



DSTO Perspectives

Dr Bernard Kachoyan
Head Maritime Security
Defence Science and Technology Organisation

NICTA
**Smart Transport Infrastructure
Technology Forum**
28 April 2010



DSTO on a page

DSTO is the Australian Government's lead agency charged with applying science and technology to protect and defend Australia and its national interests.

It delivers expert, impartial advice and innovative solutions for Defence and other elements of national security

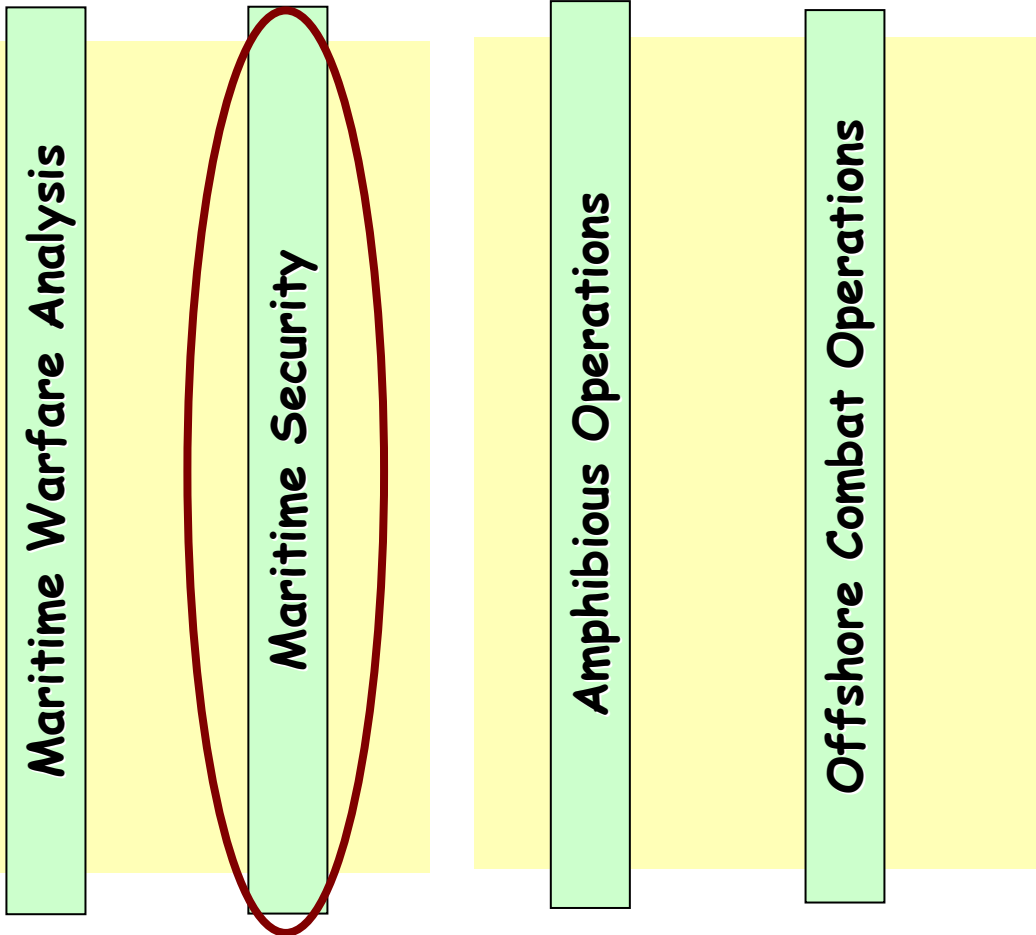


- Budget ~ \$400m
- 11 research divisions
- ~2300 staff
- 8 sites across Australia



Maritime Operations Division ATP Sydney

Operations Analysis & Concept Development



Staff Numbers:
~80-85

Facilities

- Maritime Modelling & Simulation Suite
- Underwater Measurement Systems

Technology Assessment & System Development



Challenges in Maritime Security...

