



# Ergonomics Challenges for Digitisation of Mission Planning Systems



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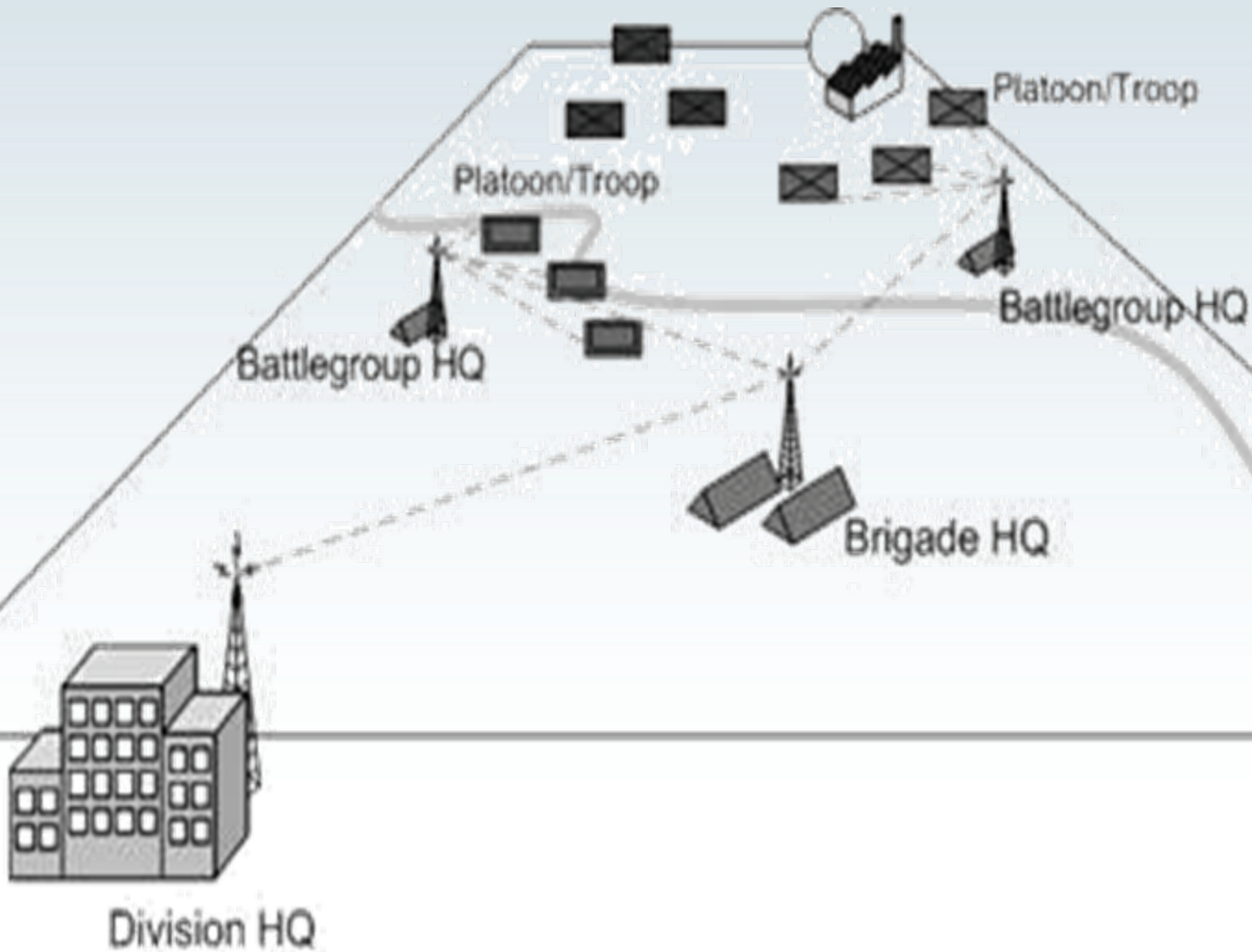
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# Overview



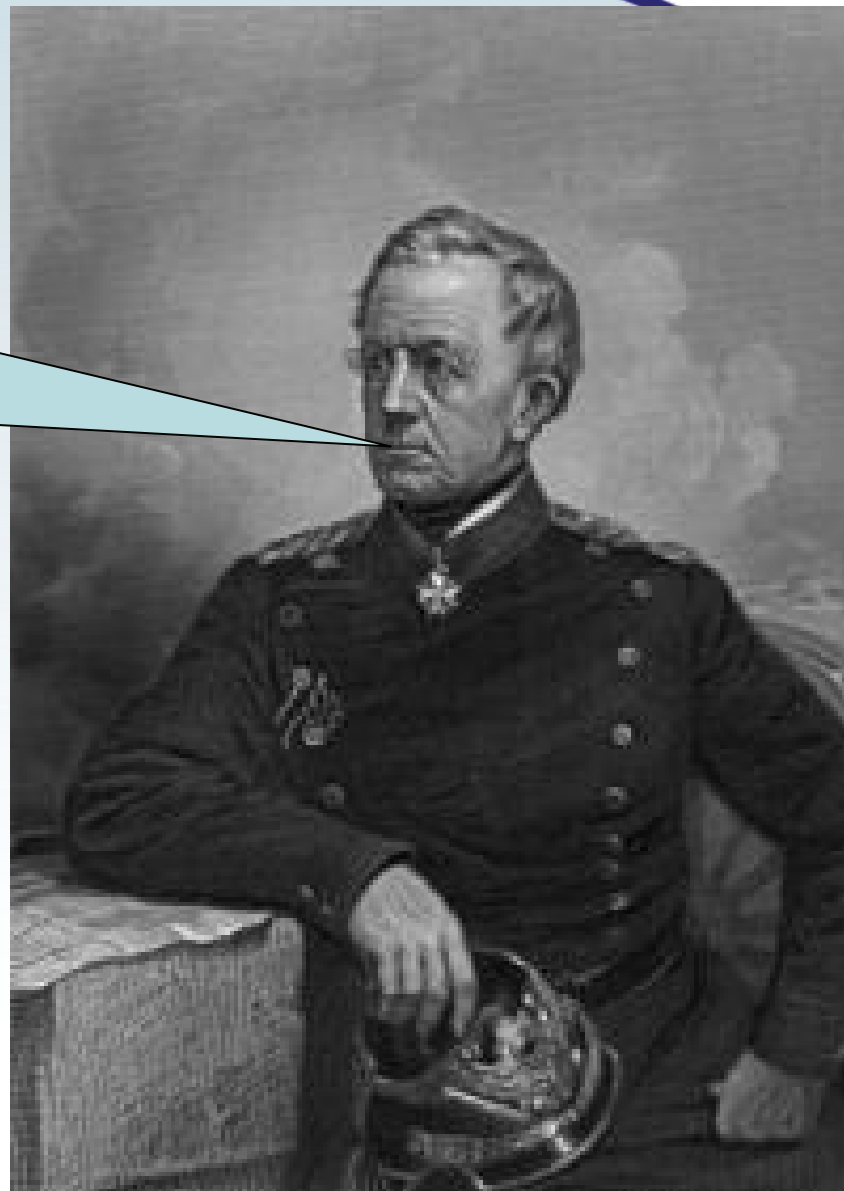
- Why digitise?
- What is mission planning?
- What needs to be digitised?
- How should it be digitised?
  
