



Quantification of subjective information assessments in C2 decision option selection

Dr. Mike Cowen
SPAWAR Systems Center, San Diego
619-553-8004
mike.cowen@navy.mil

Dr. Robert Fleming
Red-INC.
48015-2 Pine Hill Run Rd.
Lexington Park, MD 20653
bobfleming@gmail.com



BACKGROUND

- **In the past...**
 - **a major cause for a lack of consensus in a group decision making task was that all participants did not have the same information.**
- **Today...**
 - **A major cause is differing subjective assessments (importance, impact) of the same information.**
 - **Particularly true in multicultural/coalition groups**
- **Decision Making Constructs in a Distributed Environment (DCODE) is a decision support system for the elicitation, display, sharing and comparison of individual subjective information assessments.**



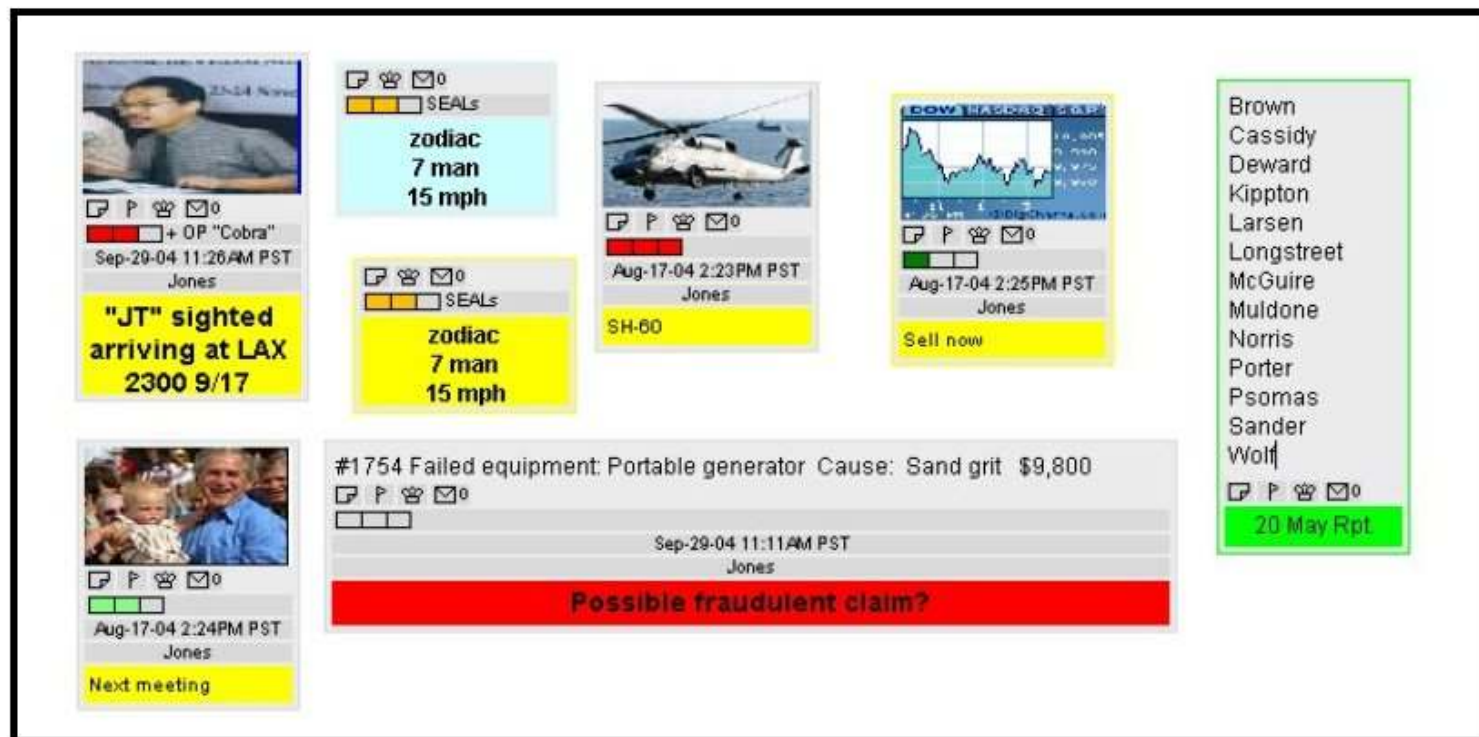
Decision Making Constructs in a Distributed Environment (DCODE)

DCODE is a component of MIT's Electronic Card Wall (EWall) project, and has been developed by SPAWAR Systems Center in San Diego.