- Knowing what's out there
 - or knowing what's out there that shouldn't be there
- Doing something about it – in time
 - Including deciding what to do about it

Challenges peculiar to Maritime Space

- Open/unrestricted boundaries
- Large space
 - Physical (global and local)
 - Informational
- Linking of local to the global
- Mix of legislative and responsibility regimes (from IMO to local official)
- Tough physical environment for technology

...ship protection during transit,
through littoral waters...or in
port...*must become an
integrated effort by all
agencies and **must start long
before a ship enters port***

NATO Report on Maritime Force Protection
Nov 07

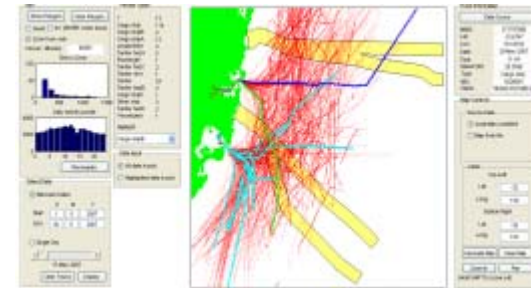
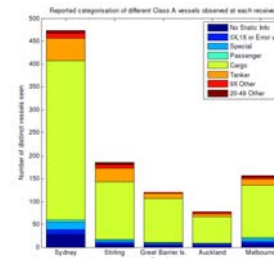
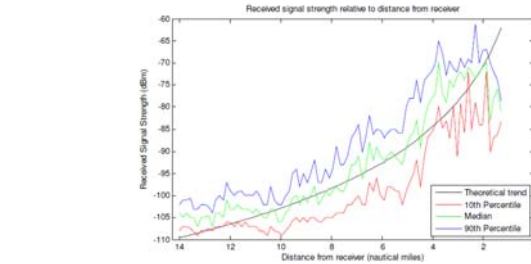
...3Ps : People, Process, Product



DSTO Automatic Identification System (AIS) Network and Analysis

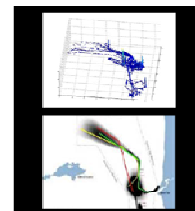
Aims

- Ownership of research quality unclassified data for analysis and development of analysis techniques
- A network of sensitive receivers collecting AIS messages and data
- A infrastructure to store and query large complete AIS datasets
- Supporting National AIS and Defence

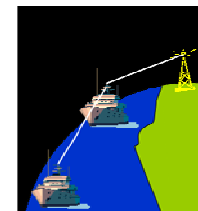


Issues

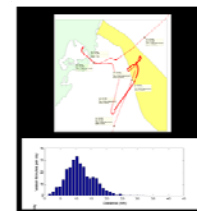
- Verification of AIS data (precision \neq accuracy)
- Data rich environment - information management, data storage, retrieval and parsing issues
- Statistical analysis – data and vessel patterns
- Characterisation of range/propagation of AIS
- AIS-B interference with AIS
- Fusion with other data/information
- Stationing of coastal stations
- Over-the-AIS-Horizon monitoring
- Satellite vs terrestrial AIS



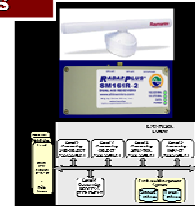
Pattern Analysis



OTH Monitoring



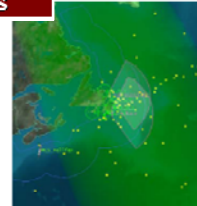
Maritime Sec. Analysis



Information Fusion



Signal Propagation

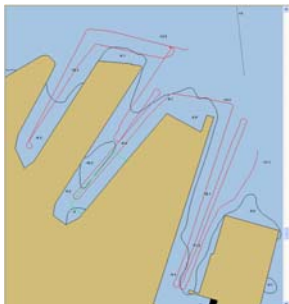


Satellite AIS



Autonomous Vehicles Research

- Underwater vehicles relatively mature, surface vehicles less so
- Navigate autonomously based on pre-scripted path plan
- Requires GPS or accurate INS
- Issues
 - Knowledge of own dynamics or environment
 - Feedback control to dynamics
 - Collision avoidance
 - System of systems