- Participant-observer
- Observation of training in mission planning
- Observation of field trials of mission planning (A & D)
  
- Presentation of analogue mission planning
- Initial thoughts for digitisation.....

# Command hierarchy



# Helmuth von Moltke (the Elder)

No plan survives  
first contact with  
the enemy





- “Simpler plans might allow better implementation and easier modification”
  - Klein and Miller (1999, p. 219)
- “Plans need to be simple, modifiable, flexible, and developed so that they are quickly and easily understood”
  - Riley et al (2006, p. 1143)

# Constraints acting on planning



- Time pressure
- Uncertainty of information
- Availability of expertise
- Scarcity of resources
- Changing environment
- Non-compliant enemy
- Mission requirements
- Structure of tasks
- Availability of assets

# Mission planning questions



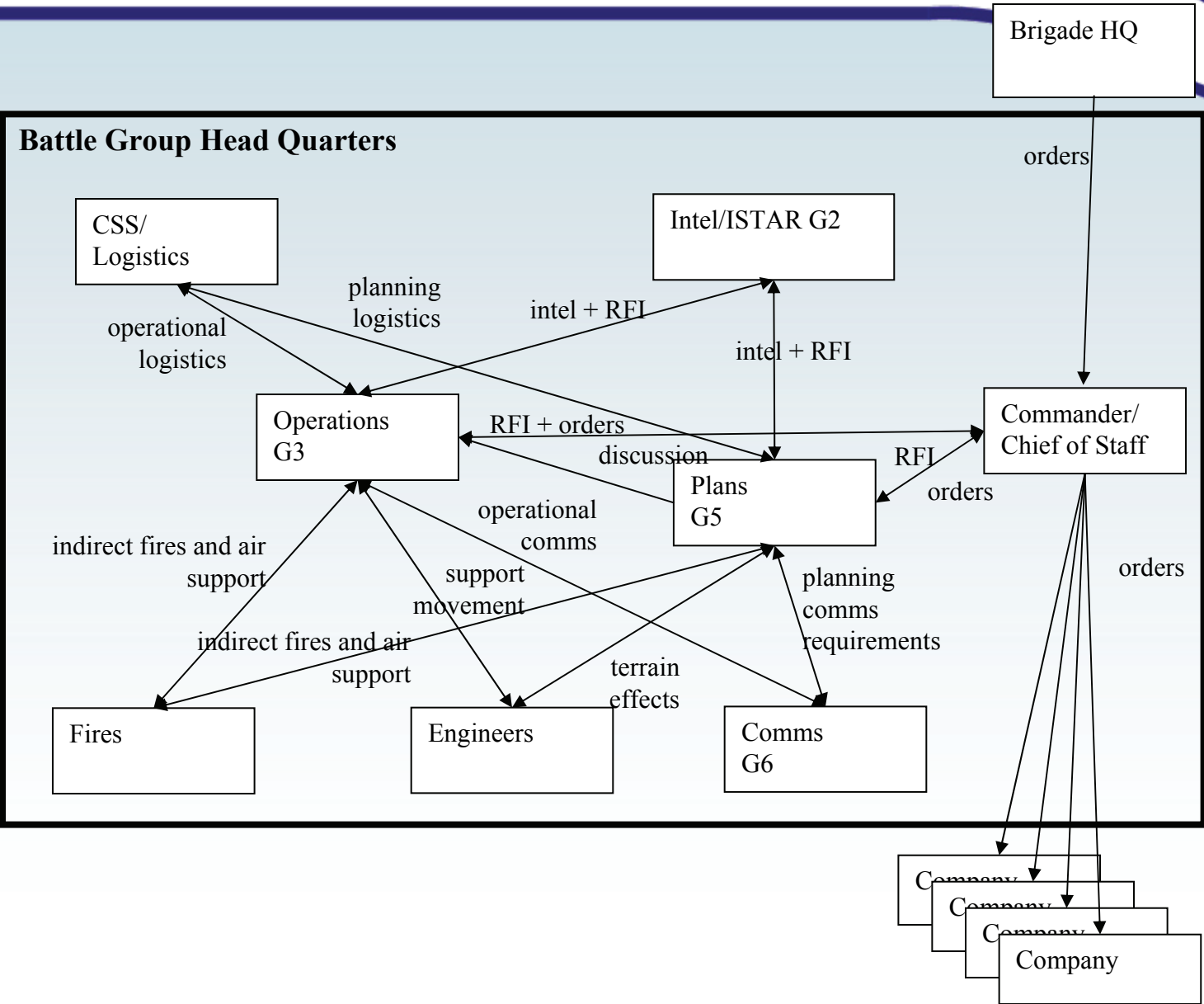
- What is the enemy doing and why?
- What have I been told to do and why?
- What effects do I want to have on the enemy?
- Where can I best accomplish each effect?
- What resources do I need to accomplish each effect?
- When and where do the actions take place in relation to each other?
- What control measures do I need to impose?

