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Joint Air Command Laboratory

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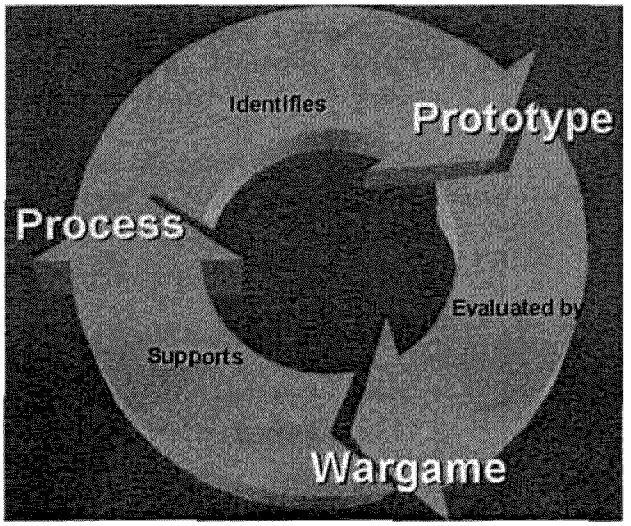
Summary: This paper will describe the concepts behind the development of the JASPA prototype, within the Joint Air Command laboratory (JACL) at DERA Malvem.

The JACL: The JACL was established in 1997 to give the customers (including the operational community) a single focus - an identity that they could turn to for information on all Air C2 issues.

The belief underpinning a great deal of the work of the JACL is that Command is about the process - it is not about technology. Technology doesn't win wars - people make decisions and people win wars.

To support this notion the work based at the JACL undergoes a cyclical nature: understand the operational process, develop the prototypes, expose the prototypes to a near real-time exercise involving operational staff, and where necessary, revise the process and prototypes.



The 3-stage process of the JACL

Military Background: Military operations today depend heavily on the C⁴ISR (Command Control, Communications, Computing, Intelligence, Surveillance and Reconnaissance) framework. This involves the collection, dissemination, processing and interpretation of large volumes of data and information. As battlefield operations become increasingly complex there is an increasing burden for commanders/operations room personnel to act as information assimilators and overseers. There is a need for a revolution in the presentation of the necessary information. This is particularly important in the context of the increasing likelihood of joint and/or combined operations, where the larger tactical picture is of fundamental importance to the operation planner and controller.

An accepted model of 'conduct' is the OODA (Observe, Orient, Decide, and Act) cycle. Previous research has tended to concentrate on the *"decide"* and *"act"* stages of this cycle. Research is required to address the *"observe"* and *"orient"* stages of the OODA cycle so that assessment of the actions (e.g. battle damage to targets, mission reports, enemy actions) can be fed into the early stages of the next cycle. For example, if a mission was launched to destroy a bridge the commander will need to know:

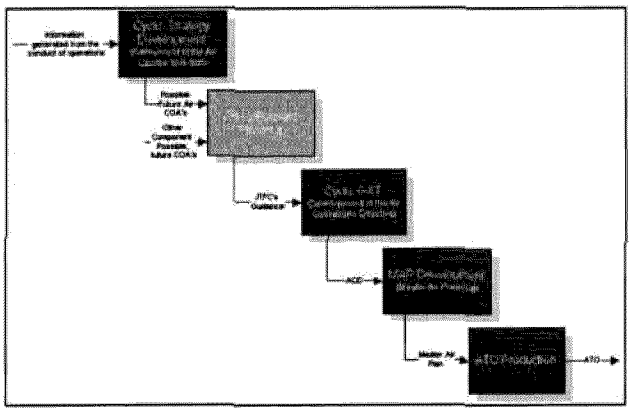
- whether the bridge was hit, and which parts of the bridge was disabled
- does the mission need to be repeated
- impacts for and against a repeat mission
- all targets missed with, with target priority/importance.

Visualisation of the battlespace will assist the battle commander to project ahead from the orientation stage to decision making. UK enemy forces currently undergo manually the OODA loop every 24 hours. There is, tlicicl'ore, an urgent need to be able to assess automatically not only the success or failure of missions, but also to monitor continuously the detail of missions and logistics in a ready and efficient manner, i.e. complete the OODA cycle in a short time.

Such rapid mission assessment would provide an advantage over the enemy for mission planning and decision making as greater visibility of the battlespace will allow the commander to optimise his own cycle and possibly allow him to make more opportunistic decisions, based upon previous actions.