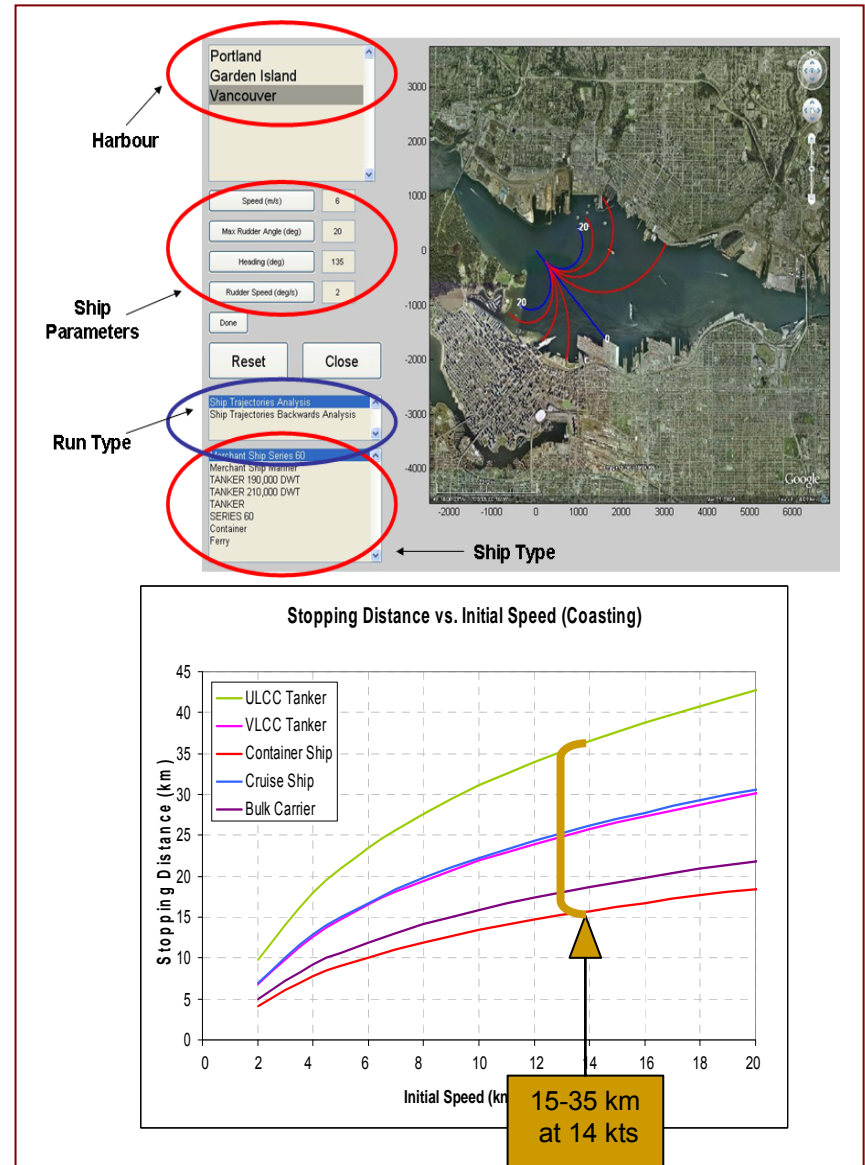
Naval Postgraduate School (NPS) - USA





Ship Dynamics Modelling

- What parts of the harbour are vulnerable to various ship classes?
- Conversely, where can the potential threats to specific locations come from?
- DSTO developed generic manoeuvrability models to answer these “what-if” questions
 - Only needs basic bulk quantities of vessel in question
 - Validated as fit-for-purpose against detailed data
- Answers can be used for location of barriers, choke points etc
- But could also be useful for incorporation into smart navigation tools





