A new rapid ISTAR assessment method

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Outline

- Introduction
  - background, need and development
- Model requirements
- Model description
- Example results
- Planned developments
- Summary
  - references and questions

Introduction

Introduction

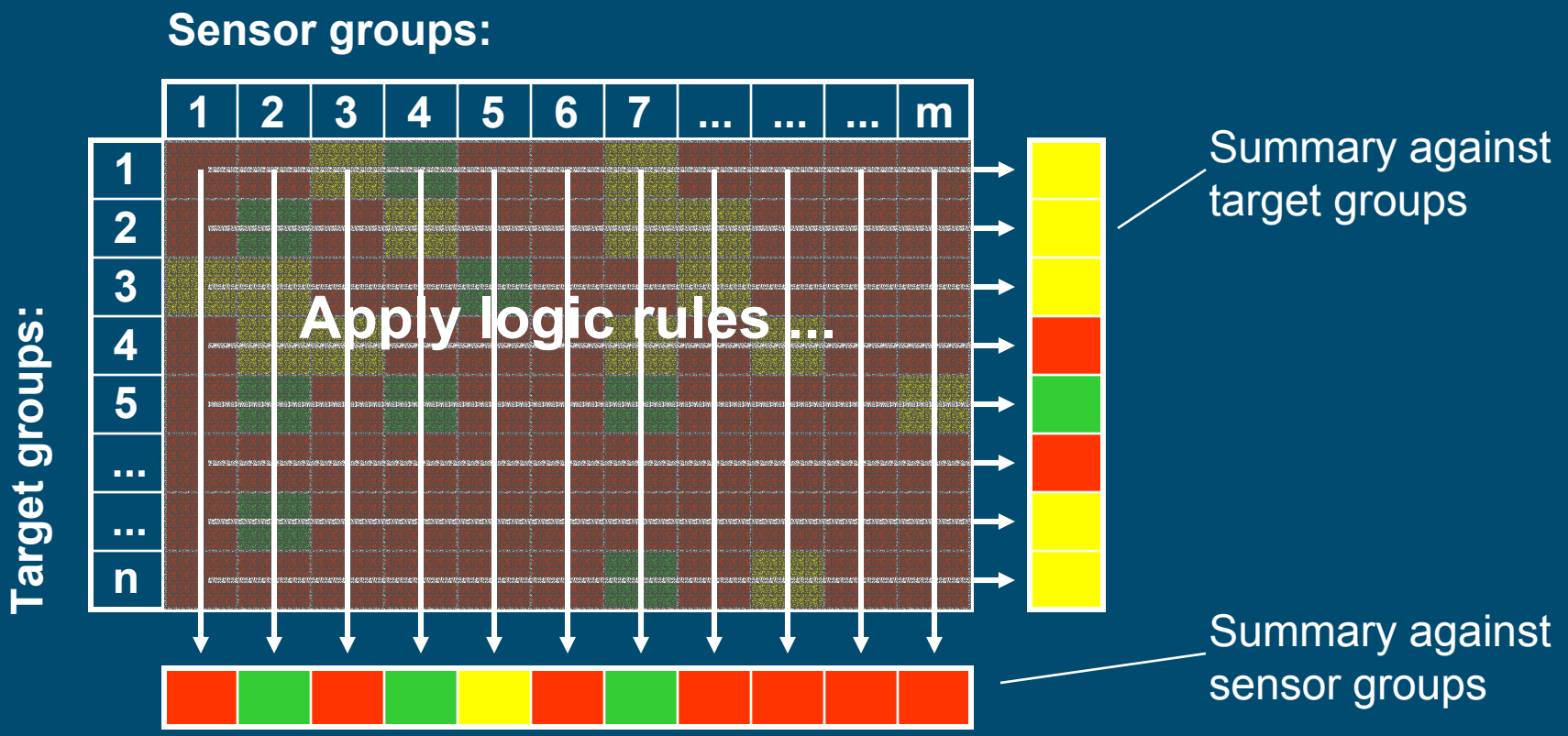
- C2 is driven by the receipt of timely ISTAR information
- Previous OA support used explicit, detailed data
  - proved inflexible and costly to run
- Dstl LSD developed a new and abstract approach …
  - no need for detailed terrain data
  - no requirement for explicit platform-level deployments
- To assess quality and timeliness from an ISTAR mix supporting the main decisions in a scenario
  - used at unit (i.e. BG) level in this preliminary study

Background

- Gap identified in C4ISTAR assessment capabilities
  - between detailed platform-level explicit modelling …
  - and judgemental techniques, e.g. military assessment panels (MAPs) and BOGSAT
- Also request from NATO support to ARRC HQ OA
- Deep fires TA study in 2002 laid conceptual framework
  - but populated judgementally – subjective and time-consuming
  - and open to ‘criterion drift’ between evaluating cases
- Allowed a framework for capability gap analysis ...