# Mission planning environment



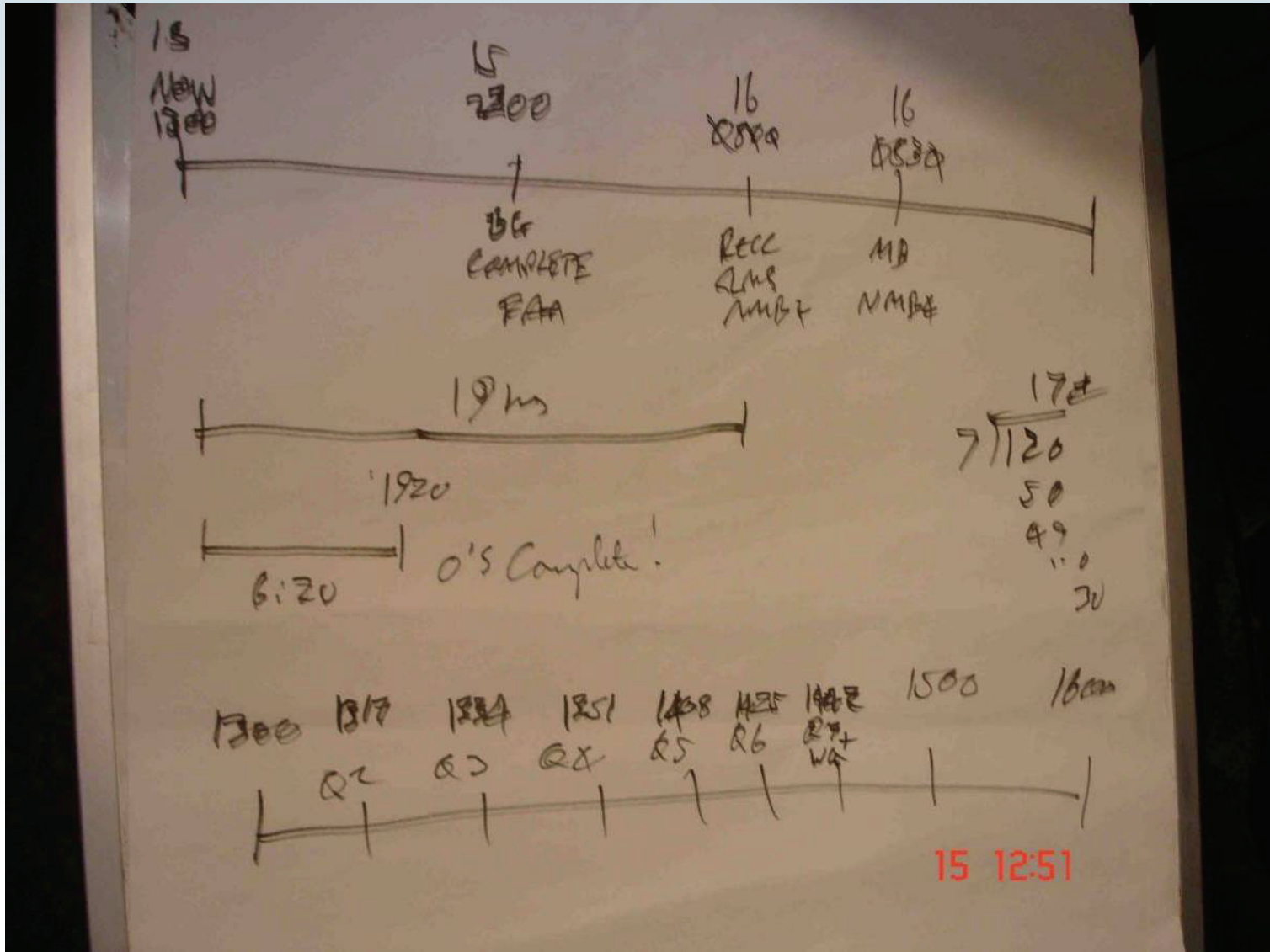


# Social organisation





# Planning time-line



Battle Group level plan

Two hours planning time

$120/7 = 17$  minutes per question



# What is the enemy doing?



Enemy  
location  
and  
strength

Mobility  
corridors

Go and  
slow-go  
areas

Known  
concepts  
and  
doctrine



# What have I been told what to do?

MINI ANALYSIS

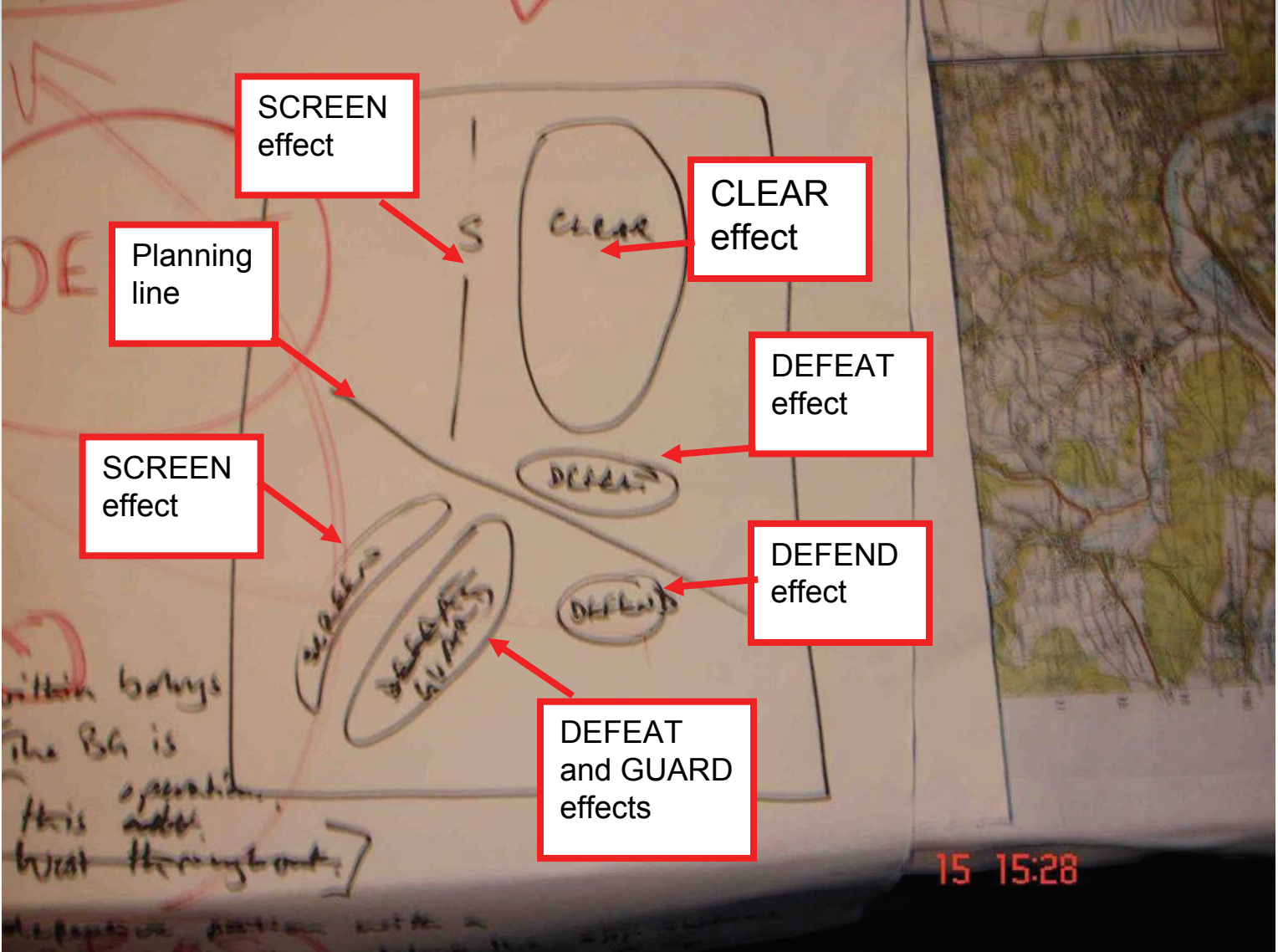
2LP MON :  
 1LP MON :  
 3G MON : **ATTACK: DEFEAT ELMS OF 12AIA ABELT 2u WITHIN 3 DAYS + BLOCK TO PREVENT ANY ELMS IN JURISDICTION FROM WEST 107 RE-EST HANNOV**  
 ME

