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Joint Intelligence Model (J2M): Evaluating ISTAR Capability

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Abstract
Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) is of great importance to current and future operations; one reason is due to the increasingly asymmetric nature of modern warfare. The design of an effective ISTAR system of systems that brings together all elements of the Direction, Collection, Processing and Dissemination (DCPD) cycle is an extremely complex process. An effective ISTAR system will give the commander a better understanding of the adversary's intent and an ability to make timely, more informed decisions.

The Joint Intelligence Model is a high level stochastic simulation model of the DCPD process, developed in SIMUL8®. It is being developed by the Dstl Land Battlespace Systems Department ISTAR Systems and Capability Support Group for use on ISTAR focussed decision support studies. These studies include the DABINETT Programme and DEP's (Director Equipment Plan) ISTAR Balance of investment Implications Study (IBIS). The model will be used to assess the effectiveness of alternative ISTAR system mixes and architectures in order to provide advice both across the ISTAR programme and in support of individual ISTAR projects.

Questions J2M could address
"Which elements of the intelligence cycle require investment to significantly improve the delivery of ISTAR capability across a range of scenarios?"

"What is the required balance of investment between collection and DPD?"

"How many long range UAVs does the UK require?"

"What are the impacts of the different elements of the DABINETT project on the delivery of ISTAR Capability?"

"What factors restrict the flow of data, information and intelligence?"

"What is the effect of increasing/decreasing the number of intelligence analysts?"

Background
The aim of the ISTAR process is to provide commanders with a timely, comprehensive and accurate understanding of the adversary. The Field Army ISTAR handbook defines ISTAR as: "the coordinated acquisition, processing and dissemination of timely, accurate, relevant and assured information and intelligence which supports the planning and conduct of operations, targeting and the integration of effects and enables commanders to achieve their goals throughout the spectrum of conflict" [1].
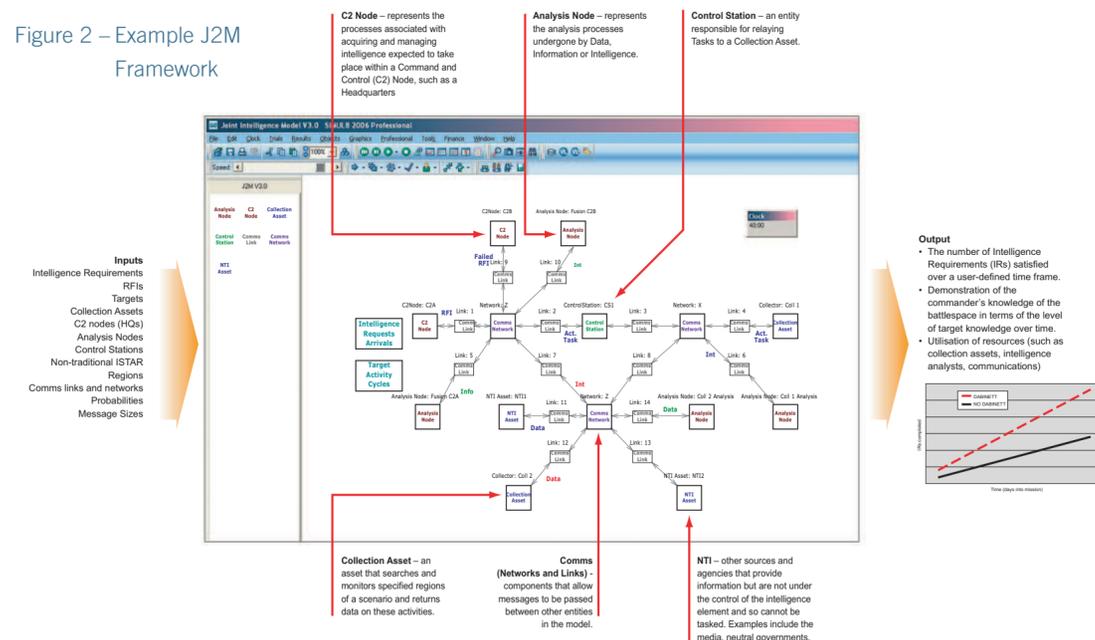
The Intelligence cycle is a structured sequence that gathers appropriate information, converts it into a relevant product and passes it to those who need it. The cycle can be considered to consist of four stages: Direction, Collection, Processing and Dissemination.

Figure 1 – The DCPD Cycle

Direction – This stage takes into account what intelligence is needed and asks the question of whether the intelligence already exists. ISTAR staff will break down prioritised Intelligence Requirements (IR) into Requests for Information (RFI) and then into tasks. If suitable intelligence is not accessible then ISTAR staff will assess what ISTAR assets are required or available to collect it. Once a suitable ISTAR asset is identified by the ISTAR staff then the instructions for the collection tasks are disseminated to the ISTAR asset. However, if intelligence already exists then it is disseminated in a timely manner to the commander.