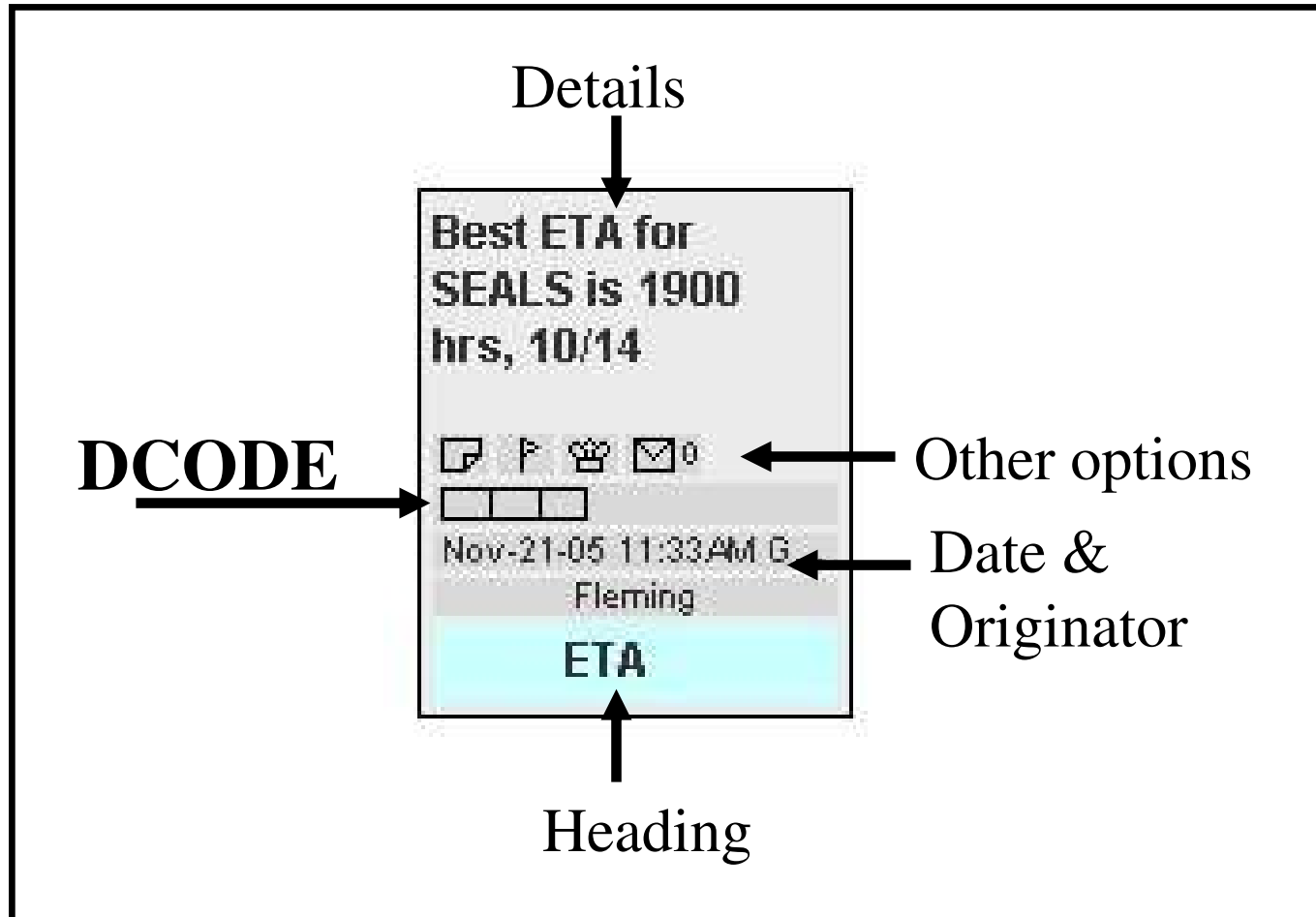
DCODE Overall Objective: the development of a decision support tool for reducing the problems involved with the storing, sharing and integration of subjective information assessments.

The use of DCODE in the quantification and sharing of these subjective assessments can improve the quality of group decision making and significantly reduce the time devoted to conflict resolution and team consensus building.

EWall cards are small iconic representations of relevant information items and include a series of information parameters. They can be configured in a variety of formats.



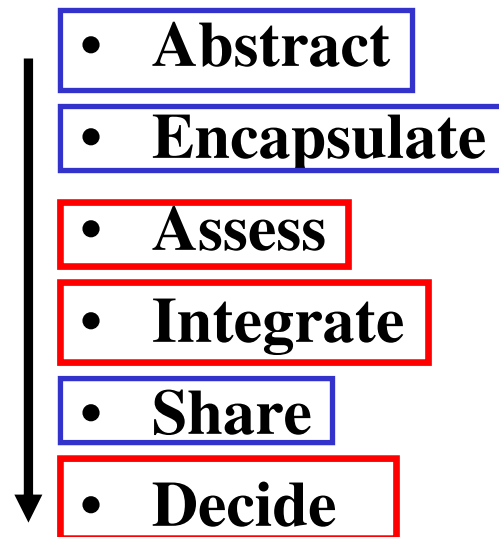
EWall Card





DCODE Process

The use of DCODE as a decision support tool involves the following sequential process for each decision relevant information item:



 EWall processes

 DCODE processes



Information Abstraction and Encapsulation

Mission: Rescue hostages from Islandia
Decision Options: Marines; SEALs; Army
Factors: Speed (ETA), Covertness, Risk, etc

CINCPAC email

To: LTCJohnson@cincpac.mil
From: steve.thomas@noaa.gov
Subject: Islandia tides and currents

Hello LTC Johnson

I have been looking at detailed marine charts of Islandia's reef system. Based on this analysis I would say that only one small section of the reef (coordinate G17) is passable, and then **only at PEAK high tide**. This will next occur at 1700 10/14. The word of caution is that the soundings are over 25 years old and may have changed (either for the better or the worse) regarding ease of crossing.

V/R
Steve Thomas

**Best ETA for
SEALS is 1900
hrs, 10/14**

☐ P ☐ ☐ ☐

☐ ☐ ☐

Nov-21-05 11:33AM G...

Fleming

ETA

**Situation Assessment:
Is Carlos still in Columbia?**

Homeland Security email

To: joseph.donovan@dea.gov
From: william.kays@omb.gov
Subject: Re: acct. activity

Mr. Donovan

Fred Barnes in Finance Tracking informs me within the last 10 days, \$27K was deposited in the referenced account (10/7) and \$25K was withdrawn on 10/9. This is unusual activity for this account

V/R
Bill Kays

Information
is abstracted,
encapsulated
but **NOT**
Assessed!

**Unusual \$ activity
in Carlos'
checking
account 10/7, 10/9**

☐ P ☐ ☐ ☐

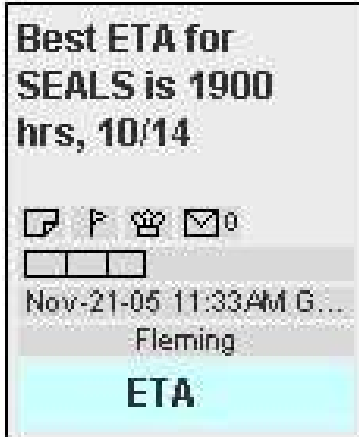
☐ ☐ ☐

Dec-19-05 9:03AM GM...

Fleming

Money Activity

DCODE Information Assessment



Which option(s) is impacted?
How is it impacted?
How important is this item?
Quality of the information?
Timely?
Credible source?
Well documented?



EWall Information Card

Information Object (IOB)

This DCODE coding
tells me that this
information ...

- Negatively impacts the viability
of the using the SEALS option.
- Is considered of high importance.
- There is some issue with the quality
of this information.

DCODE Information Assessment (cont.)