	TASKS	DEDUCTIONS	CCIR/RFI
SCIFIED	DEFEAT AA COI BLOCK FROM WEST	RENDER INEFFECTIVE LIVE WITH 2 ME BDE FIND SIGNALS WHERE TO BLOCK W/AA?	107R DESTROY W/AA - HQ-PAUL - WHAT IS THE FURTHER FROM WEST - BDRY AIRWAY - W/AA MON ELMS :: WHAT IS 107R - Switching - Double of F BLOCKS - By 107R to 107R
THRU	LO 1 HA xxx		THE FE3 W/AA 107R - BSA! 107R W/AA W/AA 107R
2000			RFI - 107R W/AA 107R
0000	BDRS	NARRU - W/AA 107R	15 13:09 107R W/AA 107R

- Interpret orders
- Identify explicit tasks
- Deduce implicit tasks
- Raise CCIRs and RFIs



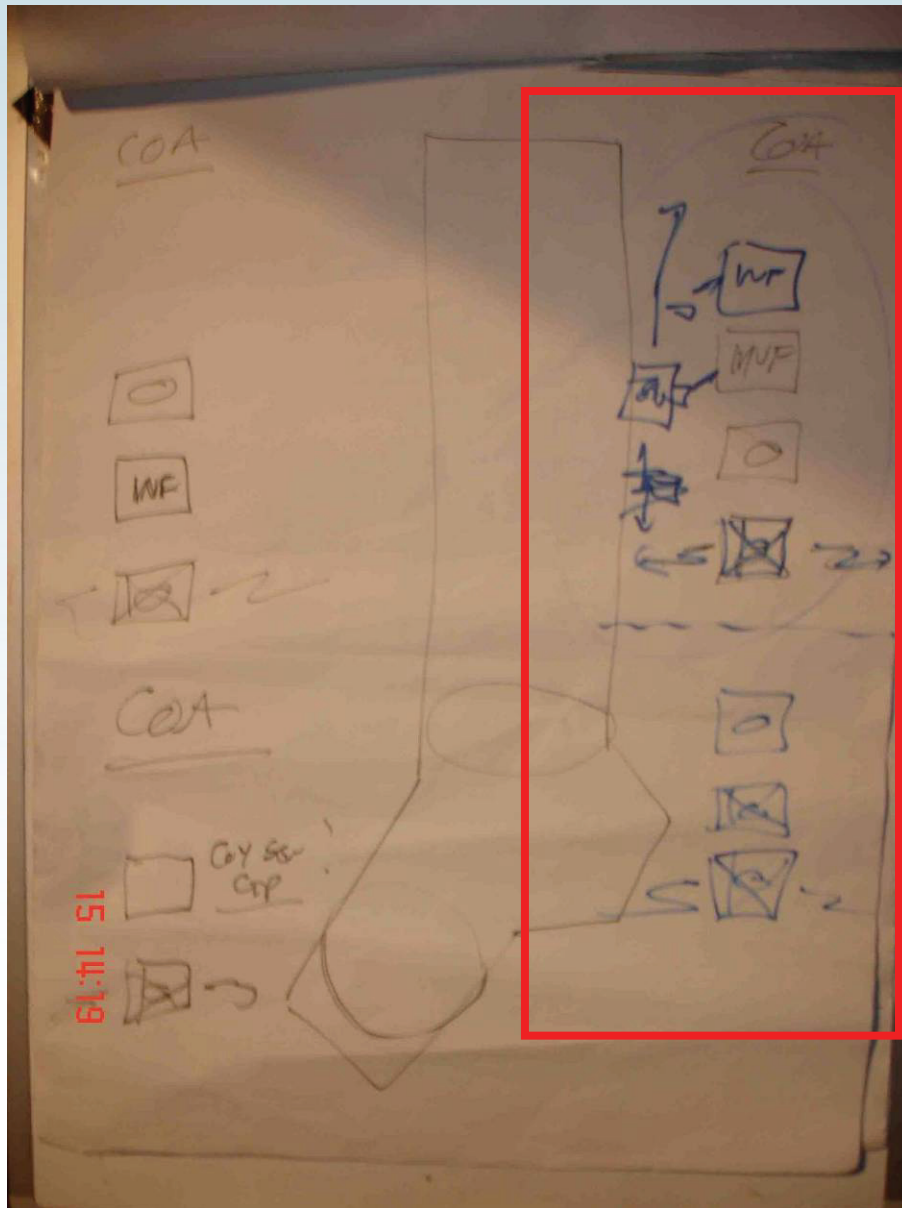
# What effects do I want to have?



