



DCODE PROJECT



Decision Making Constructs in a Distributed Environment

**Improving Collaboration in Command and Control Environments:
Creating and Exchanging Iconic Tags of Key Information**

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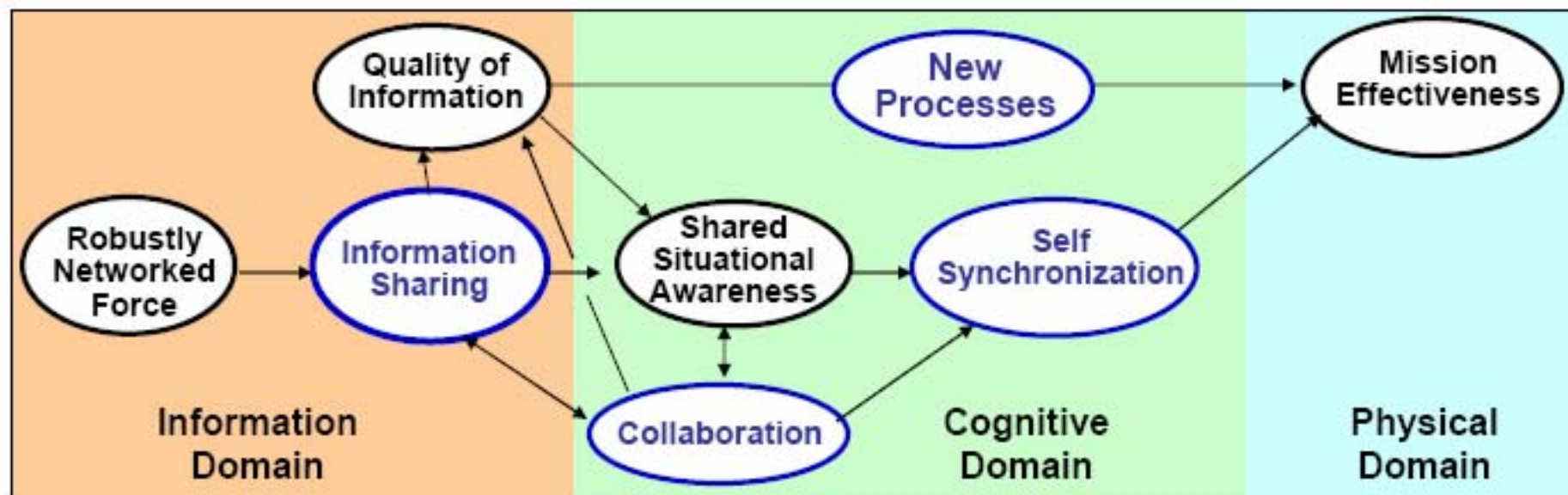
Tenets of Network Centric Warfare

...The New Value Chain



Office of Force Transformation

- A robustly networked force improves information sharing
- Information sharing and collaboration enhances the quality of information and shared situational awareness
- Shared situational awareness enables collaboration and self synchronization, and enhances sustainability and speed of command
- These in turn dramatically increase mission effectiveness





DCODE Objectives

- The DCODE objectives are to:
 - improve the ability of both individual and distributed group decision makers to evaluate, share, and integrate decision-relevant information items and
 - to improve decision time by reducing the time and effort devoted to conflict resolution and consensus building in reaching an overall group decision



DCODE



Decision Making Application Areas

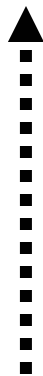
- **Information Fusion, Analysis and Situation Assessment**
- **Option Generation/Selection**
- **Course of Action (COA) Recommendations**
- **Consensus Building**

Multiple Options, Multiple Information Items About Each Option

Two Problem Areas Addressed



The most important, high impact items



#1 How do we improve the process of getting to here...

#2 How do we form an aggregate opinion from conflicting inputs.

1000's of possible decision relevant information items....





