

Developing A Requisite Analytic Trade-Space For Assessing Agile Mission Grouping



Australian Government

Department of Defence
Defence Science and
Technology Organisation



**Problem Definition For The Development
Of The DARNSTORMS Model**

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Developing A Requisite Analytic Trade-Space For Assessing Agile Mission Grouping

A series of three papers:

1. Problem Definition For The Development Of The DARNSTORMS Model
2. Theoretical Foundations of the DARNSTORMS Model
3. Approach Adopted For The Construction And Implementation Of The DARNSTORMS Model



The Agility Challenge

- UK Defence Policy is now focused on “delivering flexible forces able to configure to generate the right capability in a less predictable and more complex operational environment. This will require us to move away from simplistic platform-centric planning, to a fully “networked enabled capability” able to exploit effects-based planning and operations, using forces which are truly adaptable, capable of even greater levels of precision and rapidly deployable” (Defence White Paper, 2003)
- UK Defence Policy also assumes operating in Coalitions.



The Agility Challenge (2)

- The Australian Defence Force (ADF) similarly seeks a network centric, agile capability. In addition to recognising the key role played by information and communication technologies, the ADF places great emphasis on the role of the human operators. (*Enabling Future Warfighting: Network Centric Warfare*, 2004, Australian Defence Doctrine Publication D.3.1.)



Implications of the Agility Challenge

- **Information Age** technologies enable collaboration at a distance, inviting military to adopt **agile mission grouping**.
- **Assuming Commanders** are not willing to allow total self-organisation, they will need **agile HQ organisations** as part of the wider development of Information Age C2.
- **BUT**, the HQ agility depends upon much more than shared understanding arising from information sharing.
- **This presentation** describes how Dstl and DSTO are collaborating to show how the relevant issues might be handled by modelling



Things we know about the 'real world'

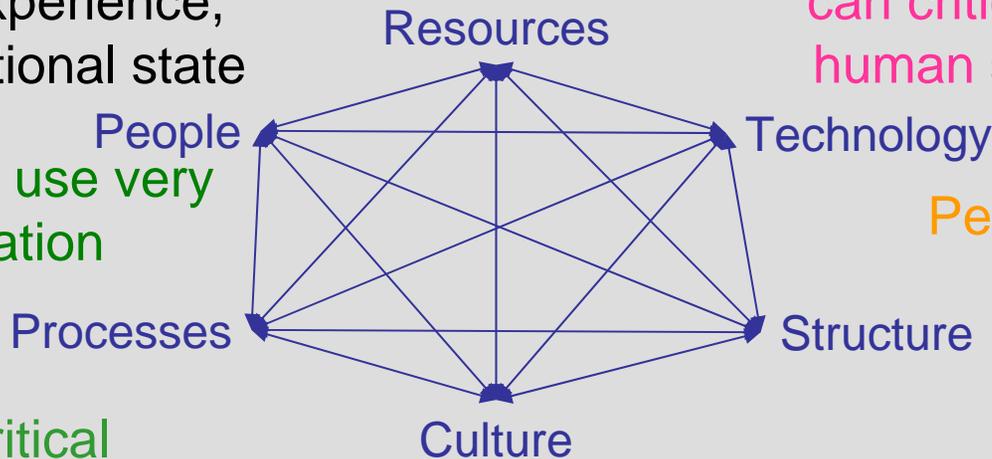
Organisation size correlates with formality of interactions

Degraded comms system performance can lead to improved information service

People process information according to their culture, experience, expectation, emotional state

Technical system performance can critically depend upon human social phenomena

Humans naturally use very little of the information available to them



People create and use informal structures, which can be more influential than the formal ones

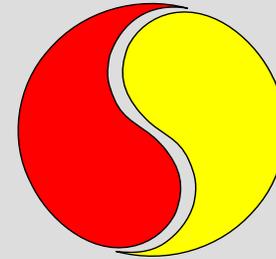
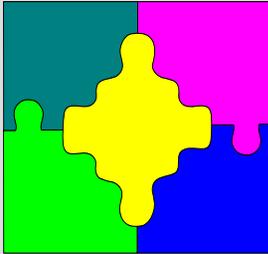
Even in safety-critical organisations, people do not consistently follow formal processes