Principal of assessment

- Based on a contingency table of sensors against targets:



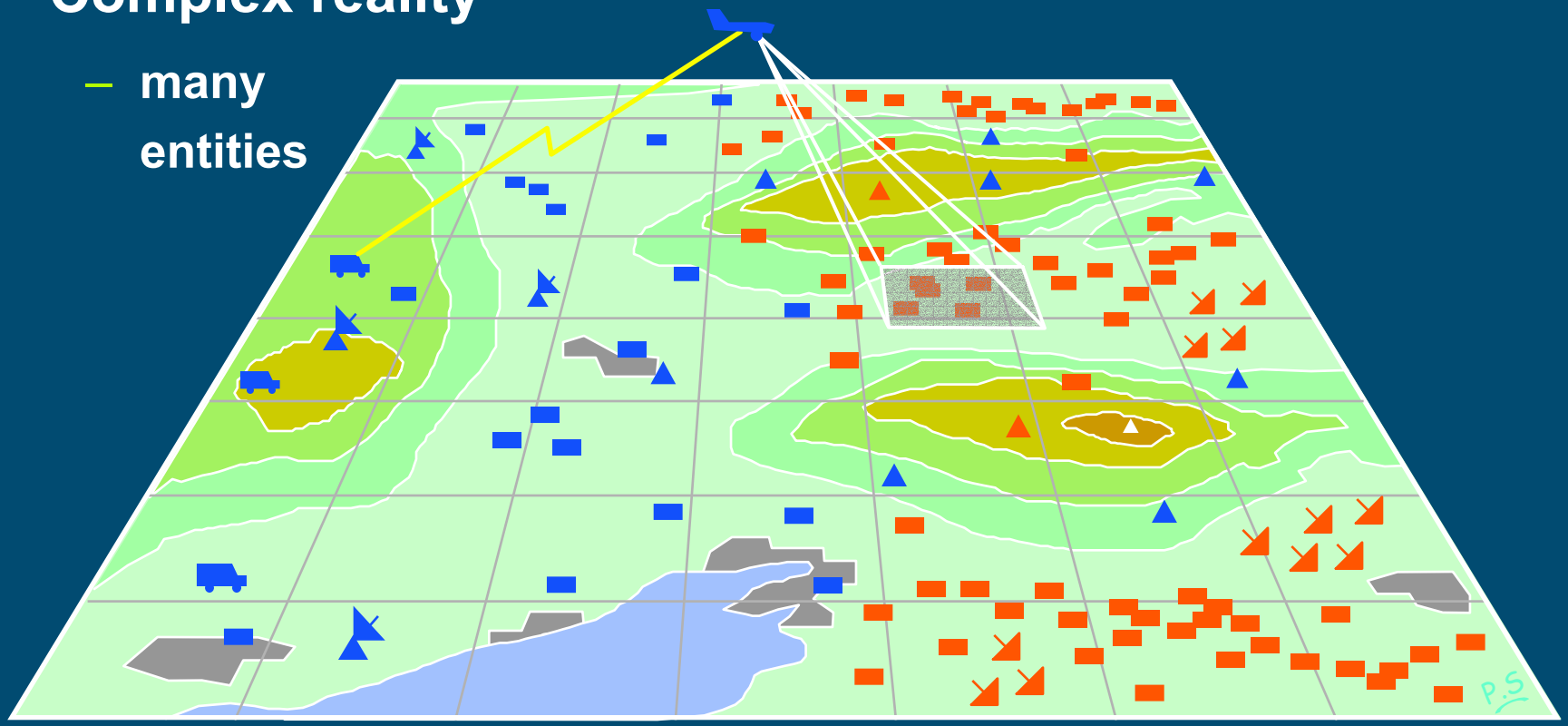
Model description

Model requirements

- **Operational:** VB for Excel, spatial information, represent a ‘snapshot’ in time, run deterministically using probabilistic data, output easy metrics
- **Technical:** approximate spatial overlap, interaction of sensor capabilities with target types and postures, effects of terrain/met/night/day on sensor performance
- **Types of sensor:** ground-based imaging (optical and thermal), GSRs, unmanned acoustic and seismic, UAV-borne, WLRs, SRs, manned recce airborne, ESM

