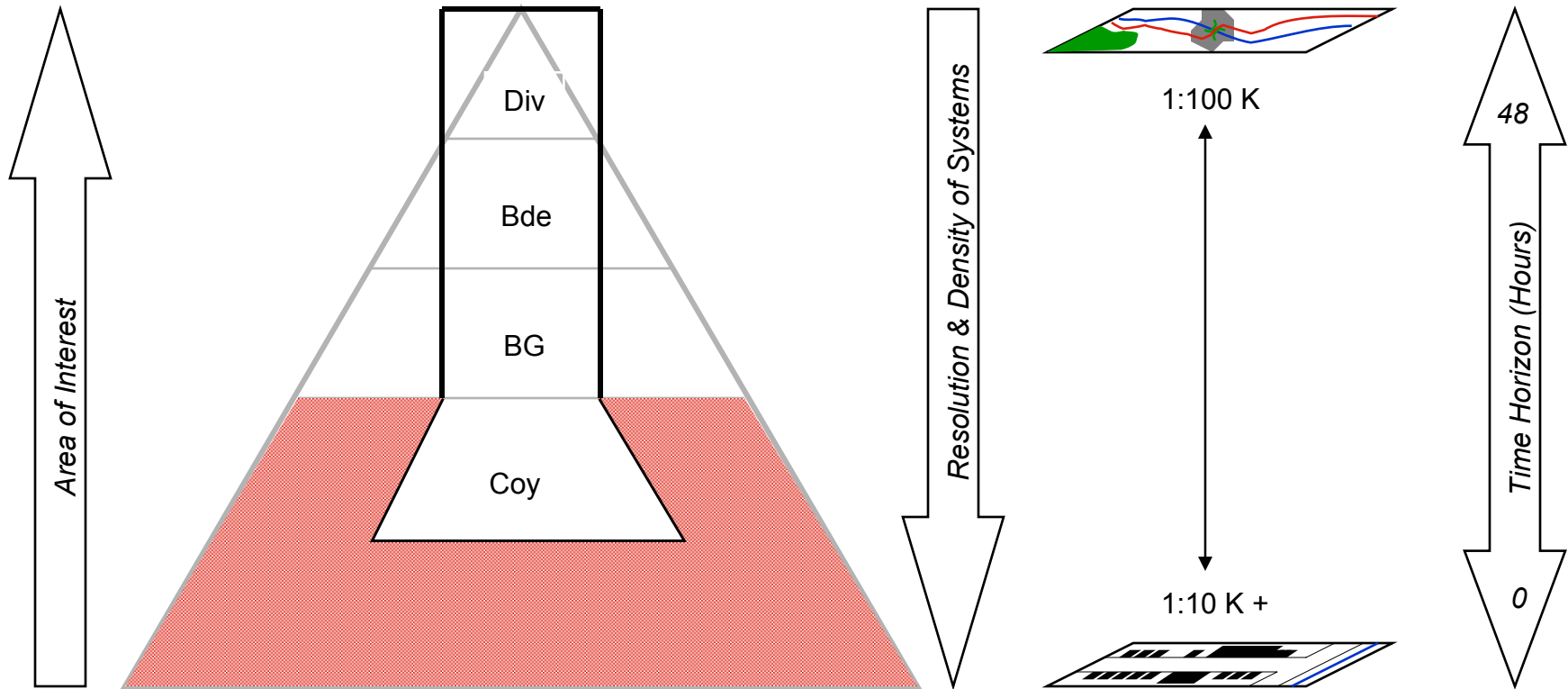
- FBCB2/BFT provided nearly 60% of US forces tactical Situational Awareness compared to 10% in UK
- The UK forces did not exploit the graphical overlay capability for control of boundaries
- The US forces attributed significantly higher confidence to FBCB2/BFT-provided information than their UK equivalents
- The UK forces did not exploit the potential for improved quality of interaction

What drove such significant differences in FBCB2/BFT utilisation?