It takes years to change an organisational culture without wholesale re-staffing

Structures emerge in organisations despite the intentions of the people involved



Modelling the 'natural core'



Formal organisation

- Purpose- and task-oriented
- Coherent goals
- Established structures
- Determined roles and rules
- Shared culture
- Coherent commitment
- Stable over time

'Natural' organisation (?)

- Social network oriented
- Multiplicity of unshared goals
- Ad hoc structures
- Emergent roles and rules
- Multiple cultures
- Varied commitment
- Adaptive over time



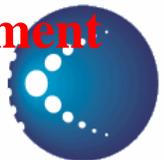
STORM

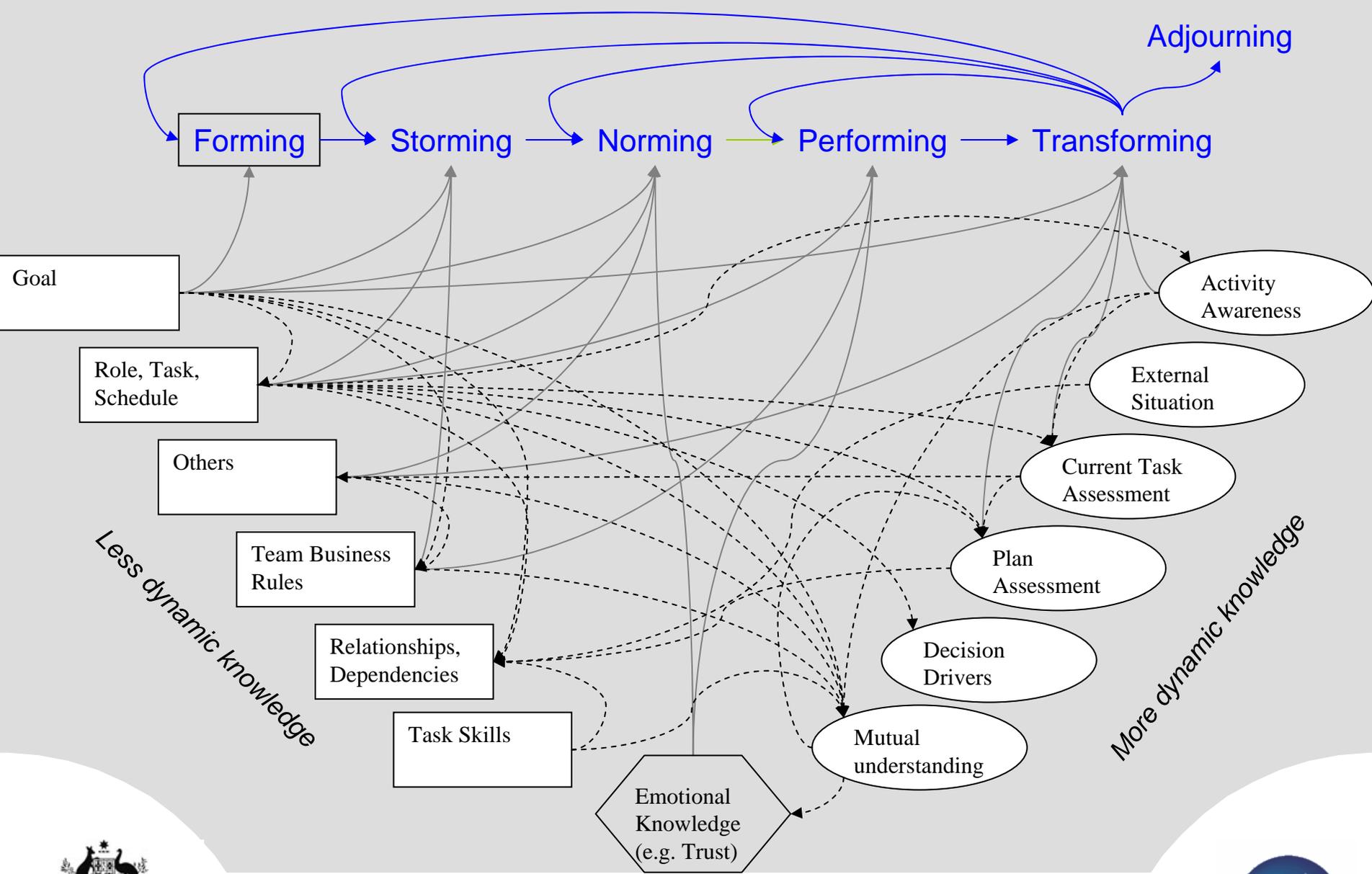
- Socio-cultural Teamworking for OR Models (STORM)
- Developed in response to a need for a model capable of dealing with agile, ad hoc team formation associated with Agile Mission Grouping
- A representation of the impacts of social and cultural factors on team performance in a coalition NEC context
- Designed to create a trade-space for multiple Lines of Development, including equipment, training, organisation
- Based on a flexible architecture covering a wide (we believe requisite) range of social and cultural phenomena relevant to military HQ operation.