- Understand Threat and mission
- Command direction
- Main effects
- Rough outline



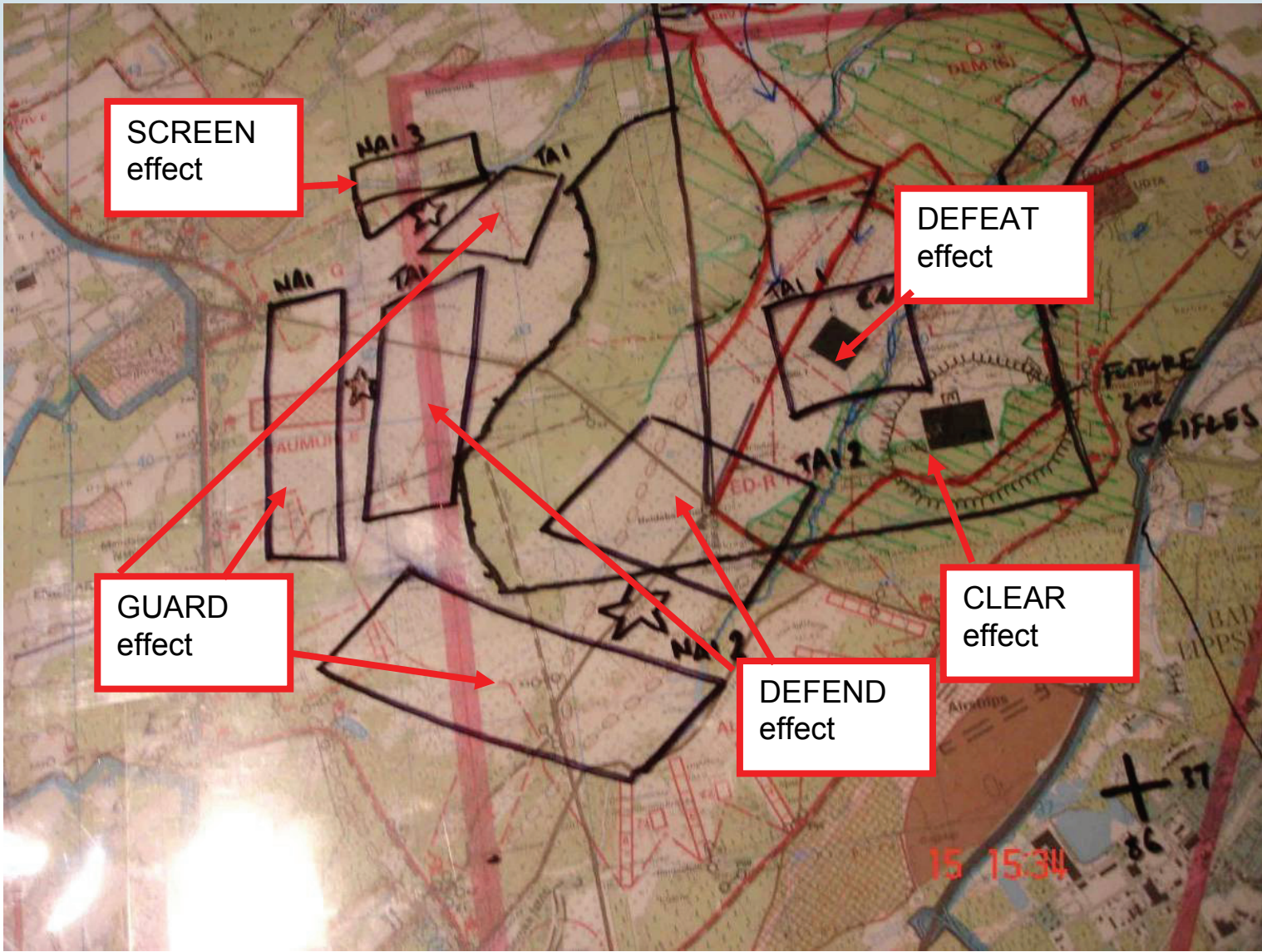
# Where can I best accomplish each effect?



Turn effects schematic into a COA or a selection of COAs  
Commander chooses COA that best interprets his effects schematic or cherry picks from alternative COAs or modifies COA(s)



# Where can I best accomplish each effect?



Chosen  
COA  
mapped  
onto  
map

Check  
relation  
between  
NAI, DP  
and TAI



# What resources do I need?

DSON

NAI	TAI	DP	LOCN	PURPOSE	ASET	LINK	REMARKS
	1		GR 849401	DEFEAT EN CVT	RECCE BG ASSETS		
2	2	2	NO WOODS/AMH N/A	CONFIRM EN ADV FROM SW DEFEAT EN LAUNCH STRIKE INTO TAI 2	RECCE ARMOUR CO-TAC/HAIN	TAI 2/DP 2 <del>DP 2</del> NAI 2 NAI 2/TAI 2	FWD ARMOUR HDRES EFG'D
3	3	3	N/A	CONFIRM EN ADV FROM NW DEFEAT EN LAUNCH STRIKE INTO TAI 3	RECCE JAVELIN CO-TAC/HAIN	TAI 3/DP 3 NAI 3/DP 3 NAI 3/TAI 3	EFFECT OUTSIDE BDRYS - SEE APPROVAL PAGE 9
4	4	4	NO WOODS/AMH N/A	CONFIRM EN ADV FROM W DEFEAT EN LAUNCH STRIKE INTO TAI 4	RECCE JAVELIN CO-TAC/HAIN	TAI 4/DP 4 NAI 4/DP 4 NAI 4/TAI 4	EFFECT OUTSIDE BDRYS - SEE APPROVAL PAGE 2

15 15:47

Map relations between NAI, TAI and DP

Identify location, purpose, and asset.