The process. A technology gap was identified by consulting the models that the JACL produced in order to understand the processes used to exercise command and control of air operations in a joint environment. The diagram below depicts a "scene" extracted from the models. It illustrates the data sources used by the Strategy Cell to refine their understanding of the enemy and the tasks that they have been given to achieve: both of these together are used to develop possible courses of action for the next cycle. The development of the courses of action is an iterative process that takes input from the other components. The selected courses of action are submitted to the JFACC for his approval

Paper presented at the RTO IST Workshop on "Multimedia Visualization of Massive Military Datasets", held in Quebec, Canada, 6-9 June 2000, and published in RTO-MP-050.

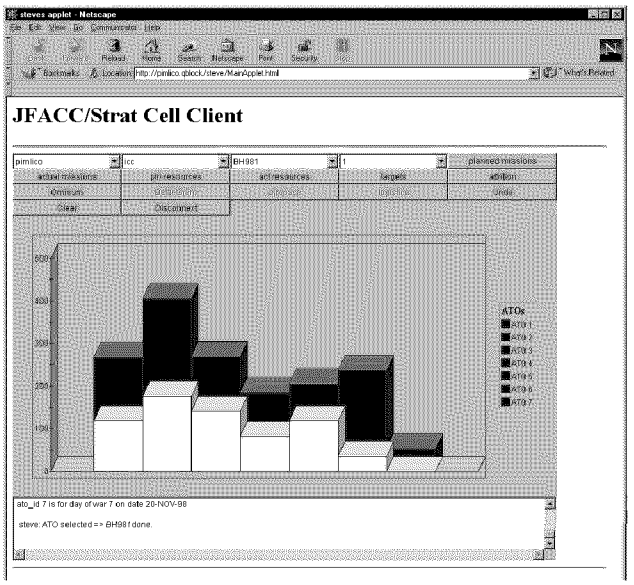


Extract from the JACL process models

JASPA: During early 1999 de-risking work was started on the visualisation of large datasets from Air Battle Planning Systems. This investigated likely technologies and methods of extracting large amounts of data from a variety of databases, processing me data and displaying the results in a user definable format by the use of a drag and drop interface. A user interface was implemented which enabled the operator to display the database data in 2-D and 3-D in a web browser; this enabled the data to be visualised on a variety of platforms and operating systems. The Figure below illustrates a method of applying data visualisation.

In this first iteration of the JASPA prototype the operator initially selects the type of data, the name of the Webserver plus the name of the database instance. A series of buttons corresponding to database SQL queries may be selected to produce a graphical representation of the data.

As the project widened its scope with interfaces to different databases and planning systems it became apparent that some method of systems to announce their presence and clients to discover what systems were available was needed



Planned missions plotted against actual missions

A distributed computing environment was developed that supported a registry lookup service; interface services were built to different systems linked in to then-database. The service once started would announce its presence on the network and register itself, clients wishing to use such a service could then locate it, and the service is uploaded to the client and is then available to perform tasks. Once the connection is made, the lookup service is not involved in any of the resulting interactions between that client and that service. The diagram below offers a representation of how this federation may operate

The initial responses from the operational community have been positive and supportive of the work. Further research is required to create flexible user interfaces, navigation tools and search methods appropriate to each type of operator and task. In addition, the tailoring of the visualisation system based on human capabilities of perception and information processing poses further challenges. With the involvement of psychologists from the Centre for Human Studies (CHS), it is intended to investigate the process of decision making from an information visualisation perspective

JiniTechnology. Jini is a set ofAPIs and network protocols, the technology is built on top of the Java application environment. It uses core Java functionality to provide a reliable, portable and simple-to-use distributed computing model, it enables networks of devices and software services to be assembled into working groups known as *federations of services* without the intervention of system administrators. The operator needs no knowledge of what services are available, or where they are located, as the list of available services is always up to date. All that the **operator** requires is a Java enabled web browser.

Discussion – Paper 9

Command in CAOC

- Joint Air Command Laboratory (Steve McQueen)
- Problems
  - Combat assessment
  - Reduce 72 hour ATO cycle
  - Distributed HCI
  - Data hiding
  - Reduce decision making cycle
  - Problems in using 2D data in 3D graph
- Approach - Process, prototype, wargame
- Notional ATO cycle
- Produced series of detailed process models
- Exercise Brilliant Force
  - Color coding to provide objective summary using dots
- UK JFHQ
  - Series of more traditional charts to show infor such as projected aircraft attrition
  - Tasked sorties
- Research
  - Campaign combat info management for future command
  - Tech infrastructure –access to distributed homogeneous data
- JASPA Visualisation
  - Customizable charts – buttons allow different information to be introduced into a 3D bar chart showing ATOs, number of sorties (planned vs actual)
  - Will be using In3D for future work
- Interested in Jini technology