Sample Decision Making Task

- We have spent a lot of money over the last two years on improving airport security.
- Has Airport Security significantly improved?
 - Review reports and assign an overall effect/impact score to the results:

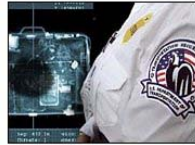
	NO!				YES!	
Definitely Not improved	☐	☐	☐	☐	☐	Definitely has improved

You search and retain 10 reports

Airport Security Gets Another 'F'

LOS ANGELES, Sept. 3, 2002

VIDEO
Screener Flunk CBS Test



(Photo: CBS/AP)

QUOTE

Screener in Atlanta and Washington US airport security under fire
CBS) In January and February, I went undercover to test security at American airports. We took lead bags, which block X-rays, through checkpoints.

Steve Elson, who used to test ch security for the Federal Aviation Administration, helped us with it

"When the bag goes through the there's a big black blob," says El "They're impossible to miss and just continually let it go."

Screener could not clearly see in our carry-ons and should have



Security on US domestic flights

By BBC News Online's St Matthews

US airline security has suff breach in history.

At least four separate tear boarded planes and hijack hours of each other.

But security experts say the terrorists had been presented with virtually an open goal.

Security on US domestic flights is so relaxed that

GAO Highlights

Highlights of GAO's 1175, a report to the Committee on Transportation and Infrastructure, House of Representatives.

Why GAO Did This Study

Passenger screening is critical to the security of our nation's aviation system, particularly in the aftermath of the September 11, 2001, terrorist attacks. The Transportation Security Administration (TSA) is tasked with securing all modes of transportation, including the screening of airline passengers. TSA has not met its requirements in this regard, such as deploying more than 50,000 federal screeners at over 400 commercial airports nationwide. To determine

September 24, 2002

AIRPORT PASSENGER SCREENING

Preliminary Observations on Progress Made and Challenges Remaining

What GAO Found

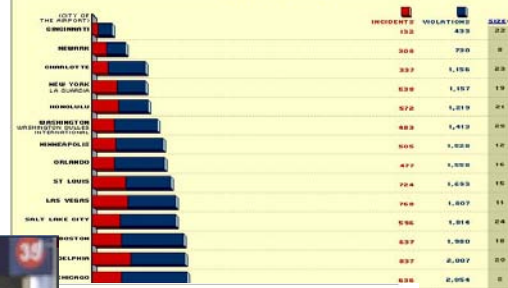
The Transportation Security Administration (TSA) was tasked with the tremendous challenge of building a large federal agency responsible for securing all modes of transportation, while simultaneously meeting ambitious deadlines to enhance the security of the nation's aviation system. Although TSA has made significant progress related to its passenger screening program, challenges remain.

TSA recognized that ongoing training of screeners on a frequent basis, and effective supervisory training, is critical to maintaining and enhancing skills. However, TSA has not fully developed or deployed recurrent or supervisory training programs. Although TSA has not yet deployed those programs, it has taken steps in establishing recurrent and supervisory training, including developing its recurrent training modules that will soon be rolled out to all



1991-2000 TOTAL AIRPORT SECURITY INCIDENTS AND VIOLATIONS

Our main chart below provides an overview of security incidents and violations reported during the past decade at the country's busiest airports. Further below, you can find a [year-by-year breakdown](#) of security breaches at the top 25 airports.



Airport Security Issues

of 11 September 2001, has made security an extremely high priority around the world. Although there has been an increase in the level the advice on this page should provide an overview of what to ng through many of the world's airports.

SPECIAL REPORT THE STERILE AIRPORT

Near-total airport security is possible. Technologies are in sight to seal the leaks, spot the bad guys, find the bombs.

by Dan Tynan

1 | 2 | 3 | 4

AIRPORT SECURITY FOR THE 9/11 AGE

Recent dummy-weapon tests at airports show it's still possible to get guns through security, here's how a super-secure airport would work.

We asked Isotec Inc., a Denver-based security systems design firm, to help us engineer an airport that would target terrorists without gumming up passenger traffic. We also sought input from CompuDyne Corp., Visage Technology, General Defense Systems, and other companies that make and install security equipment. In this exercise, money was no object; safety was our only concern.