Unusual \$ activity
in Carlos'
checking account,
10/7, 10/9

☐ ☐ ☐ ☐ ☐ 0

☐ ☐ ☐ in Columbia

Money Activity

Every time Carlos has
left Columbia, there
have been large deposits
and withdrawals in his
account

Unusual \$ activity
in Carlos'
checking
account 10/7, 10/9

☐ ☐ ☐ ☐ ☐ 0

☒ ☐ in Columbia

Dec-19-03 9:03 AM

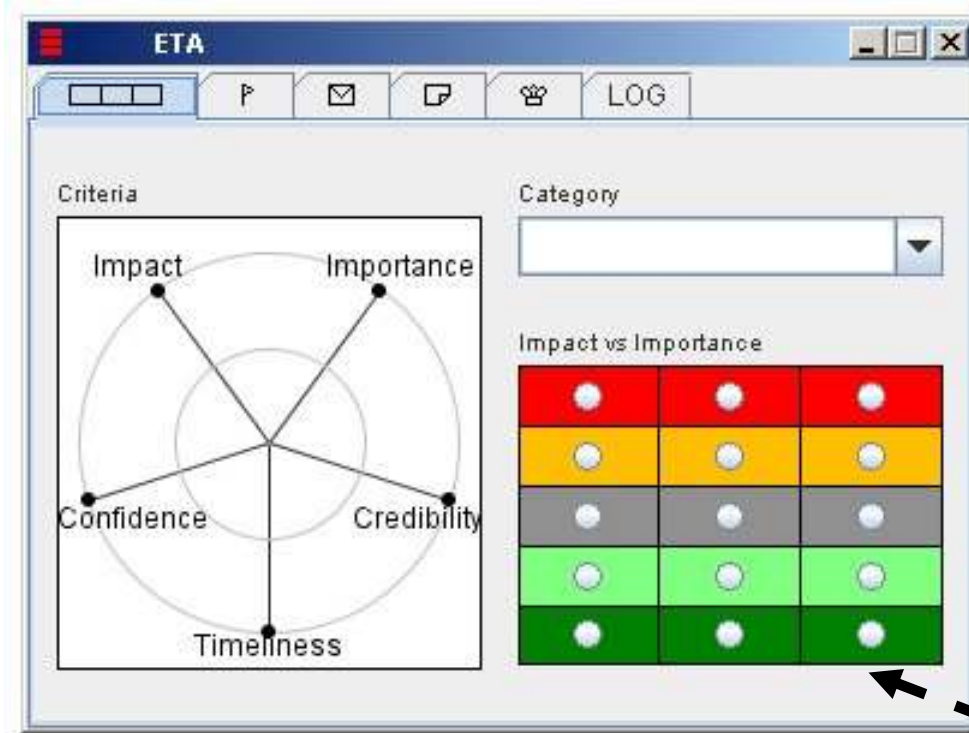
Fleming

Money Activity

This DCODE coding
tells me that this
information ...

- Very Negatively impacts the likelihood Carlos is in Columbia.
- Is considered of high importance.
- There is no question about the quality of the information.

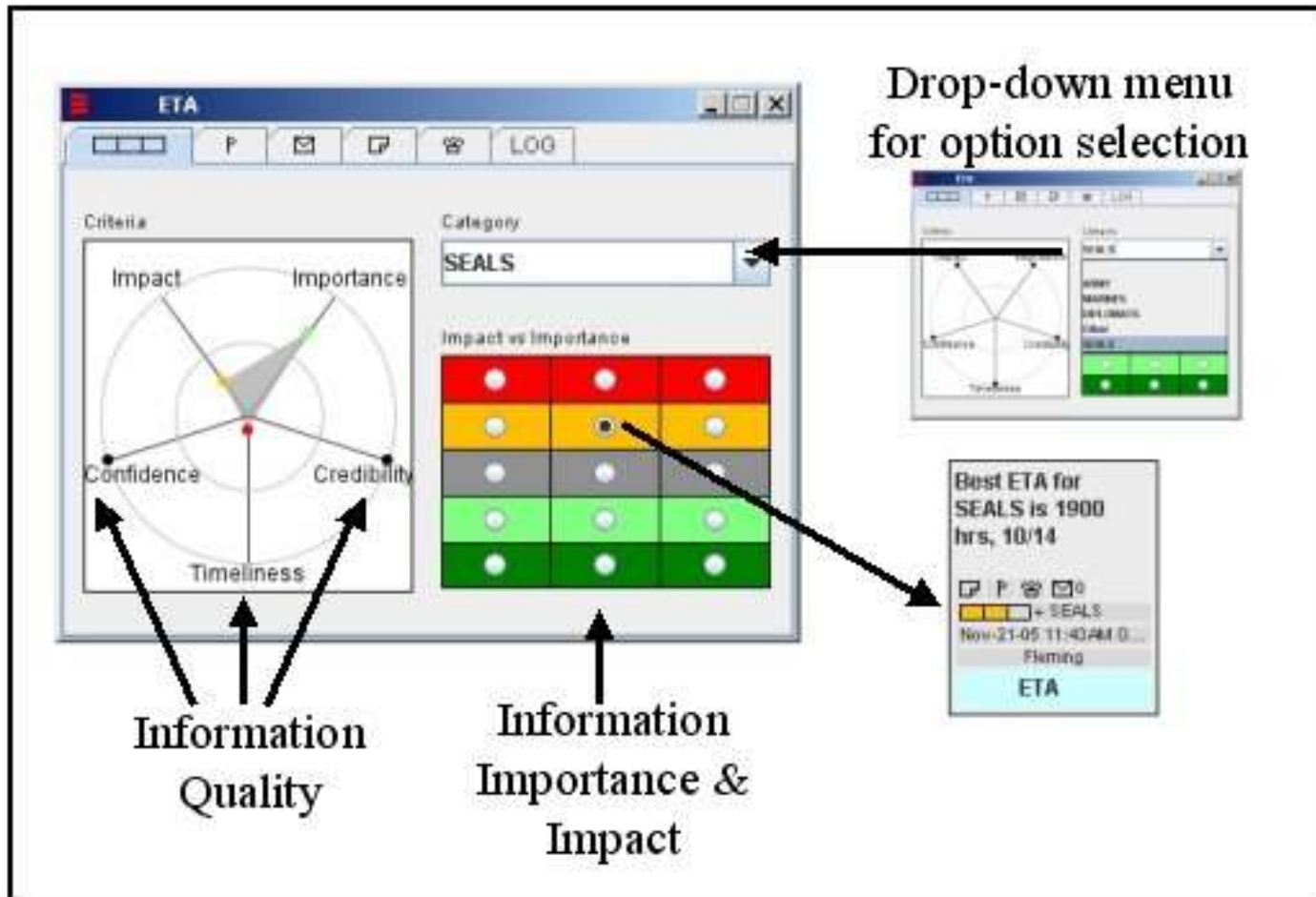
Activating the DCODE Assessment Template