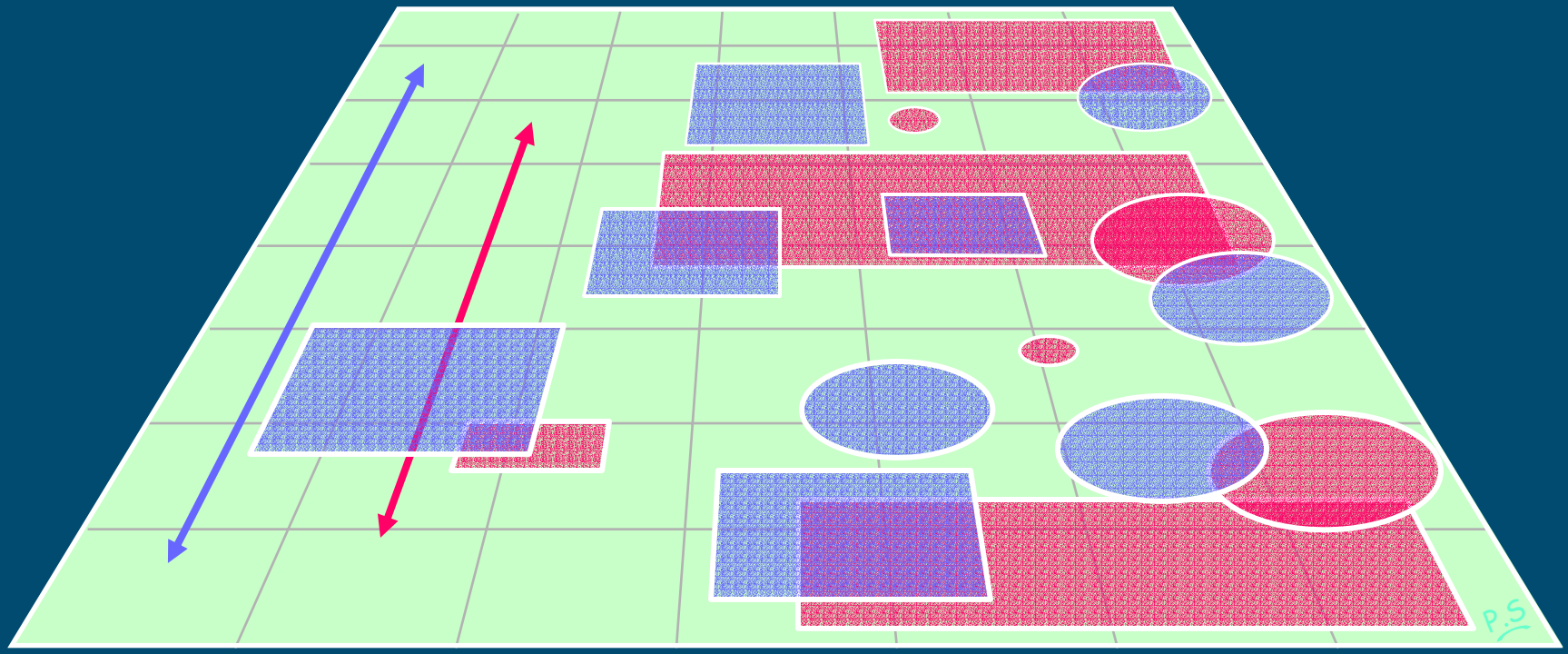
Model overview … 1

- **Complex reality**
  - **many entities**



Model overview … 2

- **Simplified view**



Model description

- Blue sensors and Red targets are represented spatially as homogeneous ‘blobs’
- Sensor performance is measure over ‘snapshots’
  - assuming quasi-static deployments
  - target postures reflect unit movement and other activities
  - e.g. advancing, open, hide, ‘shoot and scoot’, etc.
- Terrain (including culture) assumed homogeneous
- Meteorological effects on some sensors
- Levels of CCIR represented
  - influencing timeliness, TLE and resolution