FBCB2/BFT deployment density in UK forces was very limited

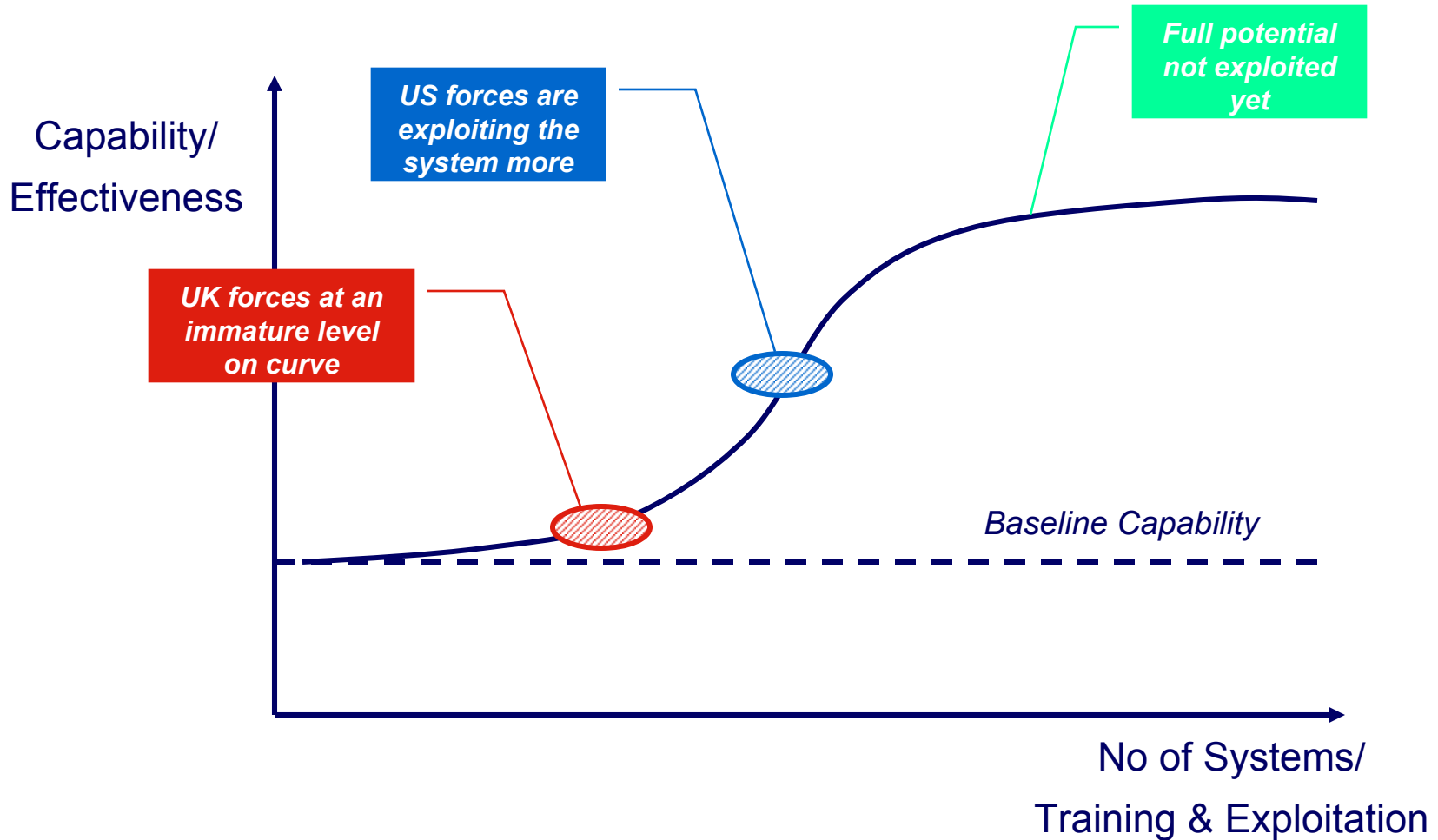
- actual deployment in 1 (UK) Armd Div ...