We set a target date of five years from now. But much of the technology is available, or will be very soon. The goal: Every person, every bag, and all supplies and equipment in an airport will be tagged, tracked, and instantly locatable.

1. CHECK-IN AND SECURE ID

Initial safeguards appear a mile outside the airport. Scanners at tollbooth-like structures along access roads aim their laser scanners at

Guest Comment

On NRO

Security, Smith's Way The cyber model.

By James D. Miller, assistant professor of economics, Smith College
October 30, 2001 9:45 a.m.

Unless the marketplace to strengthen airport security. The socialistic solution of federalizing airport-security workers will deny us the creativity we need to fight terrorists. Only by utilizing the constant competition that the free market provides can we protect America's skies.

Computer networks have to endure incessant attacks from hackers. Network providers have to continually strengthen their defenses to ward off new types of assaults. Hackers have consequently increased computer security and have made the U.S. more resistant to terrorist cyber-attacks. Computer security is not provided by the government, but rather by a marketplace that punishes any firm that can't protect its electronic assets. America's airplanes should be protected by a similar free market approach.

JRI

Canadian

Authority (1 to open four ively conduct ed in Edm



Illustration by Jameson Simpson

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Background:

- Research has shown that in a group decision making environment, members usually discount any uniquely held information that gets shared with the group.*
- This shared, uniquely held information typically does **not** impact the final decision.
 - “You can lead a group to information, but you can’t make it think.”
 - **Why is this true?**

*Stasser et al



Hypothesis

- (1) A group member already has a high cognitive burden in processing the information he has found.
- (2) Shared information from other members usually arrives in an unprocessed form:
 - “Here’s a relevant report you should read”
- (3) The new information is not integrated into the decision process because it causes too great of a cognitive burden.



Challenges

- Improve the quality of group decision making by
 - (1) enhancing the ability of each participant to **assess/evaluate** their pool of disparate information findings
 - (2) simplifying the process by which participants **share** uniquely held information
 - (3) improving the process for **integrating** this shared information into the on-going decision process and
 - (4) developing information “drill down” capabilities so that participants can quickly focus on the differing subjective assessments that are causing lack of **decision consensus**.



Approach

- Exchange processed, subjective assessment information:
 - “Read this report” vs.
 - “The originator of this report has high credibility, the information is timely, backed up by facts, is of high importance and has a strong negative effect on use of option C”
 - How do we encapsulate these subjective assessments?

Subjective conclusions from each of the reports

Vulnerabilities and Potential Improvements for the Air Cargo System: Airport Security Gets Another 'F'

What GAO Found

Numerous government and industry studies have identified vulnerabilities in the air cargo system. These vulnerabilities occur in the security of some air carriers and freight forwarders and in possible tampering with freight at various handoffs that occur from the point when cargo is shipped to the point when it is loaded onto an aircraft. As a result, weaknesses in this program could create security risks.

FAA or the TSA responsibility key remains since 1990 by this site owner.



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Yes!

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TSA recognized that ongoing effective regulatory training program. TSA has not fully training program. Although TSA has made significant progress in developing its security test program, as well as working with the industry to develop a training needs of TSA's screeners.



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1. CHECK-IN AND SECURE ID

Initial safeguards appear a mile outside the airport. Scanners at tollbooth-like structures along access roads aim their laser sensors at



Illustration by Jameson Simpson

No

Yes

Yes



What are the key Essential Elements that need to be Abstracted from an Information Item?



- Where does it **Fit**?
 - i.e. which decision criteria/factor (e.g. cost, risk, etc.)?
- How good is the information **Quality**?
 - What is the Credibility of the source?
 - How Timely is this information?
 - How much Confidence do I have in the information?
- What is the **Effect/impact** of the information on the criterion?
 - **Positive or Negative?**
 - **Strong or Weak?**
- What is the **Importance** of this item relative to other items?

DCODE Solution: Convert IMPLICIT subjective estimates into EXPLICIT estimates.



Credibility?



Effect/Impact?



Importance?



Timeliness?