# Where and when to actions take place?

Synchronise actions and co-ordinate assets

## CO-ORD MEASURES - OPO 002

1. ASST AREA LAYOUT / OOM - RECC
2. CFL - NAMED REPORT LINES. - FPC
3. AD ADV - BOUND BEHIND A SQW - AD  
TRACK ON SIDE
4. WAN CONTROL - AD
5. BM - AIR/AVN - FAC
6. A1 + RAP W FAA. RAP STAY. A1 TO MOV BEHIND FECH - BGLO
7. OOM: RECC - SQW - A COY - FAC - 292MOR - D COY - A1  
↳ AD (TRACK) ↳ BOMTDS
8. RAP - ON CALL. LIKELY LOSCS FND ONCE MOV REACHED LINE? - BGLO
9. PSP LOC/FUP GR 854410 & GR 847408
10. REORG - RECC MOV TO SCREEN (DURING ASST). JAV MOV TO JOIN
11. FLANK PROTECTION -  $\frac{1}{2}$  W  $\frac{1}{2}$  RESERVE (BPT FOR E) - JAV  
↳ TANK TRK

15 1750

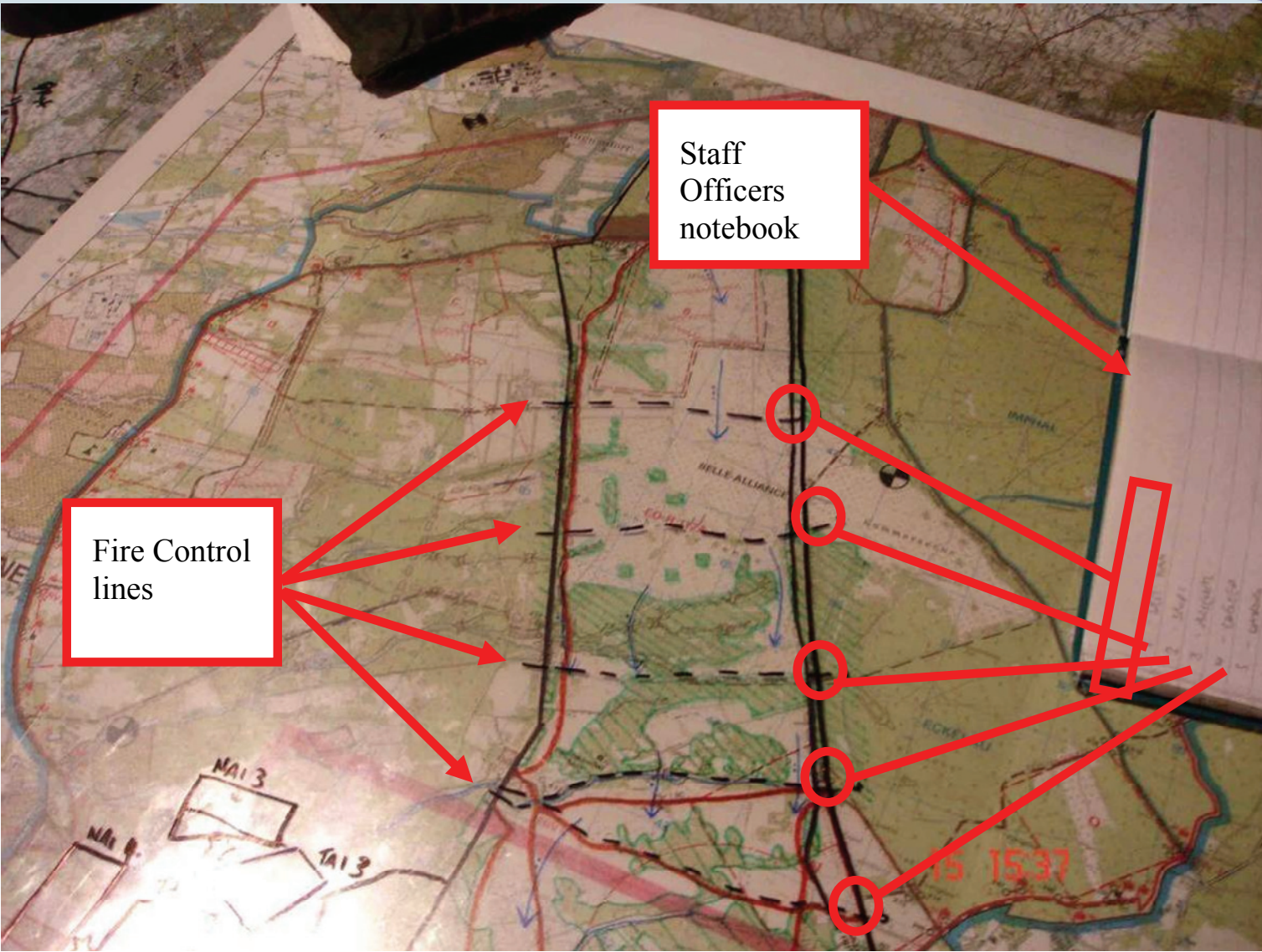
# Where and when to actions take place?



Check synchronisation via war-game to validate matrix



# What control measures?



Identify control measures to help with coordination and help prevent fratricide



# Overview of products and media

Products/Media	Paper	Maps/ Overlays	White board	Flip chart	Staff Note book
Warning order					
Planning time line					
Q1. BAE/TI					
Q2. Mission Analysis					
Q2. CCIRs/RFI					
Q3. Effects Schematic					
Q4. COA					
Q4. DSO					
Q5. DSOM					
Q6. War-game					
Q6. Co-ordination					
Q7. Fire control					