‘Logic engine’

- Runs six ‘coupling tests’ on each sensor/target pair:
  - spatial overlap
  - spectral compatibility
  - activity compatibility (for STI/MTI sensors)
  - resolution (DRI)
  - target location error (TLE)
  - timeliness
- All compared against target and CCIR parameters
- Sensor must pass all six to acquire target group

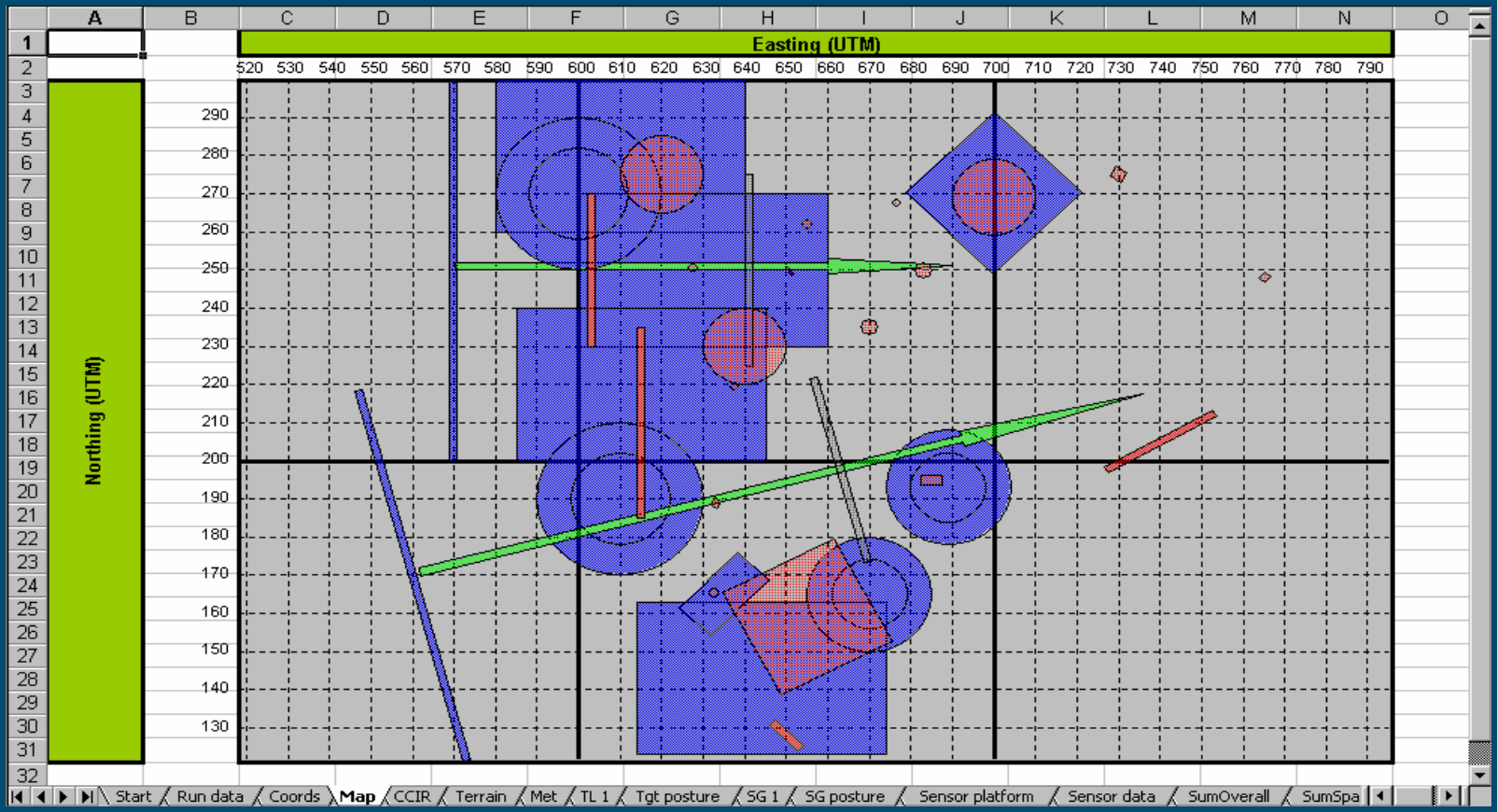
Influences on logic engine

Factor: / Test:	Spatial	Spectral	Activity	Resolution	TLE	Timeliness
Deployments	🗐					
Relief	🗐					
Terrain features	🗐	🗐				
Meteorology	🗐	🗐				
CCIR				🗐	🗐	🗐
Sensor performance	🗐	🗐	🗐	🗐	🗐	
Searcher platform/group	🗐		🗐			🗐
Target group postures		🗐	🗐	🗐	🗐	🗐

‘AND’ logic ⟹ MoP

Example results

Example results



[dstl]

Base case summary

Overall summary. Parameters: TL 1; SG 1; Europe, hilly; Planning; Clear day

Name/Type	Sensors													
	1. Scout-1	2. Scout-2	3. Scout-3	4. Engr-R	5. MUAV-1	6. LEWT	7. FOO-1	8. FOO-2	9. MFC-1	10. MFC-2	11. A Sqn	12. SRT		
1. TkRegtHQ	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
2. Dump	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
3. Relay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
4. Ech	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
5. AD1	0.00	0.50	0.00	0.54	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	2	1
6. AD2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
7. Mtr Ptn	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0
8. TkCoy1	0.30	0.05	0.00	0.00	0.00	0.04	0.00	0.21	0.00	0.00	0.00	0.00	0	2
9. TkCoy2	0.00	0.18	0.00	0.26	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.30	0	3
10. TkCoy3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
11. Recce	0.08	0.30	0.00	0.09	0.00	0.04	0.00	0.24	0.00	0.00	0.00	0.03	0	2
12. ATk Ptn	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
13. EW Ptn	0.00	0.09	0.00	0.39	0.00	0.17	0.39	0.00	0.00	0.00	0.00	0.00	0	3
14. RAG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0	1
15. WLR1	0.30	0.30	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0	2
16. WLR2	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.30	0	3