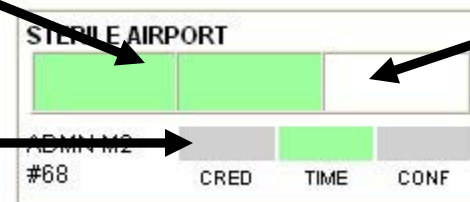


Encapsulate the scores into an icon (called an Information Object, IOB) that displays information quality, impact and importance

Effect/Impact: **Color**

Quality of information

Information **Importance:**
Size of color bar (1, 2 or 3 sections filled)



IOB



DCODE Approach

- Improve the ability of both individual and group decision makers to:
 - Abstract
 - Encapsulate
 - Assess
 - Share
- ...all decision relevant information items.

Information Tagging

The EWall program is a highly efficient method of displaying, organizing and sorting diverse information.



Critical concept is translating each information item into an EWall card, also called an Information Object (IOB)



DCODE



DCODE enhances EWall capabilities by adding the ability to:

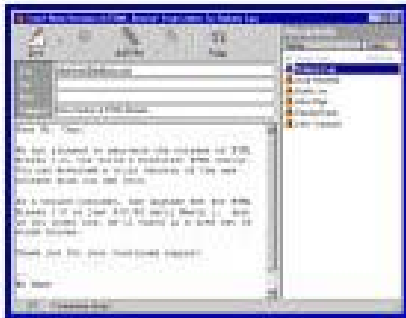
**assess, store and display a user's
cognitive interpretation of the information,**

**specifically, the impact, importance and
quality of any decision-relevant information
item**

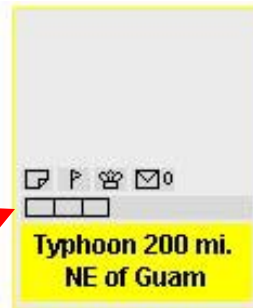
EWall & DCODE

- **EWall**: Architecture for the Abstraction, Encapsulation and Sharing of information.

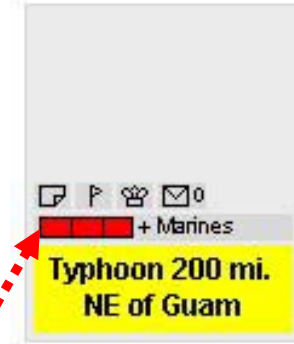
Original Document



EWall Icon



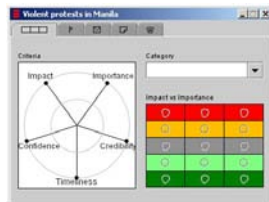
(1.5 x 2.0 in.)



Information Object (IOB)

DCODE: Process for capturing and displaying the cognitive **assessments** of each information item (“what does this mean?”)

The DCODE assessment “bar”



The DCODE assessment template



DCODE/EWALL Example



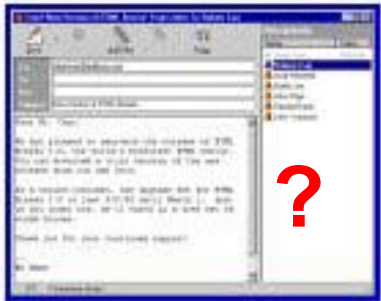
**Scenario: Rescue 3 Red Cross workers
from the Island of Drapo (insurrections)**

Options: Use SEALs, Marines or the Army

Analysts: Baker, Jones, Smith

This is Jones, looking at the viability of the Seals option

Information Abstraction, Encapsulation and Assessment



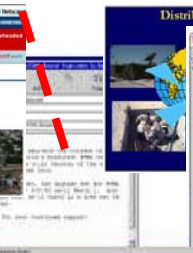
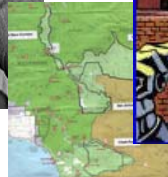
“Typhoon has serious and very negative effect on using the Seals”