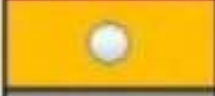

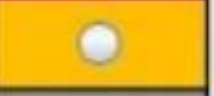
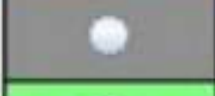
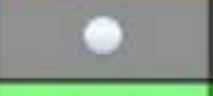
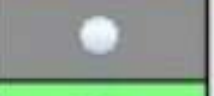
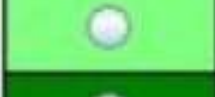
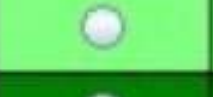
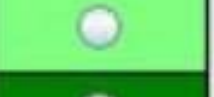



Best ETA for
SEALS is 1900
hrs, 10/14

Nov-28-05 10:45AM G...
Fleming
ETA

The Assessment Template



Scoring Impact and Importance

		Importance		
		Average	High	Very High
I M P A C T	Very Negative			
	Negative			
	Neutral			
	Positive			
	Very Positive			

Item is of “High” importance (2 boxes) and has a “Negative” impact (yellow) on this option.

IMPORTANCE (# boxes filled):

AVERAGE (1)



HIGH (2)



VERY HIGH (3)



IMPACT: (color)

Very
Positive



Positive



Negative

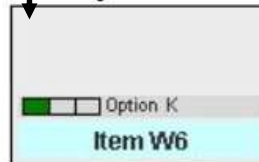


Very
Negative



Average Importance

Very Positive



High Importance

Very Positive



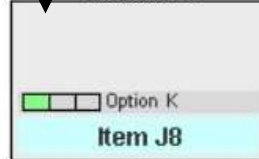
Very High Importance

Very Positive



Average Importance

Positive



High Importance

Positive



Very High Importance

Positive



Average Importance

Negative



High Importance

Negative



Very High Importance

Negative



Average Importance

Very Negative



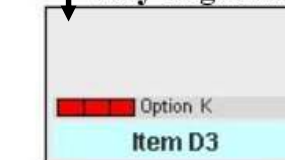
High Importance

Very Negative



Very High Importance

Very Negative



Sample DCODE Assessments

Single Option: Buy stock "A"?

Selecting a House

<p>22 min.</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Concord Blvd</p> <p>Nov-28-05 11:29AM G...</p> <p>Fleming</p> <p>Commute time</p>	<p>47 min.</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Adams St.</p> <p>Nov-28-05 11:29AM G...</p> <p>Fleming</p> <p>Commute Time</p>
<p>Parking Lot</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Concord Blvd</p> <p>Nov-28-05 11:32AM G...</p> <p>Fleming</p> <p>View</p>	<p>Shoreline</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Adams St.</p> <p>Nov-28-05 11:32AM G...</p> <p>Fleming</p> <p>View</p>

Selecting a Car

<p>9.7 mpg</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Hummer</p> <p>Nov-28-05 11:24AM G...</p> <p>Fleming</p> <p>Gas Mileage</p>	<p>28.1 MPG</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Civic</p> <p>Nov-28-05 11:27AM G...</p> <p>Fleming</p> <p>Gas Mileage</p>
---	---

Selecting a College

<p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Wisconsin</p> <p>Nov-28-05 11:33AM G...</p> <p>Fleming</p> <p>Parties</p>	<p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Utah</p> <p>Nov-28-05 11:40AM G...</p> <p>Fleming</p> <p>Parties</p>
---	--

<p>87</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Dec-1-05 10:39AM GM...</p> <p>Fleming</p> <p>P/E ratio</p>
--

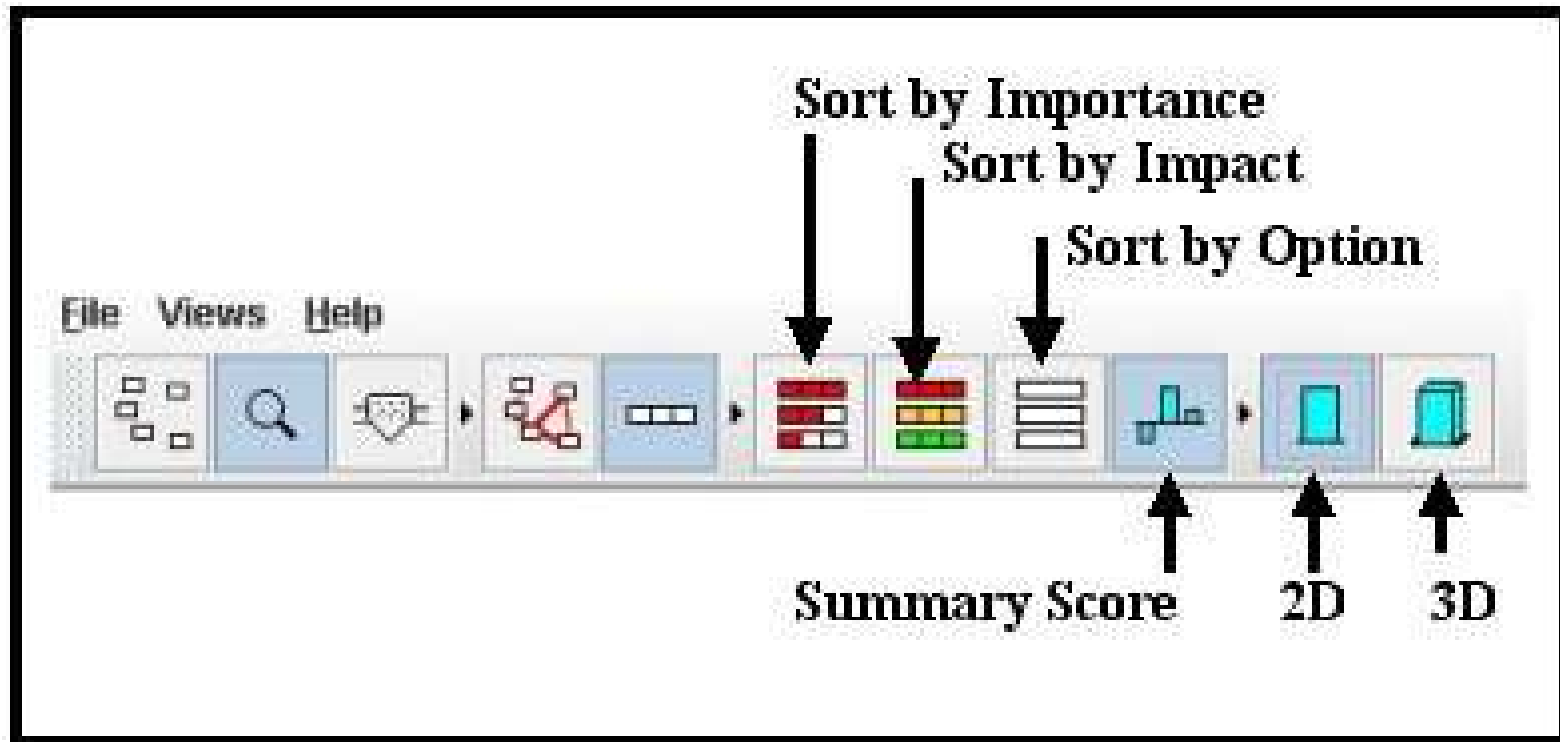
<p>7.9%</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Dec-1-05 10:39AM GM...</p> <p>Fleming</p> <p>5-yr avg. return</p>