Video analytics / intelligent video

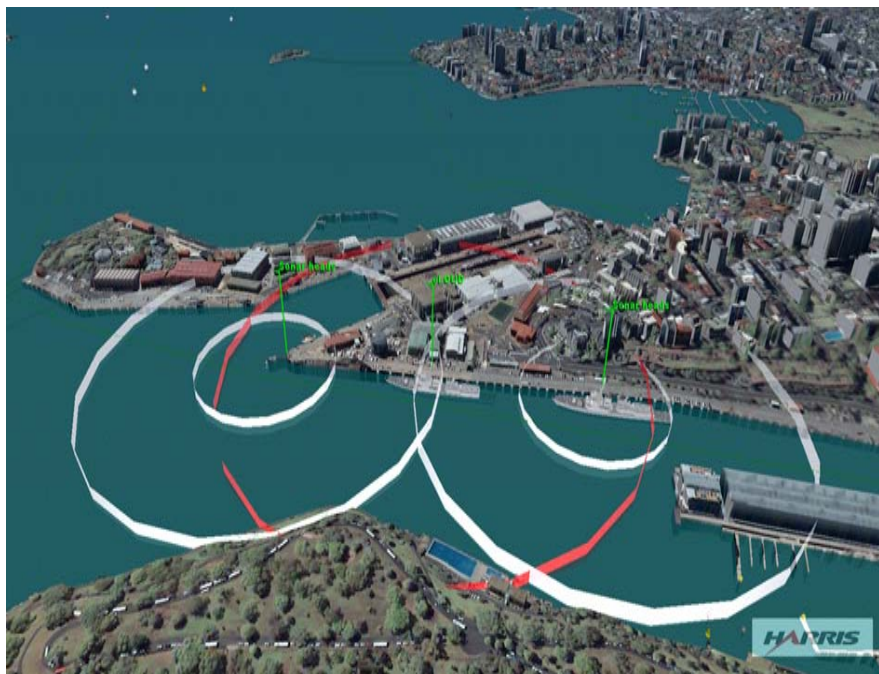
- Optics (visual/IR) crucial in security applications, but has been restricted to post event reconstruction
 - Human factors
 - Attention spans
 - Multiple inputs
 - Data vs information
- Video analytics automatically detects objects of interest and provides security alerts
 - generally based on inappropriate location or behaviours
- Key Issues
 - Waterside environment difficult for video analytics
 - Detection and identification in a single sensor
 - Training/ time to optimally set up & maintain system
 - Solution architecture
 - Interaction with human factors
 - Integration with other technologies
 - Integration of multiple systems
 - 1 FA/day per camera = 1 FA per 6 min for 240 cameras
 - 360 deg cameras vs fixed vs PTZ?
- Several companies working on this, DSTO supporting NICTA PhD in the maritime area





3D technology and embedded video

- Ease human cognitive load
- Asset placement in complex dynamic environment
- Training/virtual exercises





Summary



- Maritime Security a partnership of People, Processes and Products
- High leveraging of Defence & non-Defence
- Combination of mature and non-mature technologies into a system
- Problematic areas:
 - Human factors
 - Cost-effectiveness
 - Systems analysis
 - Multi-agency interaction
- Try before you buy – test-beds / visualisation / T&E for finalising concepts and choosing solutions



Maritime Security Program

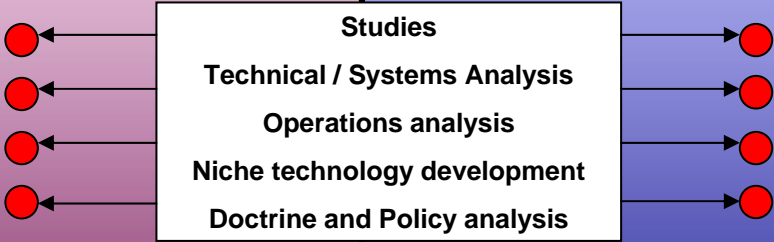
Mission
 Maritime Security Group solves problems and enhances decision making in Maritime Force Protection and Maritime National Security through the conduct and co-ordination of research, analysis, and experimentation

Maritime Force Protection

In-harbour protection
 Counter-FIAC defence
 Maritime Interdiction Operations

Maritime National Security

Surveillance and Response
 Maritime Domain Awareness
 Critical Infrastructure Protection



Operations Research, Capability Analysis, Modelling and Simulation; Operations Analysis; Experimentation and gaming; Specialist technologies; Legal Analysis