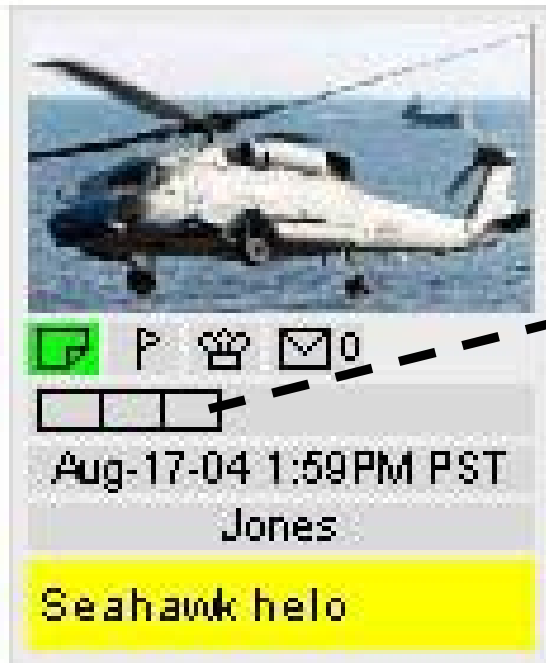
Perform DCODE assmt. on IOBs that are retained for use/sharing in final decision making. **(Assessment)**



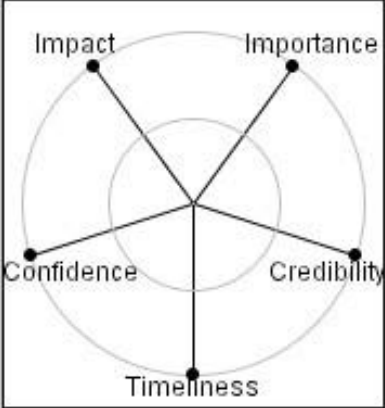
Convert candidates from original format into EWall IOBs **(Abstraction, Encapsulation)**



DCODE Assessment



Criteria



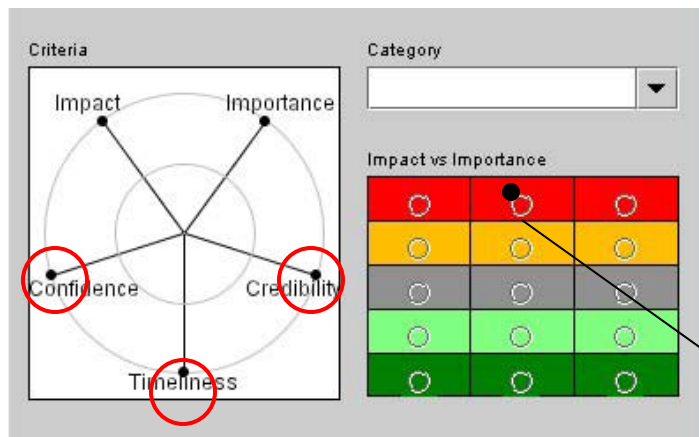
Category

Impact vs Importance

☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐

Cognitive Assessment

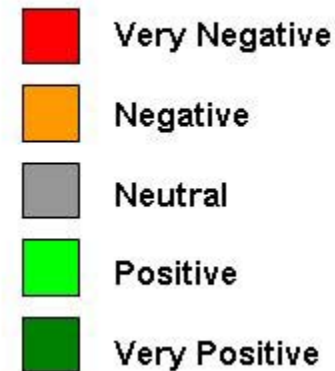
The subjective assessments of each IOB are converted into size and color coded icons.



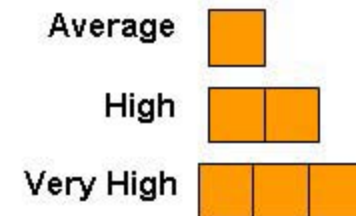
3 Slider-bar adjustments for Information Quality

Very negative impact on SEALs, High Importance

Impact on a COA



Importance



IOB Designs

IOB design can be tailored to meet specific decision making requirements.