No direct SA from FBCB2/BFT

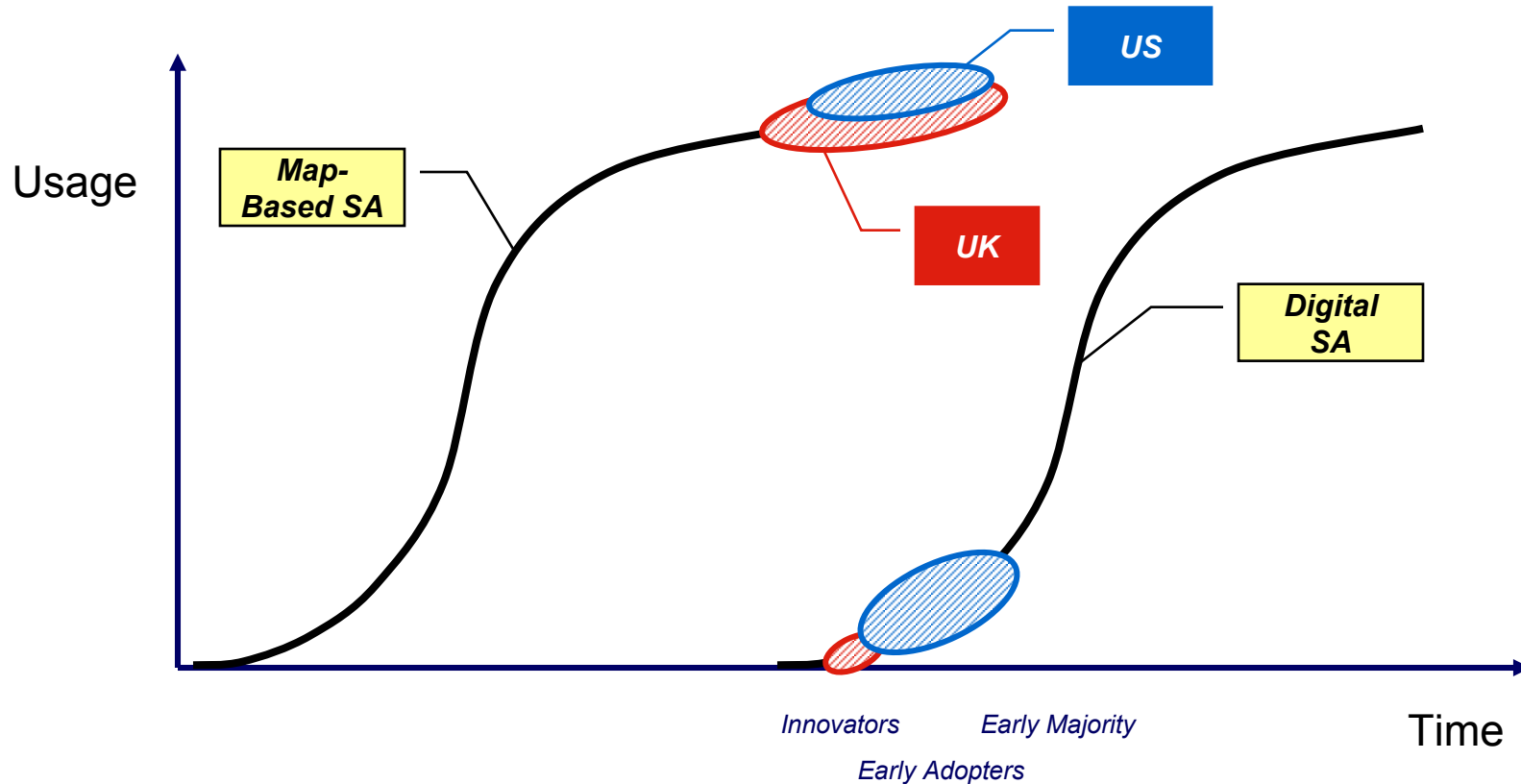


Possible impacts of deployment density and degree of training ...