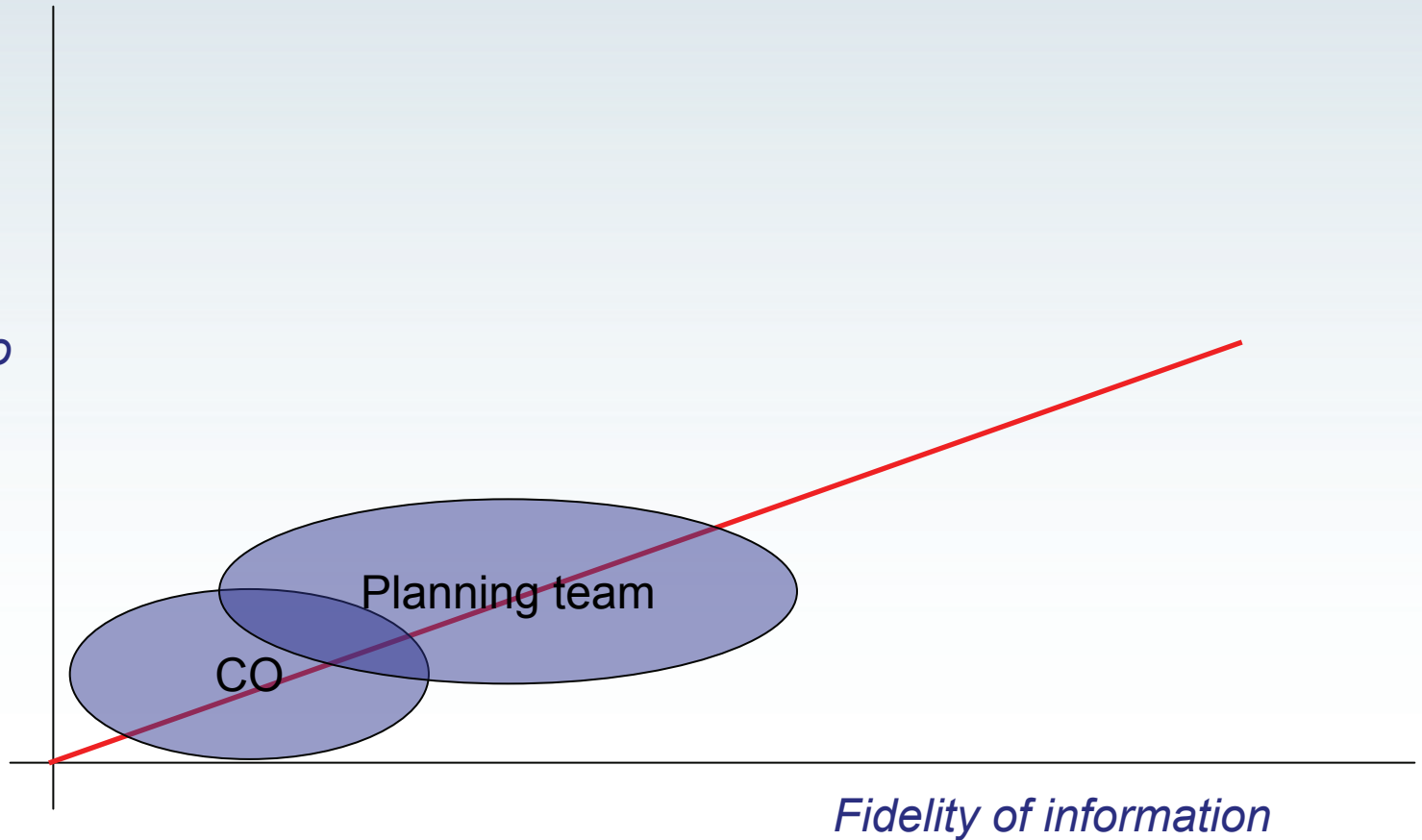
# Task work or team work?

Planning process	Task work or team work?
Q1. What is the enemy doing and why?	Cooperative activity around the table
Q2. What have I been told to do and why?	Isolated intellectual activity followed by collaborative assessment of the CCIRs and RFIs
Q3. What effects do I want to have on the enemy?	Isolated intellectual activity followed by cooperative activity around the table
Q4. Where can I best accomplish each action/effect?	Collaborative activity in which the products shared
Q5. What resources do I need to accomplish each action/effect?	
Q6. Where and when do the actions take place in relation to each other?	
Q7. What control measures do I need to impose?	

# From Lo-Fi to Hi-Fi



*Time to create*

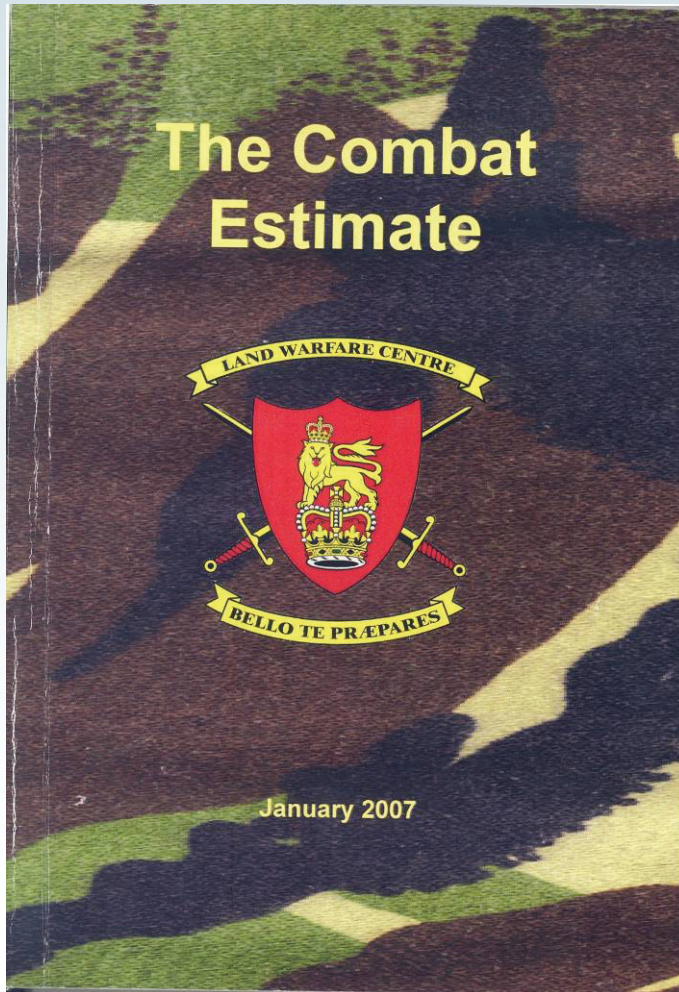


# Initial thoughts for digitisation..



- Keep the planning process 'public' and 'collaborative'
- Keep the planning process 'elastic' and 'creative'
- Focus analysis on the relationship between 'activities' and traditional 'artefacts'
- Support the planning process with design of 'cognitive artefacts' (cheat sheets, stickies, ...)
- Use accepted 'models' and 'metaphors'
- Make the computer 'invisible'
- Make sure that 'digitisation' isn't an additional planning constraint