Picture/text



Information Bar



Assessment



SEALS

Date

Aug-17-04 2:23PM PST

Author

Jones

Keyword

SH-60



Decision Team



Grouped/Sorted DCODE IOBs



Option A



Option B



Option C

Analyst(s)



Evaluated (DCODE) IOBs

The local police force in Manila is staying loyal to the govt despite
P P P
PI evoc
Local police stay loyal to govt

"swift and harse punishment" was the term used by President Malaga
P P P
PI evoc
President vows to crush rebels

Several newspapers report large scale
P P P
PI evoc
Manila residents furious over loss of water

Unconfirmed reports say that several Army
P P P
PI evoc
Reports of Army defectors to Rebels

In an unexpected move, a leading cleric for the
P P P
PI evoc
Church comes out in support of rebels

"...retain/use these items.."

Data Collector(s)



Create EWall IOBs



"...may be of interest.."

Agents, Bots, Search Engines

1000's of possible relevant information sources





IOB Sorting

Sorting/organizing of completed IOBs are used to evaluate each COA

EWall Workspace View - Jones

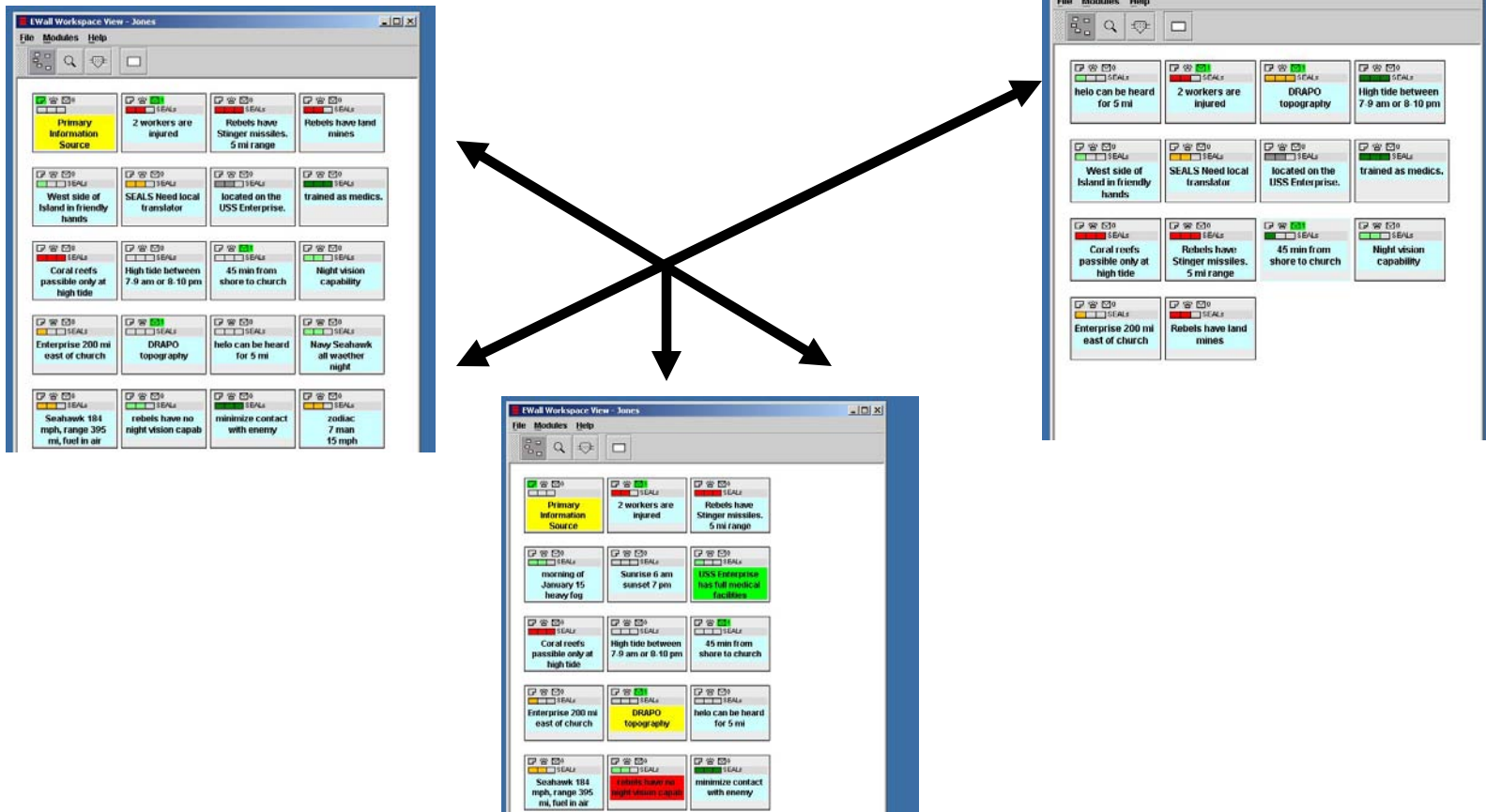
File Modules Help

Work Space

 Coral reefs possible only at high tide	 Rebels have Stinger missiles. 5 mi range	 trained as medics.	 minimize contact with enemy