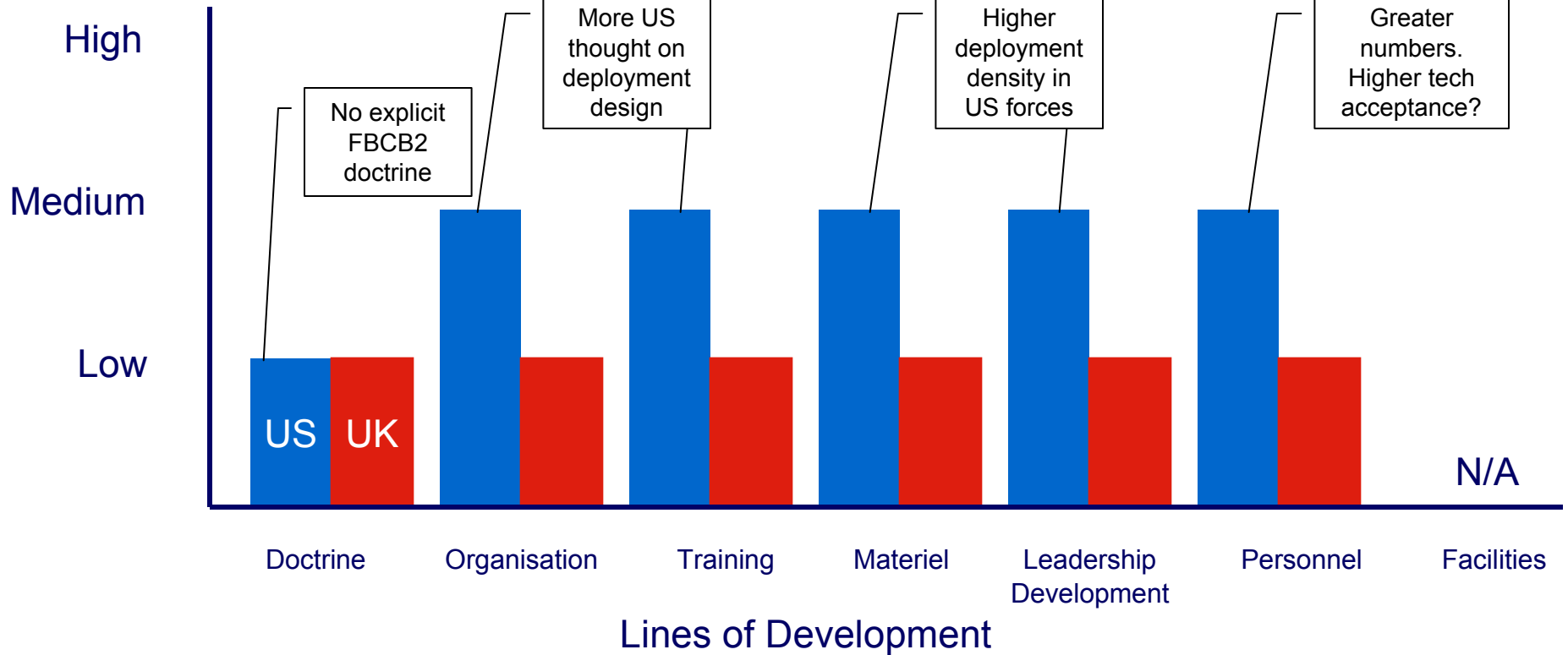
... possible cultural issues regarding technology acceptance