Collection – An ISTAR asset is tasked to collect data.

Processing – The analysis of collected data to produce the requested intelligence.

Dissemination – Delivering the requested intelligence to the right person at the right time.

Why J2M is being developed?
Due to the increasingly asymmetric nature of warfare, the need for more timely and accurate intelligence is more important than ever.

Previous OA models focussed primarily on the collection element of ISTAR. Operational evidence has shown that there are significant failings within the Direction, Processing and Dissemination elements of the intelligence cycle. Hence there is significant benefit in being able to conduct analysis of all elements to advise customers on the most beneficial areas for investment. As no existing models satisfied the requirements for the IBIS or DABINETT studies, both sharing similar requirements, Dstl decided to develop a single model - J2M. The development of J2M has been supported by funding from: IBIS and DABINETT.

J2M is being developed to assess alternative architectures by demonstrating their contribution to delivering improved ISTAR capability, and hence will support customer decision-making on balancing investment within ISTAR. J2M will highlight weaknesses within the intelligence process and measure the impact of potential enhancements.

What is J2M?
J2M is a high level stochastic simulation model of the DCPD process, developed in SIMUL8®. It is being developed incrementally to allow the model to evolve as studies extend their requirements.   It enables the user to construct a range of ISTAR architectures based on formally approved scenarios. It is a data driven model and therefore allows the user to evaluate the impact of alternative architectures on the delivery of ISTAR capability.

Figure 2 (below left) shows an example J2M framework which the user constructs in SIMUL8® in order to build an ISTAR architecture. The behaviour of each component is captured using Visual Logic.

The outputs from J2M are time-based Measures of Effectiveness (MoE) which focus on the ability to deliver the required intelligence to the commanders. In addition, there are measures that allow the user to assess where the "bottlenecks" are in the architecture. Analysis undertaken using J2M will be carried out based on multiple scenarios; the scenario independent MoEs will allow results to be compared across all the scenarios being studied.

Way ahead
J2M is currently undergoing an extensive verification and validation (V&V) process in order to ensure it meets the users' requirements and is an appropriate representation of the intelligence cycle. A realistic generic scenario is being constructed within J2M. This scenario will be used to demonstrate J2M to a range of subject matter experts from across the ISTAR community in order to achieve an initial level of validation.

J2M is planned to be used by studies from October 2008.

DABINETT
DEC(ISTAR)'s DABINETT Programme aims to deliver an effective and efficient end-to-end ISTAR service, including a deep and persistent collection capability, in order to provide actionable information and intelligence (i2) to inform decision makers.

J2M will be the primary Decision Support tool: measuring the increase in ISTAR capability that the Programme will deliver, assessing alternative Programme delivery strategies, and helping to evaluate different Project options on the basis of their effectiveness.

IBIS
The aim of the ISTAR Balance of Investment Study (IBIS) is to assess the campaign-level effectiveness of potential ISTAR architectures, and their impact and dependence on the enabling information and communications systems. The architectures include all aspects of the people, processes and equipments that contribute to the intelligence cycle.

The study is using J2M to analyse the ability of such architectures to meet the Commanders' Intelligence Requirements for a number of formally approved scenarios. The outputs from J2M are then fed into high-level campaign effectiveness models.

J2M will be used to support analyses of issues such as:

• the overall ISTAR mix, process and architecture that delivers the most cost-effective capability over time;

• how the overall ISTAR system should be altered in response to changes in requirements or resources;

• the need for individual ISTAR systems.

References
[1] Field Army ISTAR handbook AC71869 (P.5)

[2] Intelligence Support to Joint Operations Joint Warfare Publication 2-00

Figure 2 – Example J2M Framework

C2 Node – represents the processes associated with acquiring and managing intelligence expected to take place within a Command and Control (C2) Node, such as a Headquarters

Analysis Node – represents the analysis processes undergone by Data, Information or Intelligence.

Control Station – an entity responsible for tasking Tasks to a Collection Asset.

Inputs
Intelligence Requirements
RFIs
Targets
Collection Assets
C2 nodes (HQs)
Analysis Nodes
Control Stations
Non-traditional ISTAR
Regions
Comms links and networks
Probabilities
Message Sizes

Output
• The number of Intelligence Requirements (IRs) satisfied over a user-defined time frame.
• Demonstration of the commander's knowledge of the battlespace in terms of the level of target knowledge over time.
• Utilisation of resources (such as collection assets, intelligence analysts, communications)

Collection Asset – an asset that searches and monitors specified regions of a scenario and returns data on these activities.

Comms (Networks and Links) - components that allow messages to be passed between other entities in the model.

NTI – other sources and agencies that provide information but are not under the control of the intelligence element and so cannot be tasked. Examples include the media, neutral governments.