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# Report Documentation Page

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## Relocating Vessels of Interest in Maritime Security Operations

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For the MORS Blue Water MDA WG

October 29, 2009



Defence Research and  
Development Canada

Recherche et développement  
pour la défense Canada

Canada



## Outline

- Background of Op ALTAIR and CTF 150
- Reachback request
- Development of a VOI planning tool
- Lessons learned
- Current Situation
  - Further tool deployments
  - Further development inside a larger project



## Background of Op ALTAIR

- CDN contribution to Op ENDURING FREEDOM
- Iroquois, Protecteur, and Calgary for Roto 4
- Cmdre Davidson in command of CTF 150 from Jun to Sep 2008
- Reachback request identified 2 requirements





## Request for Reach Back

- Formal request copying chain of command with deadline for initial response
- Back and forth dialogue to clarify problems with its requirement and intent
- Focus shifted to two problems
  - Arranging limited assets over a large area to best achieve mission success and MDA
  - Looking for vessels that have fallen off the Recognized Maritime Picture (RMP)
- Back and forth continued during tool design by sending the documentation for comment before final product



## **VOIR Development (VOI Reconnaissance Tool)**

- Developed as a stand alone Matlab application
- Estimate the position of a vessel based on past known location and up to 3 likely courses
- Results plotted on a geographic map that includes locations/areas of interest
- Probabilities calculated and transferred to a “heat map” for better visualization
- Various statistics calculated
- Estimated helicopter search times



# VOIR GUI

**VOIR The VOI Reconnaissance Tool 1.11.3**

**VOI Data**

Latitude (N/S)	Longitude (E/W)
Last Position (DMS) <input type="text" value="250000N"/>	<input type="text" value="0580000E"/>
Top Speed (kts) <input type="text" value="12"/>	
Last known position DTG <input type="text" value="221238ZAPR09"/>	
Analysis DTG <input type="text" value="221638ZAPR09"/>	<input type="button" value="Use Current System DTG"/>
Delay (hrs) <input type="text" value="4"/>	

**Blue Force Asset**

Display a Blue Force Position

Asset Name

Latitude (DMS N/S)

Longitude (DMS E/W)

**COA 1**

COA 1

Probability (%)

Heading (deg)  +/-

Likely Speed: Min/Max (kts)

Expected Contact Density: Min  per 100 nm<sup>2</sup>

Max  per 100 nm<sup>2</sup>

**COA 2**

COA 2

Probability (%)

Heading (deg)  +/-

Likely Speed: Min/Max (kts)

Expected Contact Density: Min  per 100 nm<sup>2</sup>

Max  per 100 nm<sup>2</sup>

**COA 3**

COA 3

Probability (%)

Heading (deg)  +/-

Likely Speed: Min/Max (kts)