17. DivEngr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0	1
18. MR Bn1	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.01	0.15	0	3
19. MR logs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
20. Civilians	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
	0	2	0	1	0	0	0	0	0	0	0	0		
	2	4	3	2	1	2	1	2	1	1	1	4		

CCIR variation: Targeting

Overall summary. Parameters: TL 1; SG 1; Europe, hilly; Targeting; Clear day

Name/Type	Sensors													
	1. Scout-1	2. Scout-2	3. Scout-3	4. Engr-R	5. MUAV-1	6. LEWT	7. FOO-1	8. FOO-2	9. MFC-1	10. MFC-2	11. A Sqn	12. SRT		
1. TkRegtHQ	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
2. Dump	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
3. Relay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
4. Ech	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
5. AD1	0.00	0.20	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	2
6. AD2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
7. Mtr Ptn	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0
8. TkCoy1	0.30	0.05	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0	2
9. TkCoy2	0.00	0.18	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0	3
10. TkCoy3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
11. Recce	0.02	0.06	0.00	0.04	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0	1
12. ATk Ptn	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
13. EW Ptn	0.00	0.04	0.00	0.31	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0	2
14. RAG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0	1
15. WLR1	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	2
16. WLR2	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0	1
17. DivEngr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0	1
18. MR Bn1	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.01	0.08	0	2
19. MR logs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
20. Civilians	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
	0	1	0	0	0	0	0	0	0	0	0	0		
	2	3	3	3	1	0	1	2	1	1	0	2		