<p>"Hold"</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 0</p> <p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Dec-1-05 10:39AM GM...</p> <p>Fleming</p> <p>Broker rating</p>
--

Which is the BEST option?

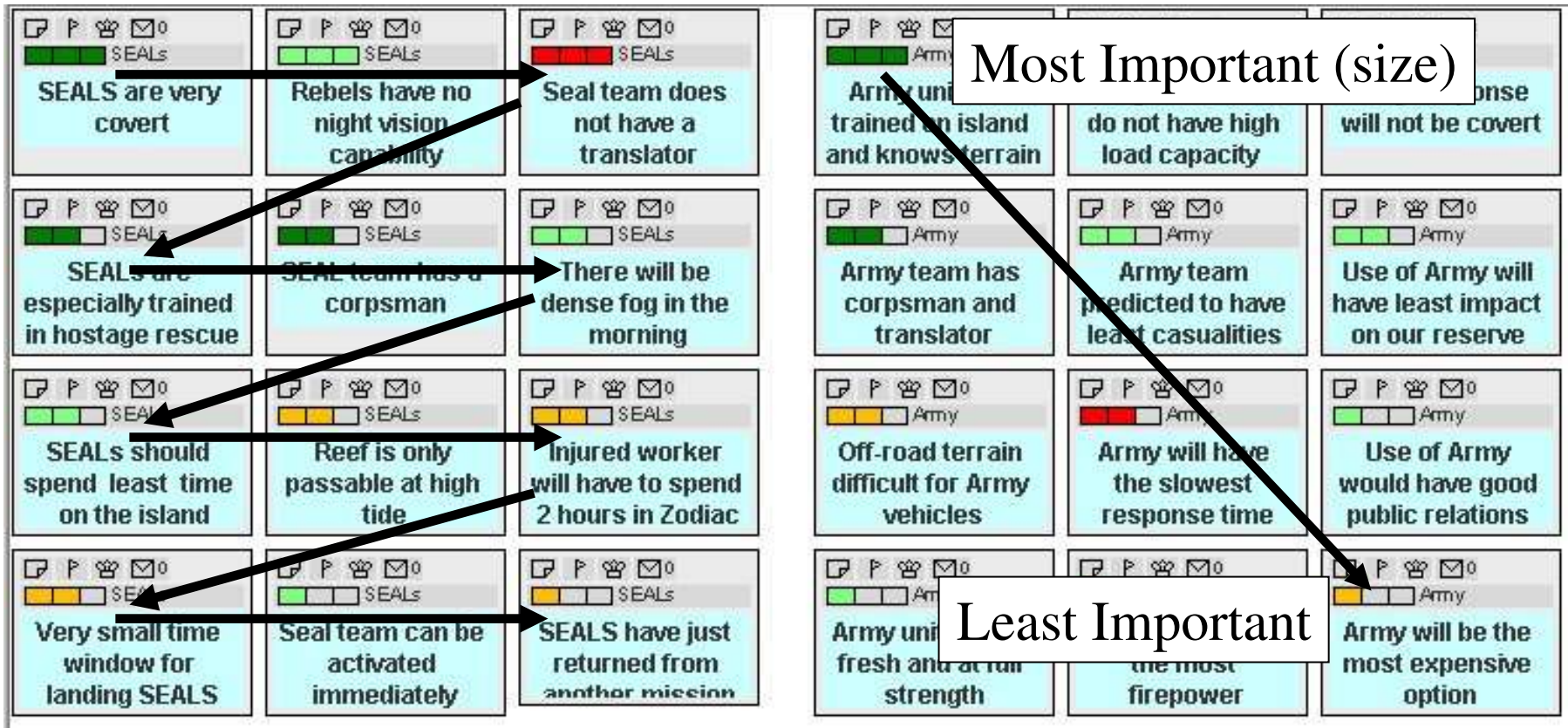
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS Rebels have no night vision capability	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS SEALS have just returned from another mission	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Bridges on roads do not have high load capacity	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army will be the most expensive option
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS SEALS are very covert	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS There will be dense fog in the morning	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army will have the most firepower	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Off-road terrain difficult for Army vehicles
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS Seal team can be activated immediately	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS Very small time window for landing SEALS	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Use of Army will have least impact on our reserve	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army team predicted to have least casualties
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS Seal team does not have a translator	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS Injured worker will have to spend 2 hours in Zodiac	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army team has corpsman and translator	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army unit has trained on island and knows terrain
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS SEALS are especially trained in hostage rescue	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS SEAL team has a corpsman	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army unit is very fresh and at full strength	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army response will not be covert
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS SEALS should spend least time on the island	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  SEALS Reef is only passable at high tide	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Army will have the slowest response time	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0  Army Use of Army would have good public relations

Integration of IOBs



Sorted by Importance:

Very High – High -- Average



Sorted by Impact:

Very Positive, Positive, Negative, Very Negative

<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS SEALS are very covert	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS SEAL team has a corpsman	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS SEALS are especially trained in hostage rescue	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Army unit trained on and knows terrain	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army translator	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Army will impact on our reserve
<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS Rebels have no night vision capability	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS There will be dense fog in the morning	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS SEALS should spend least time on the island	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Army team predicted to have least casualties	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Use of Army would have good public relations	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Army will have the most firepower
<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS Seal team can be activated immediately	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS Very small time window for landing SEALS	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS Injured worker will have to spend 2 hours in Zodiac	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Army unit is very fresh and at full strength	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Off-road terrain difficult for Army vehicles	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Army will be the most expensive option
<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS Reef is only passable at high tide	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS SEALS have just returned from another mission	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 SEALS Seal team does not have a translator	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Bridges do not have load capacity	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Most Negative	<input type="checkbox"/> P <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 0 Army Army will have the slowest response time

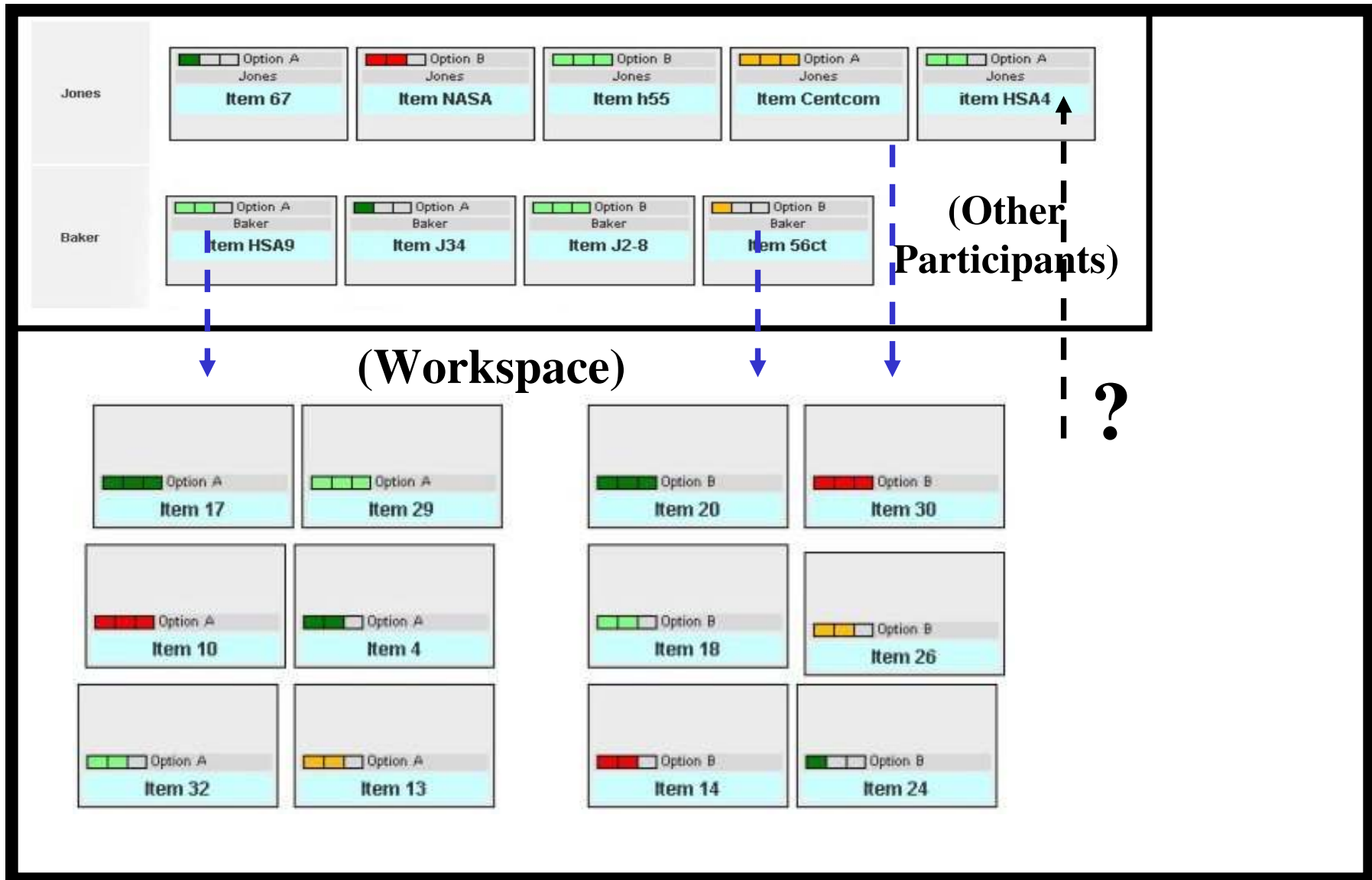
Most Positive (color)

Most Negative



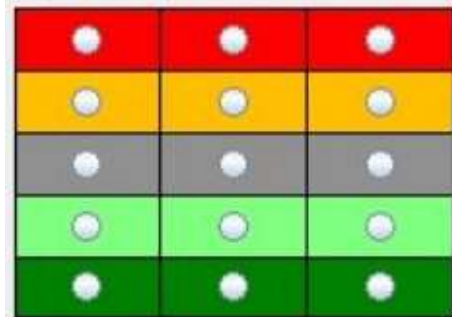
DCODE Sharing

Research & Engineering
Development, Inc. (RED-Inc)



Smith's Display (EWall workspace + Exchange view)

Making Decisions with DCODE (the weighting matrix)



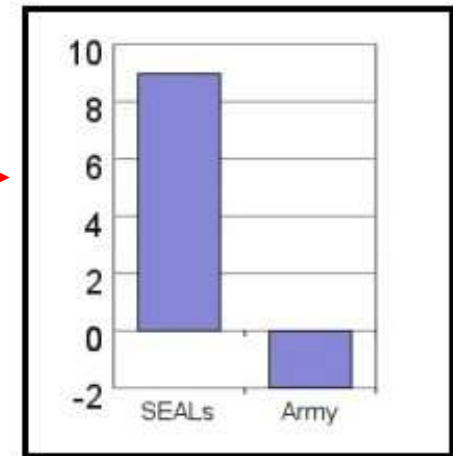
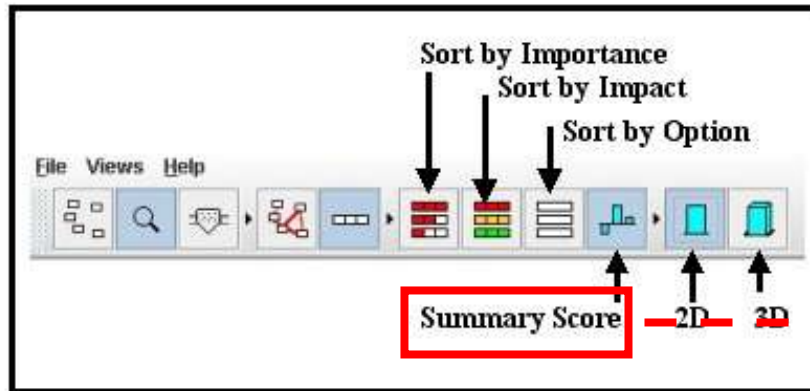
IMPORTANCE