Expected Contact Density: Min  per 100 nm<sup>2</sup>

Max  per 100 nm<sup>2</sup>

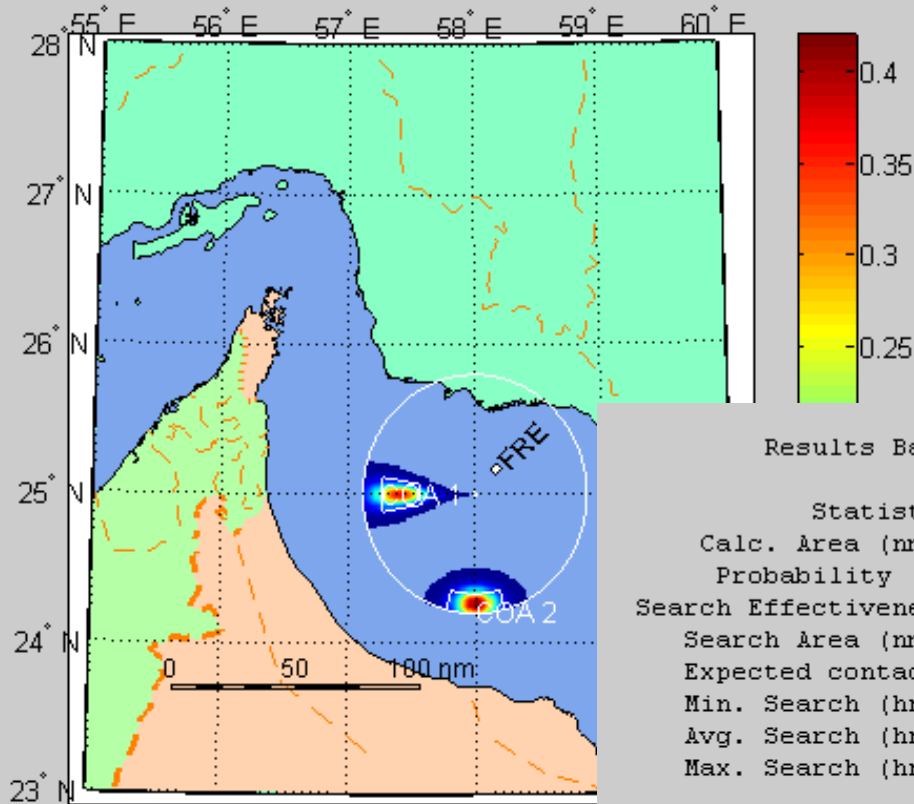
**Map Limits**

Latitude (N/S)	Longitude (E/W)
South-West (DMS) <input type="text" value="230000N"/>	<input type="text" value="0550000E"/>
North-East (DMS) <input type="text" value="280000N"/>	<input type="text" value="0600000E"/>
Grid Spacing (deg) <input type="text" value="1.0"/>	





# VOIR Output



Last Known DTG: 221238ZAP:  
 Analysis DTG: 221638ZAP:  
 Heat Map Cell Size = 1 r

## Results Based on Input Parameters (Outlined Areas)

Statistic	COA 1	COA 2	COA 3	Total	Other
Calc. Area (nm <sup>2</sup> )	178.7	184.3	NaN	363.0	6850.0
Probability (%)	33.5	40.0	NaN	73.5	26.5
Search Effectiveness	18.7	21.7	NaN	20.2	0.4
Search Area (nm <sup>2</sup> )	176.0	184.0	NaN	360.0	NaN
Expected contacts	9 - 18	9 - 18	NaN	NaN	NaN
Min. Search (hrs)	1.0	1.0	NaN	NaN	NaN
Avg. Search (hrs)	1.5	1.5	NaN	NaN	NaN
Max. Search (hrs)	2.0	2.0	NaN	NaN	NaN

## Results Based on Coloured Heat Map Areas of each COA

Statistic	COA 1	COA 2	COA 3	Total	Other
Calc. Area (nm <sup>2</sup> )	688.0	609.0	NaN	1297.0	5916.0
Probability (%)	50.0	50.0	NaN	99.9	0.1
Search Effectiveness	7.3	8.2	NaN	7.7	0.0



## Observations and Lessons Learned

- An embedded scientist is a great asset
  - Need a liaison and a military champion within
  - Need ongoing dialogue
- Keep it simple during operations
  - Limited time
  - Avoid obstacles and delays
- Follow-on work must be managed



## Positive Fleet Response

### ... But Also Room for Development ...

- Overall excellent:
  - VOIR “could be of great use”
  - “There are several advantages to using” VOIR
    - Visualization with map and color codes
    - Automated rather than manual calculations
    - Uncertainty in VOI course taken into account
    - Variable VOI speed
  - “TFAS will continue to use this tool... during this deployment”