STORM (2)

- Focuses on team performance based on team composition, context and maturity
- STORM is a synthesis of transactional memory & team maturity theories
- Based predominantly in 2 theories:
 - 1) Tuckman & Jenson's team maturity theory
 - 5 stage model of team maturity through the lifespan of a team: Forming, Storming, Norming, Performing & Adjourning (plus transforming).
 - 2) Noble's agent/team representation of team performance based on transactive memory theory
 - **12 Knowledge Enablers required by teams to perform effectively; 6 of which are based on team preparation, 6 on status assessment & decision making.**





DARNOS

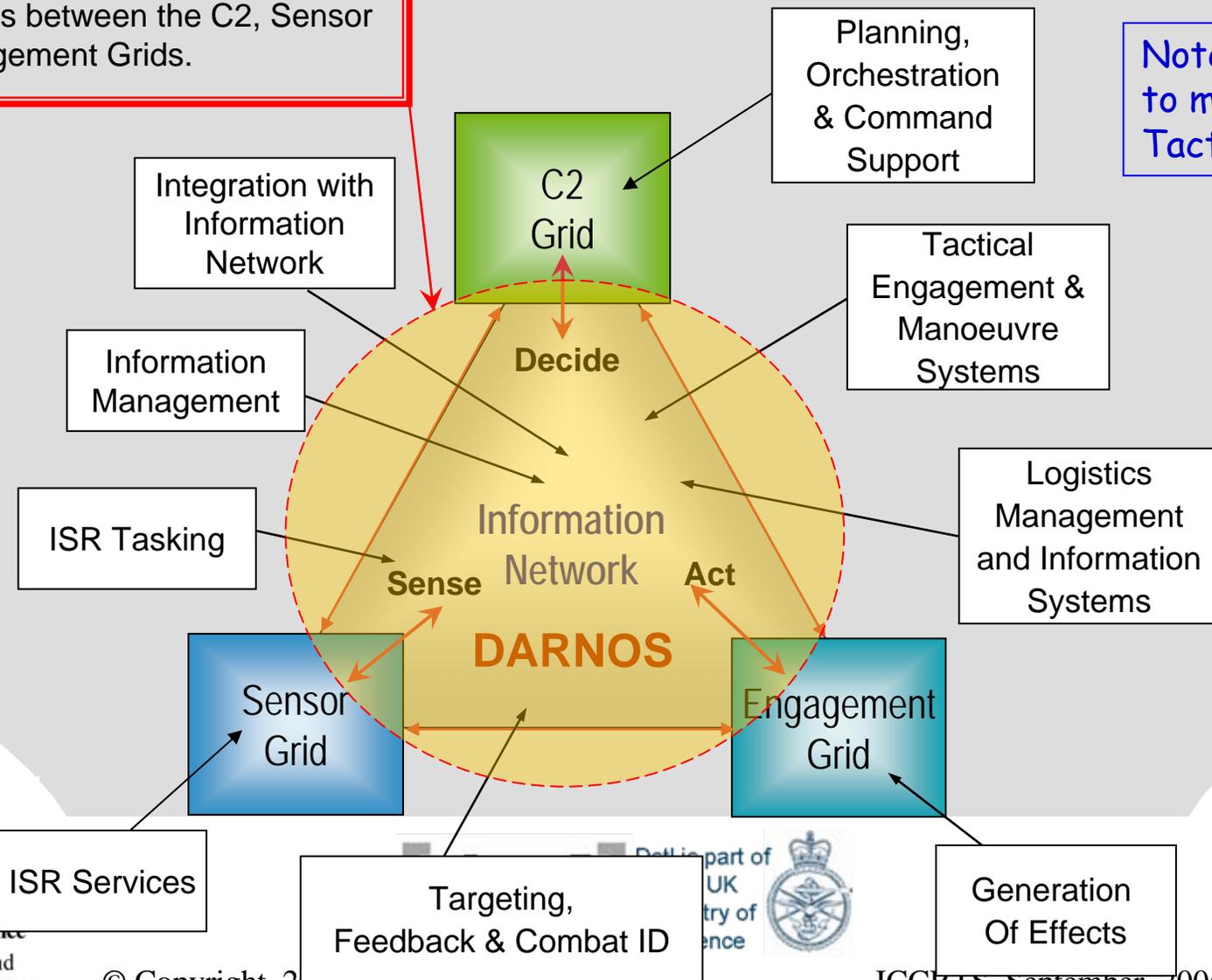
- **DARNOS uses organisation-oriented intelligent agents to model the dynamic behaviours and interactions of the players in a networked force, from C2 to information dissemination to decision-making.**
- **When DARNOS is supported by a suitable simulation infrastructure and battlespace representation (e.g. DSTO BattleModel), the combined modelling and simulation package has the highly desirable capability of being able to model a networked force's ability to successfully translate high quality information into superior decision and successful action.**



DARNOS and the NCW Grid Framework

DARNOS dynamically controls the structures of C2 and information network, and manages the dynamic interactions between the C2, Sensor and Engagement Grids.

Note Grids tend to merge at the Tactical Level.