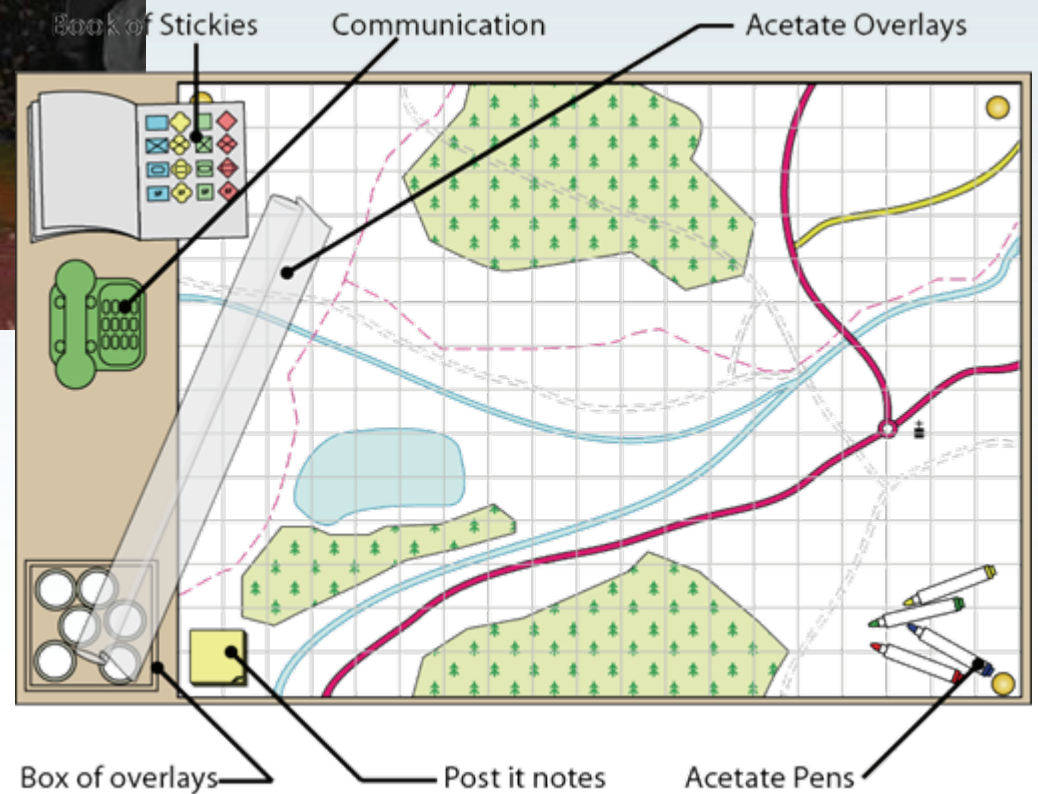
# Combat Estimate



- “Answer the 7 questions, but use the tools selectively and creatively. Do not just slavishly follow process” (Combat Estimate, p. 2, 2007)
- “Too frequently information [...] disappears into staff officers notebooks. [...] large format boards are recommended to prevent information getting lost” (Combat Estimate, p. 6, 2007)



# Analogue to Digital System



# Where to find out more...

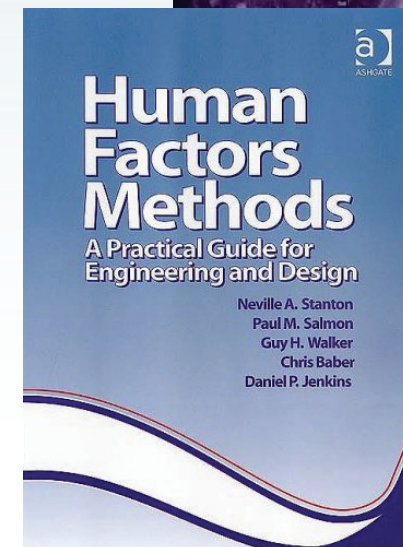
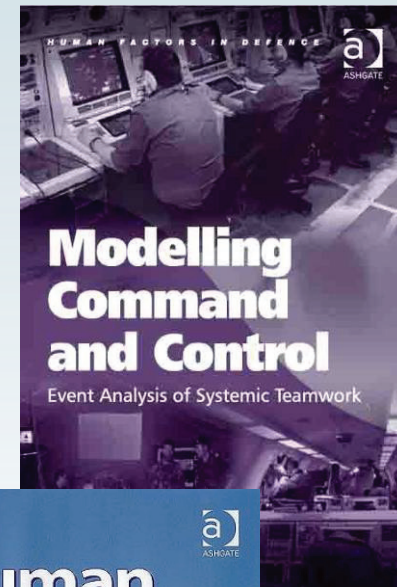


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# Digitising Command and Control



**'A thorough analysis of the various Human Factors critical to command and control planning and modelling of military missions.** These include goal/function analysis, situation awareness, social interactions and cognitive work analysis, among others.'

Thomas Sheridan, Professor Emeritus of Engineering and Applied Psychology MIT, and Chief Systems Engineer for Human Factors, Federal Aviation Administration, USA

**'This book demystifies the digitization of military command and control** and reveals that successful systems, as always, require careful attention to the details of users, use, and context. The book is a welcomed and detailed treatment of the limits and successes of current digital planning and management systems for the battlefield.'

Professor David Woods, Department of Integrated Systems Engineering, The Ohio State University, USA

**'Computerizing complex undertakings is often promoted as a panacea.** To be done properly, system designers and system owners must realise that they are building a socio-technical system, and that **Human Factors therefore must be taken into account from the very start.** Failing to do so will seriously hamper both the efficiency and the safety of the final product, **as amply illustrated by this meticulous evaluation of a complex military system.'**

Prof Erik Hollnagel, MINES ParisTech, France

**'In taking the reader through the contributions to this work, the book provides excellent overviews of a range of approaches and methods in practice.** Since the context remains the same throughout, this lends a coherence of explanation, a basis for comparison **and a view on methods integration that is rarely found in the Human Factors literature.'**

Prof John Wilson, University of Nottingham, UK

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