Meteorological variation: Rain, night

Overall summary. Parameters: TL 1; SG 1; Europe, hilly; Planning; Rain night

Name/Type	Sensors													
	1. Scout-1	2. Scout-2	3. Scout-3	4. Engr-R	5. MUAV-1	6. LEWT	7. FOO-1	8. FOO-2	9. MFC-1	10. MFC-2	11. A Sqn	12. SRT		
1. TkRegtHQ	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
2. Dump	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
3. Relay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
4. Ech	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
5. AD1	0.00	0.20	0.00	0.37	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0	3
6. AD2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
7. Mtr Ptn	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
8. TkCoy1	0.12	0.02	0.00	0.00	0.00	0.03	0.00	0.13	0.00	0.00	0.00	0.00	0	2
9. TkCoy2	0.00	0.07	0.00	0.18	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.24	0	2
10. TkCoy3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
11. Recce	0.03	0.12	0.00	0.06	0.00	0.03	0.00	0.14	0.00	0.00	0.00	0.02	0	2
12. ATk Ptn	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
13. EW Ptn	0.00	0.04	0.00	0.27	0.00	0.15	0.24	0.00	0.00	0.00	0.00	0.00	0	3
14. RAG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0	1
15. WLR1	0.12	0.12	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0	2
16. WLR2	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.24	0	3
17. DivEngr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0	1
18. MR Bn1	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.12	0	3
19. MR logs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
20. Civilians	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
	0	0	0	0	0	0	0	0	0	0	0	0		
	2	4	3	3	0	2	1	2	1	1	1	4		

Terrain variation: Desert, flat

Overall summary. Parameters: TL 1; SG 1; Desert, flat; Planning; Clear day

Name/Type	Sensors													
	1. Scout-1	2. Scout-2	3. Scout-3	4. Engr-R	5. MUAV-1	6. LEWT	7. FOO-1	8. FOO-2	9. MFC-1	10. MFC-2	11. A Sqn	12. SRT		
1. TkRegtHQ	0.00	0.27	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0	1
2. Dump	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0	0
3. Relay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
4. Ech	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
5. AD1	0.00	0.89	0.00	0.89	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	2	1
6. AD2	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0	1
7. Mtr Ptn	0.00	0.89	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	1	1
8. TkCoy1	0.54	0.09	0.00	0.00	0.00	0.04	0.00	0.24	0.00	0.00	0.00	0.00	1	1
9. TkCoy2	0.00	0.32	0.00	0.43	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.30	0	3
10. TkCoy3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
11. Recce	0.15	0.54	0.00	0.15	0.00	0.04	0.00	0.27	0.00	0.00	0.00	0.03	1	3
12. ATk Ptn	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0
13. EW Ptn	0.00	0.16	0.00	0.65	0.00	0.17	0.45	0.00	0.00	0.00	0.00	0.00	1	3
14. RAG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0	1
15. WLR1	0.54	0.54	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	2	0
16. WLR2	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.30	2	1
17. DivEngr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0	1
18. MR Bn1	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.02	0.15	1	2
19. MR logs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0
20. Civilians	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	1
	2	4	3	2	0	0	0	0	0	0	1	0		
	1	3	0	2	1	4	1	2	1	1	0	4		

Strengths and weaknesses

- Comparative strengths of new model ...
  - flexibility to model ISTAR from unit to theatre levels
  - represents a wide variety of collectors on an equal basis
  - rapid preparation and runs: pilot study ran 80 cases in one day
- Comparative weaknesses …
  - simple models shift burden of modelling onto data …GIGO!
  - uniform terrain assumption
  - poor representation of time
  - poor modelling of the intelligence process

Conclusions

- New technique developed to meet changing needs
  - speed, flexibility and responsiveness
  - for equipment procurement and operational support
- Used successfully on an ISTAR capability study
  - into equipments at the unit (battalion) level
- Strengths and weaknesses common to simple models ...

[dstl]

Planned developments

- C3I enhancements to include the intelligence process
  - improving representation of NEC
- Better terrain representation
  - simple terrain areas, similar to deployment method
- Enhanced resolution of sensor capabilities
  - search rates and range-related performance
- Allowance for sensor vulnerability
  - using mean time between loss (MTBL) curves
- Aim to encompass HUMINT on comparable basis

Summary, references and questions

Summary

- A new rapid, high-level, automated ISTAR assessment tool
  - avoids drawbacks of detailed, engineering-type models
  - runs deterministically with probabilistic data
  - suited to quick capability gap analysis
- Modular design allows the six tests to be run independently
  - flexible, user-friendly, and easily verified
- Wide range of sensors and platform types
  - all assessed on an equitable basis
  - target posture included to reflect realistic battlefield scenarios
- CCIRs, terrain and meteorology reflect C2 environment and RoEs
- Potentially suitable for front-line OA use

References

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Questions?