	X	X	X
	1	2	3
-2	-2	-4	-6
-1	-1	-2	-3
1	1	2	3
2	2	4	6

Weighting Matrix



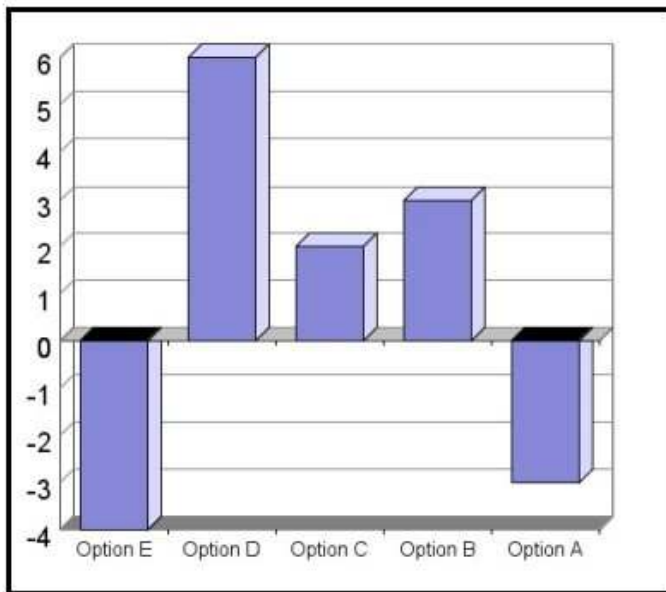
Summary Score Bar Chart



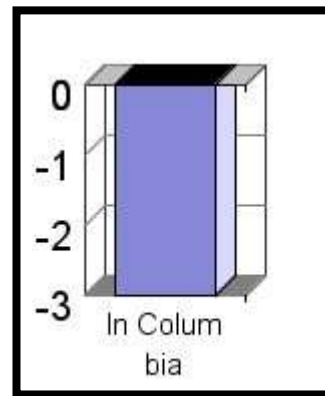
Algebraic sum
of all IOBs for
each option.

<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs SEALs are very covert	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs SEAL team has a corpsman	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs SEALs are especially trained in hostage rescue	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army unit has trained on island and knows terrain	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army team has corpsman and translator	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Use of Army will have least impact on our reserve
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs Rebels have no night vision capability	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs There will be dense fog in the morning	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs SEALs should spend least time on the island	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army team predicted to have least casualties	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Use of Army would have good public relations	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army will have the most firepower
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs Seal team can be activated immediately	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs Very small time window for landing SEALs	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs Injured worker will have to spend 2 hours in Zodiac	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army unit is very fresh and at full strength	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Off-road terrain difficult for Army vehicles	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army will be the most expensive option
<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs Reef is only passable at high tide	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs SEALs have just returned from another mission	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> SEALs Seal team does not have a translator	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Bridges on roads do not have high load capacity	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army response will not be covert	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Army Army will have the slowest response time

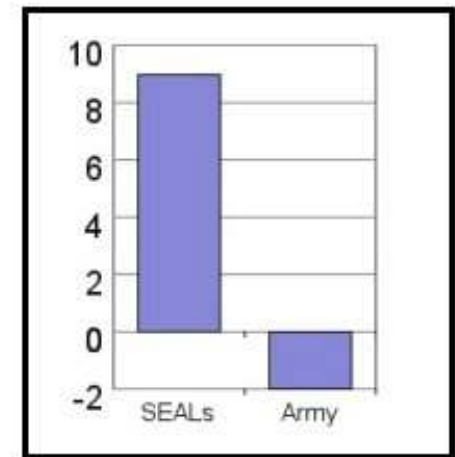
Sample DCODE Summary Results



Multiple Options



Single Option
(Yes-NO, Act-Don't Act)



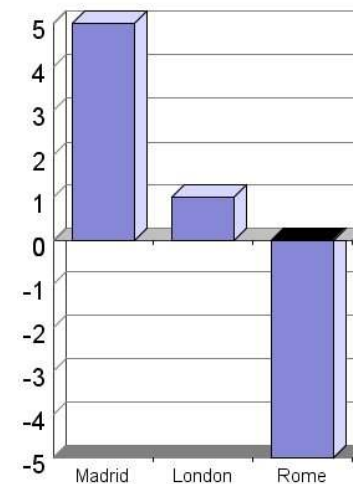
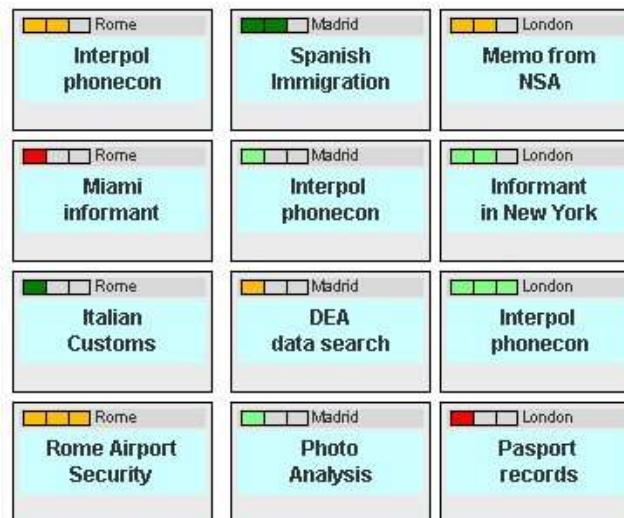
Two Options

Use of DCODE in the Intelligence Community

“Is Carlos still in Columbia?”



“Where is Carlos?”