 Rebels have land mines	 2 workers are injured	 SEALs are very covert	 morning of January 15 heavy fog
 High tide between 7-9 am or 8-10 pm	 SEALs Need local translator	 45 min from shore to church	 Night vision capability
 Enterprise 200 mi east of church	 zodiac 7 man 15 mph	 Navy Seahawk all weather night	 rebels have no night vision capab
		 USS Enterprise has full medical facilities	 DRAPO topography
		 Sunrise 6 am sunset 7 pm	 located on the USS Enterprise.
		 West side of Island in friendly hands	

IOB Exchange

Group participants can exchange, incorporate or modify each other's IOBs (drag & drop)

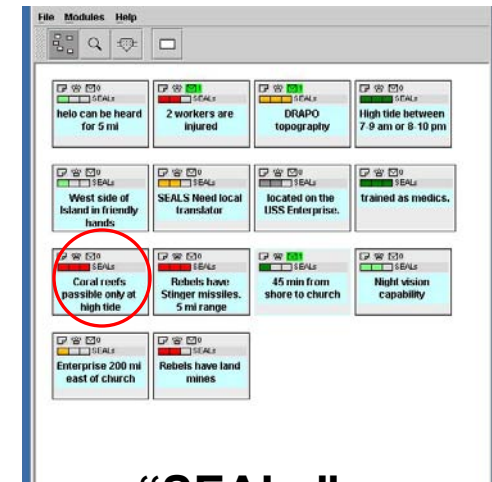


Conflict Resolution/ Consensus Building

Exchange/evaluation of the IOB pool permits focused discussion on differing COA selections and results in quicker/better group decisions.



“Marines”



“SEALs”

“SEALs”

CSU Experiment

- 36 Subjects at Colorado State
- Rank Order 3 companies in terms of a good stock investment
 - Standardized test used in other studies
- Compare decision performance of subjects who used IOB subjective assessment color bar (Effect and Importance) vs. those that did not.