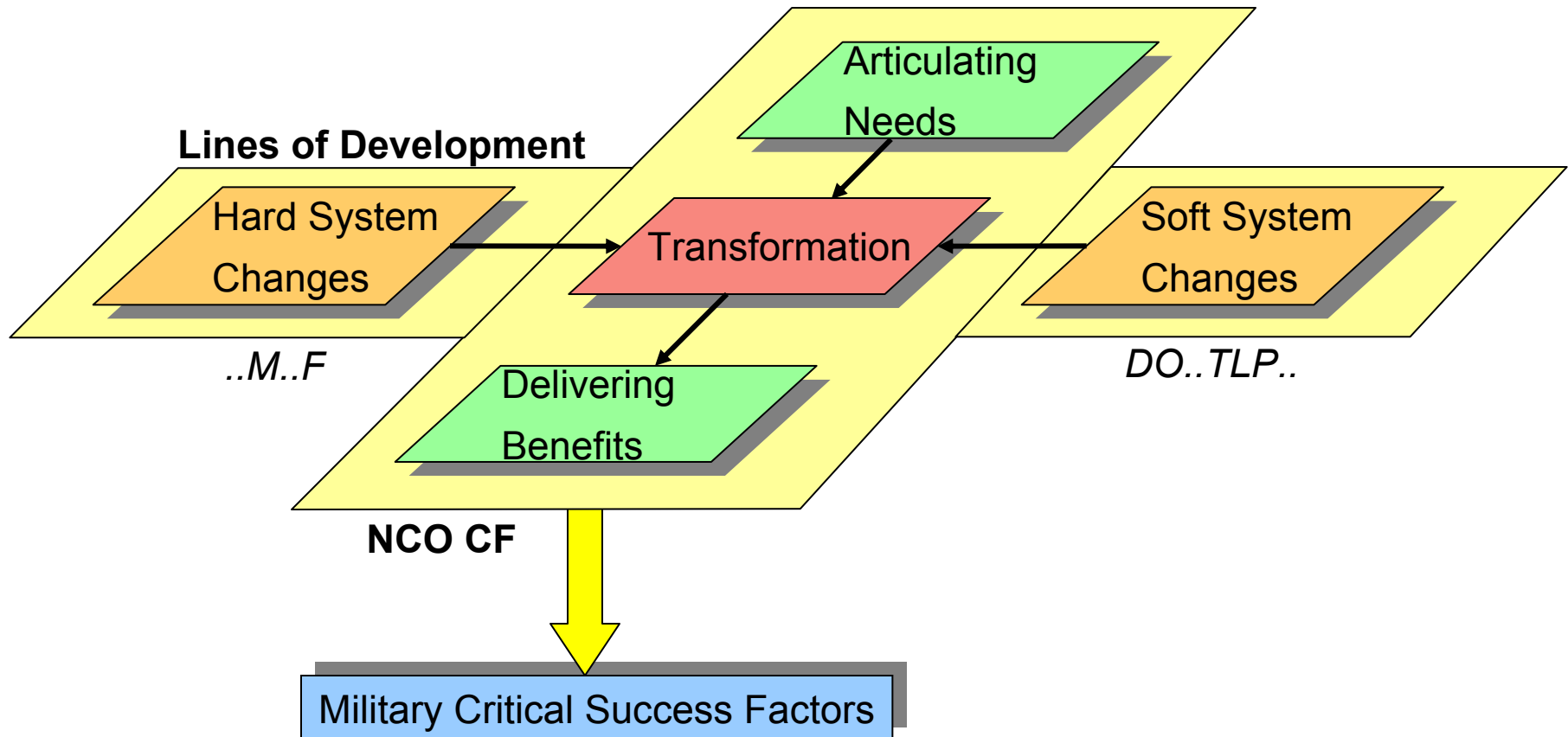
... and comparative integration across all LoDs for FBCB2/BFT

LoD readiness for FBCB2/BFT





Which stresses the role of soft as well as hard factors in deploying complex C4I capabilities





Summary

- **US FBCB2/BFT lessons from OIF:**
 - **Provided significant enhancement to operational capability**
 - **Operational tempo and extended lines of communication encouraged its use**
 - **US forces embraced the technology**
 - **Consistent direction on the deployment / utilisation of FBCB2/BFT**
 - **Enhanced command agility**
- **UK FBCB2/BFT lessons from Op TELIC:**
 - **Provided very limited improvement to operational capability**
 - **UK communications were good without needing FBCB2/BFT**
 - **Limited direction given on the deployment / utilisation of FBCB2/BFT**
 - **Perceived a great potential for the technology, but not exploited yet**

- **Common lessons:**
 - **FBCB2/BFT does not replace voice – it augments it**
 - **Significant impact on morale – visibility of the macro picture**
 - **Need to integrate with CS and CSS assets**
 - **Greater and “deeper” deployment desired**



Recommendations

- **With respect to FBCB2/BFT in OIF:**
 - **The inability to adequately integrate all LoDs due to time pressure limited the operational effectiveness**
 - **The potential of such situational awareness systems is good – provided that the TTPs can be suitably aligned to exploit them**
 - **A unit's effectiveness also depends upon its CS and CSS – which also need good SA**
- **With respect to NCO CF:**
 - **The language of the framework could be made more accessible for combat units / non-US forces**
 - **Quantifying metrics can be very difficult for these types of operations**
 - **The influence of exogenous variables can be at least as significant as those in the framework**



OFT
OASD/ NII

Questions?