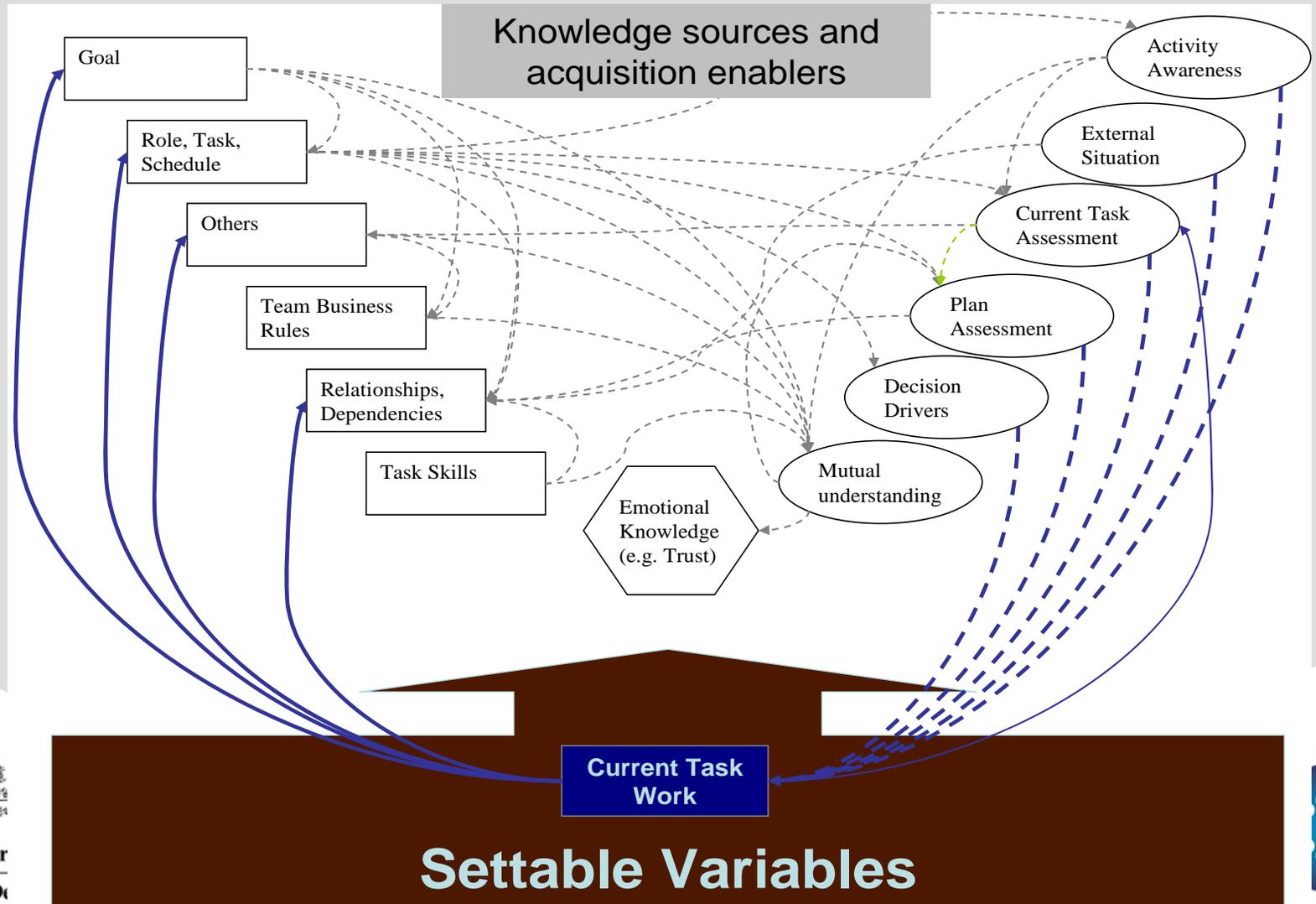
The DARNSTORMS Project

- **Background**

- Out of previous UK-AS collaboration in the area of improvement of Coalition related NEC simulation, the UK have developed the STORM algorithm, capable of representing a wide range of social and cultural variables inherent in the adaptive teamworking typically required here.
- AS have developed DARNOS, a model capable of representing agile teamforming as part of a wider network centric approach to operations.



Interaction Of STORM With DARNOS C2 Task Working Activities



Settables

- **Socio-cultural coherence**
- **Personal experience/coherence**
- **Leadership style**
- **Organisational coherence**
- **Coordination style**
- **Teamwork skills**
- **Situation brief**
- **On-task location**
- **Off-task location**
- **Adversary environment**
- **Task difficulty**
- **Task richness**
- **Goal brief**
- **Task novelty**
- **Task skills**

Personal/team coherency settables

Organisation coherency settables

**Situational
settables**

Task specific settables



The DARNSTORMS Project

- **Goals**
 - **UK goal** to demonstrate STORM algorithm is practical & effective, opening the way for wider exploitation in emerging UK simulations. Also will obtain valuable insights from DARNOS into how to represent agility in C3I assessment studies.
 - **AUS goal** to gain a key improvement in modelling capability, allowing a wider range of social & cultural issues to be addressed by DARNOS.
- **Value-added**
 - Both Dstl and DSTO have good customer support & explicit funding for this collaboration.



Enabling an integrated 'trade-space' across Defence Lines of Development