DCODE Process

Best ETA for
SEALS is 1900
hrs, 10/14

Nov-21-05 11:33AM G...
Fleming

ETA

- Abstract
- Encapsulate

Best ETA for
SEALS is 1900
hrs, 10/14

Nov-21-05 11:43AM G...
Fleming

ETA

- Assess
- Option
- Importance
- Impact
- Quality

- Option
- Importance
- Impact

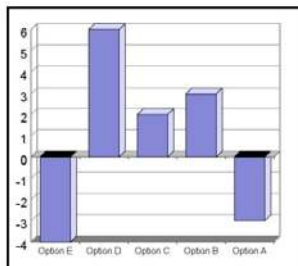
<p>Army unit has trained on island and knows terrain</p>	<p>Bridges on roads do not have high load capacity</p>	<p>Army response will not be covert</p>
<p>Army team has corpsman and translator</p>	<p>Army team predicted to have least casualties</p>	<p>Use of Army will have least impact on our reserve</p>
<p>Off road terrain difficult for Army vehicles</p>	<p>Army will have the slowest response time</p>	<p>Use of Army would have good public relations</p>
<p>Army unit is very fresh and at full strength</p>	<p>Army will have the most firepower</p>	<p>Army will be the most expensive option</p>

- Integrate/Sort

- Share

<p>Option A Jones Item 67</p>	<p>Option B Jones Item NASA</p>	<p>Option B Jones Item h55</p>	<p>Option A Jones Item Centcom</p>	<p>Option A Jones Item HSA4</p>
<p>Option A Baker Item HSA0</p>	<p>Option A Baker Item J34</p>	<p>Option B Baker Item J2-B</p>	<p>Option B Baker Item 50ct</p>	

- Decide





Recent DCODE Developments

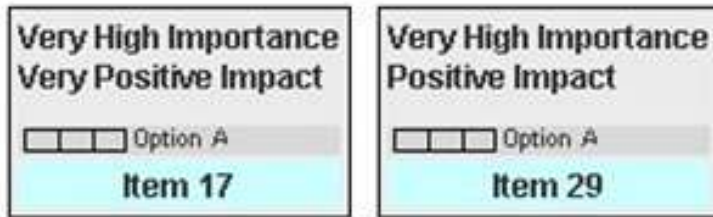


Does DCODE Work?

DCODE Experiment

- 123 College Students
- Task: Rank order three cities (A, B and C) in terms of expansion sites for a new plant
- 12 items of information about each city
- Items had been rated on importance (three levels) and impact (4 levels)
- Given 30 min. for task (most took 10-15 min.)
- Text vs DCODE COLOR coding
- Male vs Female

Text versus Color Condition



Two Text Item Examples



Color Equivalent

OPTION A		OPTION B		OPTION C	
Very High Importance Very Positive Impact Option A Item 17	Very High Importance Positive Impact Option A Item 29	Very High Importance Very Positive Impact Option B Item 28	Very High Importance Positive Impact Option B Item 19	Very High Importance Very Positive Impact Option C Item 20	Very High Importance Very Negative Impact Option C Item 30
Very High Importance Very Negative Impact Option A Item 10	High Importance Very Positive Impact Option A Item 4	Very High Importance Positive Impact Option B Item 15	High Importance Very Positive Impact Option B Item 27	High Importance Positive Impact Option C Item 18	High Importance Negative Impact Option C Item 26
High Importance Positive Impact Option A Item 32	High Importance Negative Impact Option A Item 13	High Importance Negative Impact Option B Item 12	High Importance Very Negative Impact Option B Item 23	High Importance Very Negative Impact Option C Item 14	Average Importance Very Positive Impact Option C Item 24
High Importance Negative Impact Option A Item 9	High Importance Negative Impact Option A Item 16	Average Importance Negative Impact Option B Item 8	Average Importance Negative Impact Option B Item 22	Average Importance Positive Impact Option C Item 3	Average Importance Positive Impact Option C Item 36
Average Importance Very Positive Impact Option A Item 25	Average Importance Positive Impact Option A Item 1	Average Importance Negative Impact Option B Item 5	Average Importance Negative Impact Option B Item 21	Average Importance Positive Impact Option C Item 6	Average Importance Positive Impact Option C Item 34
Average Importance Positive Impact Option A Item 7	Average Importance Negative Impact Option A Item 11	Average Importance Negative Impact Option B Item 31	Average Importance Negative Impact Option B Item 33	Average Importance Negative Impact Option C Item 2	Average Importance Very Negative Impact Option C Item 35

36 Item Display
Text Condition

OPTION A		OPTION B		OPTION C	
Option A Item 20	Option A Item 30	Option B Item 17	Option B Item 29	Option C Item 28	Option C Item 19
Option A Item 18	Option A Item 26	Option B Item 10	Option B Item 4	Option C Item 15	Option C Item 27
Option A Item 14	Option A Item 24	Option B Item 32	Option B Item 13	Option C Item 12	Option C Item 23
Option A Item 3	Option A Item 36	Option B Item 9	Option B Item 16	Option C Item 8	Option C Item 22
Option A Item 6	Option A Item 34	Option B Item 25	Option B Item 1	Option C Item 5	Option C Item 21
Option A Item 2	Option A Item 35	Option B Item 7	Option B Item 11	Option C Item 31	Option C Item 33

36 Item Display
Color Condition



Response Sheet

- Write your choice as Best option on the “100” line.
- Write your choice as Worst option on the “0” line.
- Circle the number that best represents where you would assign the remaining option.

100	<u>Option C</u>
90	
80	
70	Option A
60	
50	
40	
30	
20	
10	
0	<u>Option B</u>

Results

- Color condition had significantly fewer errors
- Color condition had significantly more people get all 3 rankings correct
- Color condition was significantly better at assigning position to the Middle rank
- Text condition had more people select the Best option—but then performed significantly worse than chance on the last two rankings
- Males had significantly more confidence in their rankings



DCODE **S**mall business **T**echnology **T**ransfer Program (**STTR**) Awarded

- N06-T025 Decision Making Constructs for a Distributed Environment (DCODE)
- OBJECTIVE: Enable quick-response knowledge interoperability in coalition operations decision making.
- PHASE I: Develop a cognitive processing-based concept, tool or methodology 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.

Three Phase I proposals accepted by ONR 6/06



More Information

- DCODE contacts:
 - bobfleming@gmail.com
 - Mike.cowen@navy.mil
- DCODE documentation, updates:
 - <http://www.dcode-onr.net/>
- EWall information:
 - Paul Keel, keel@mit.edu
- ONR Sponsor
 - Mike Letsky letskym@onr.navy.mil



**Research & Engineering
Development, Inc. (RED-Inc)**