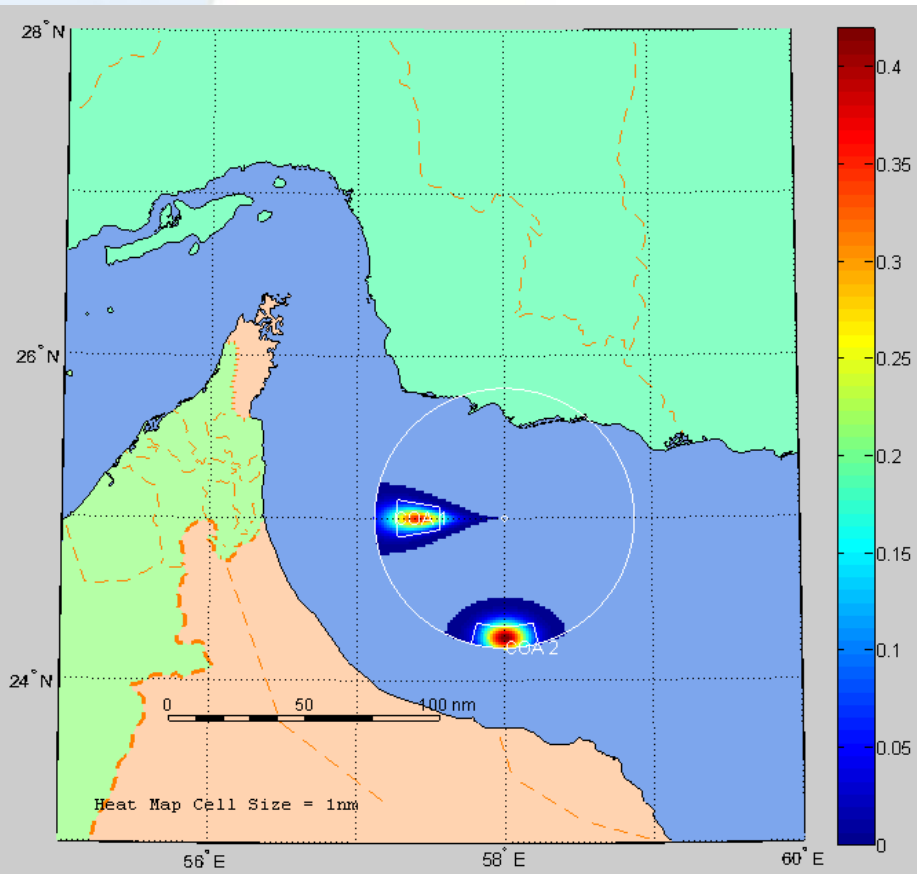


## Current Situation

- Maritime Evaluation – formal tasking process
  - Ships performing Maritime Security Operations are to evaluate VOIR and provide feedback
- VOIR 1.11 developed for WINNIPEG deployment
  - Saving/loading scenarios, improved interface, User guide
- VOIR 1.11.3 developed for FREDERICTON deployment
  - Blue Force position added
- Development of VOIR to continue within an Applied Research Project which began in April
  - Land avoidance, previously searched areas, VOI waypoints, alternate situations
  - Covers from R&D right up to operational use
- ARP also aims to:
  - develop a tool for the placement of TG assets
  - continue work on the Recognized Maritime Picture