Used Subjective assessment

Did not use Subjective assessment





Task

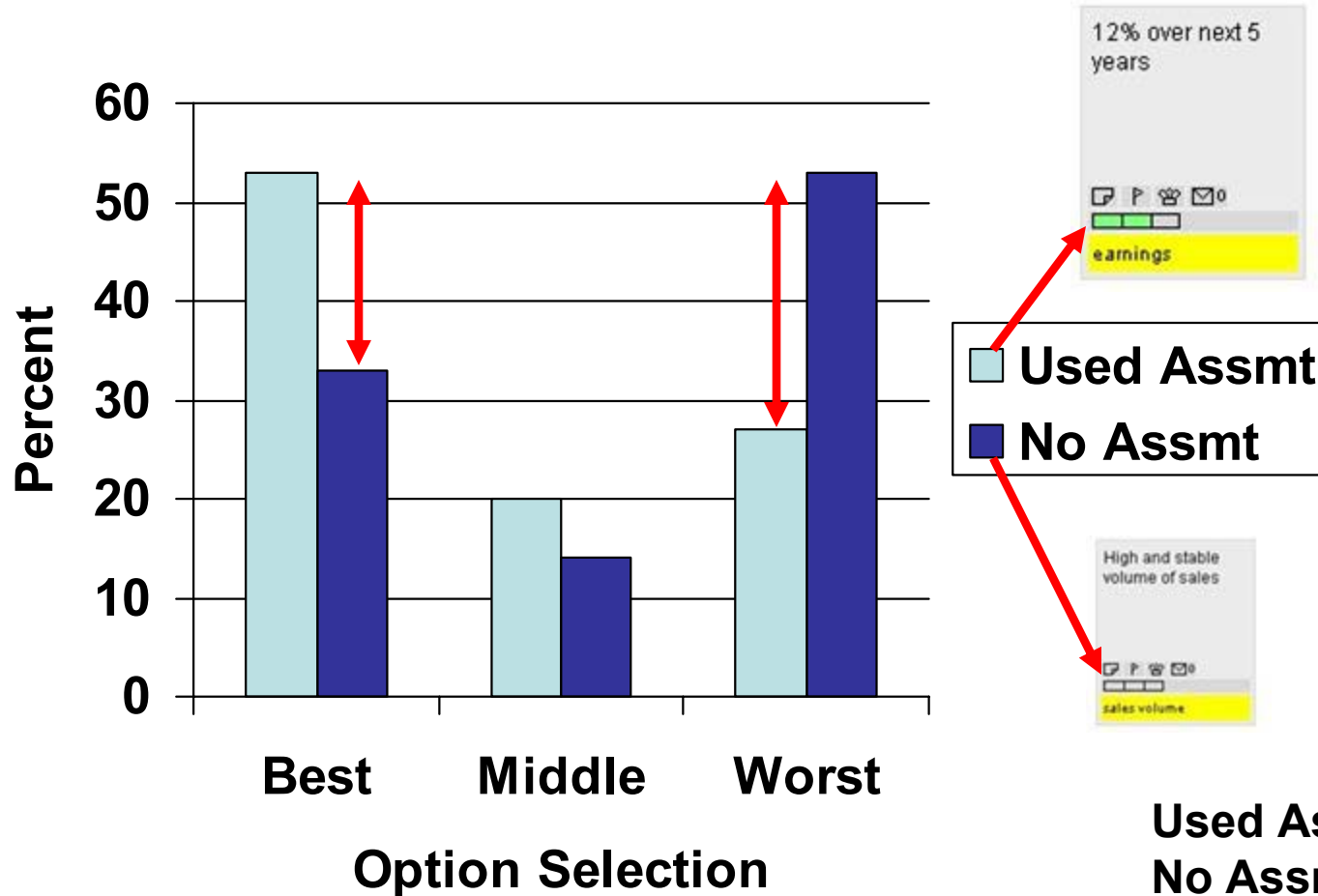
- Select the best company to invest in out of a group of three.
- Read a report about each company
 - Profits, work force, CEO, new markets, etc.
- Create IOBs about each company
 - Watched AVI videos on how to create and use IOBs and the DCODE options.
 - Creation, layout, contents, DCODE options totally under subjects control.
- Make a final Rank Ordering of the 3 companies.
- \$ incentive for best performance



Overview

- 36 subjects participated
 - 14 Females
 - 22 Males
- 15 of the subjects used the DCODE color bar option

Use of Subjective Assessments



Experiment at Colorado State



DCODE



Concept of Operations:

DCODE works with MIT's Electronic Card Wall (Ewall) Program, which provides a strong framework for the abstraction, encapsulation and sharing of decision relevant information items.

DCODE expands/enhances this capability by capturing, displaying and sharing the **subjective assessments** a team member attaches to each item. An Ewall card, with the attached DCODE assessments is referred to as an **Information Object (IOB)**

IOBs compactly display physical **data** (reference link, originator, abstract, time tag, etc.) as well as **meta data** (credibility of source, importance, option impacted, timeliness, etc). This combination of information helps individuals and teams consider the full range of pooled assessments available on a topic, and to balance the diversity of viewpoints.

The critical feature of DCODE is its ability to capture, display and share these subjective assessments.