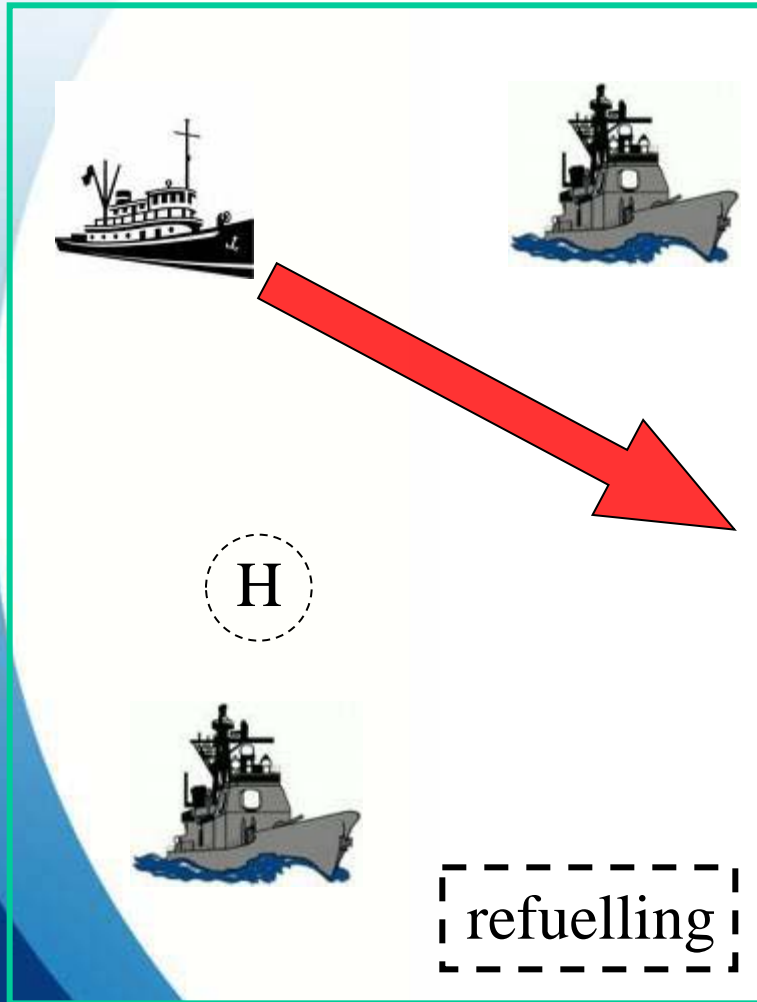
# WBE 2: VOI Planning Tool



- Locate and observe a known VOI with avail resources
- Include
  - Data constraints, e.g. possible destinations vs start points
  - PIM track estimates
  - Land and boundaries
  - Variety of surveillance assets (ships, helos, MPAs, UAVs, satellites, fixed sensors)
  - Unsuccessful searches and negative information
  - Imperfect surveillance
  - Various VOI objectives
  - Need to operate covertly
- Coordinate Training package, SOPs, etc.



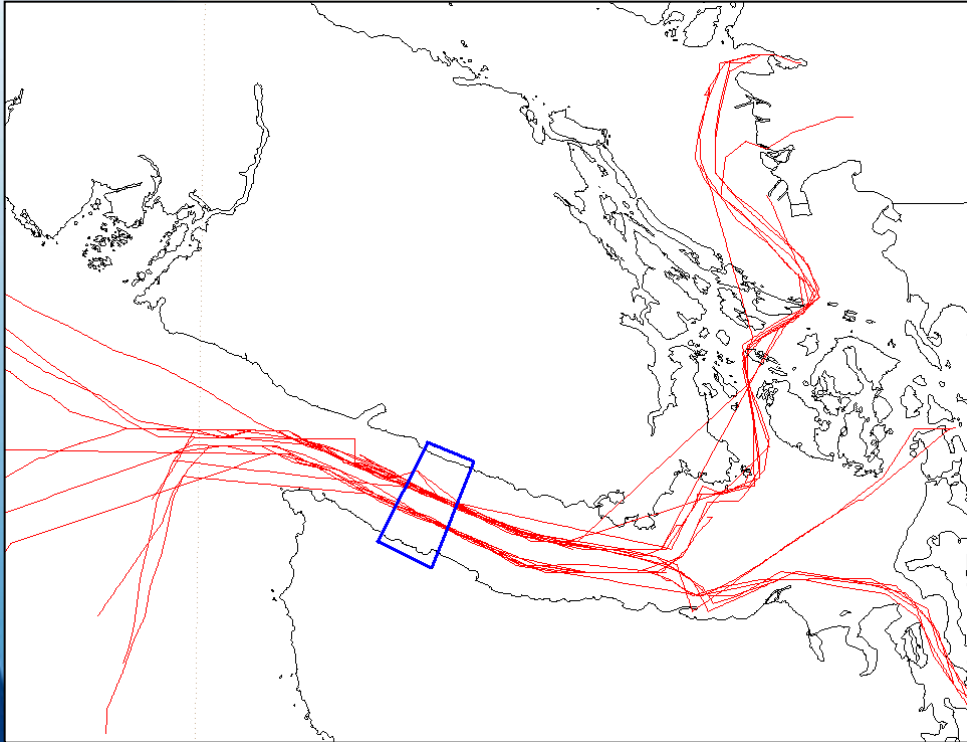
# WBE 3: Planning Tools for MDA Resource Deployment



- Plan resource deployment that achieves best chance of mission success
- Capabilities
  - Handle combinations of mission objectives & tasks
  - Dynamic to allow for planned & unscheduled changes in fleet and other asset composition
  - Balance variety of resources & their employment restrictions
  - Propose changes when current deployment is compromised
- Manage actual plan
  - Generate tasking instructions



## WBE 4: RMP Tools & Analysis



- Prototype RMP architecture and help direct the operational RMP architecture
- Further develop Prototype RMP Analysis Toolset (PRAT) & its operationalization into RAT
  - Develop or refine metrics and reports for the RMP
  - Use for TTCP AG8 analysis for Trident Warrior 09
- Analysis
  - New analyses to support clients
  - Recurring analysis from existing tools
  - Consultation to other C4ISR projects



## Summary

- Delivered a VOI Reconnaissance (VOIR) Tool to CTF 150
- Started a new Applied Research Project to:
  - Continue work on VOIR;
  - Develop an asset deployment tool; and
  - Continue work on RMP architecture and RMP Analysis Toolset
- Looking for partners with common interests in each of these three areas





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