Australian Government
Department of Defence
Defence Science and
Technology Organisation

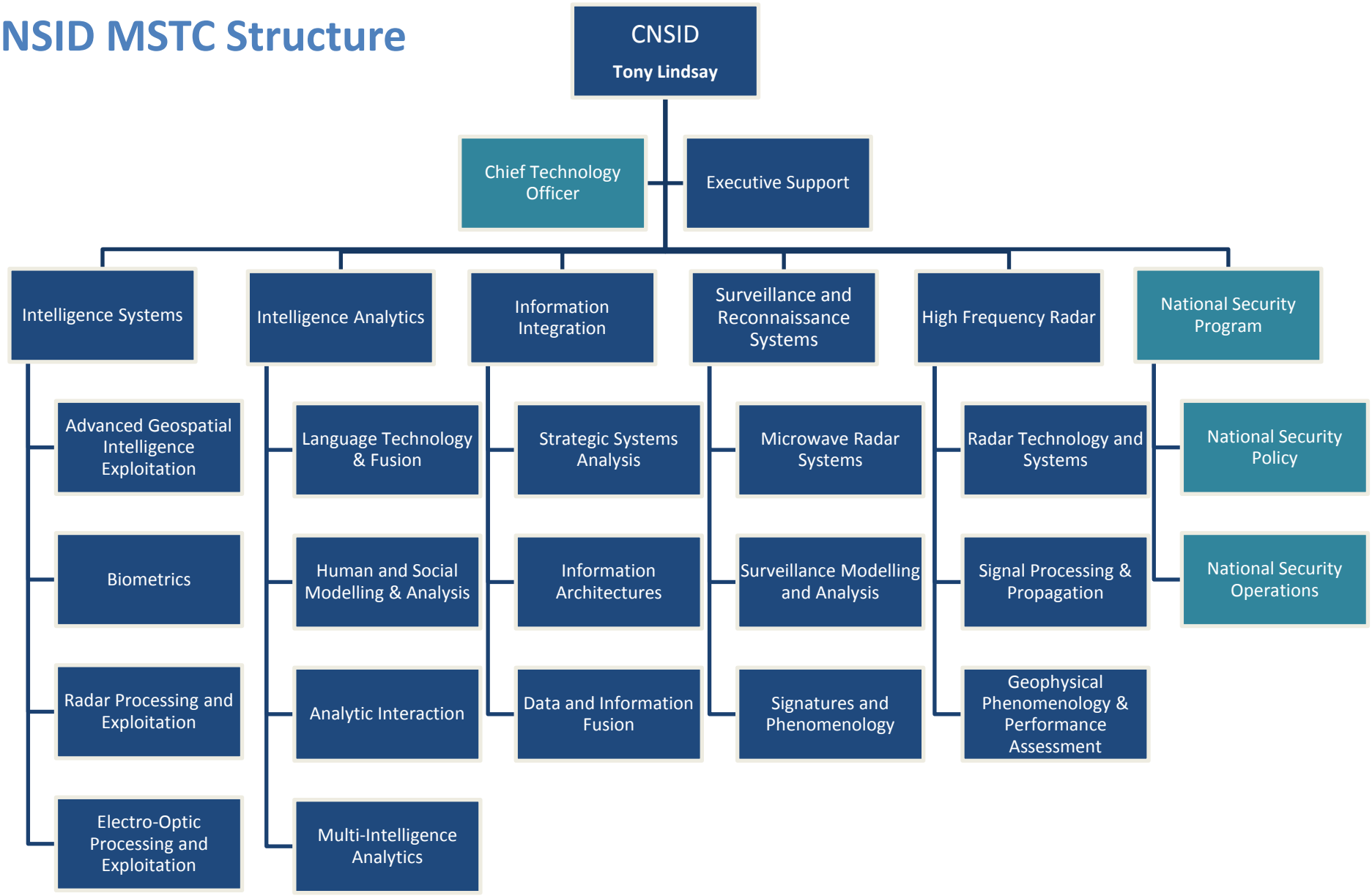
National Security and Intelligence, Surveillance and Reconnaissance Division

Dr Tony Lindsay, Chief, National Security and Intelligence, Surveillance and Reconnaissance Division

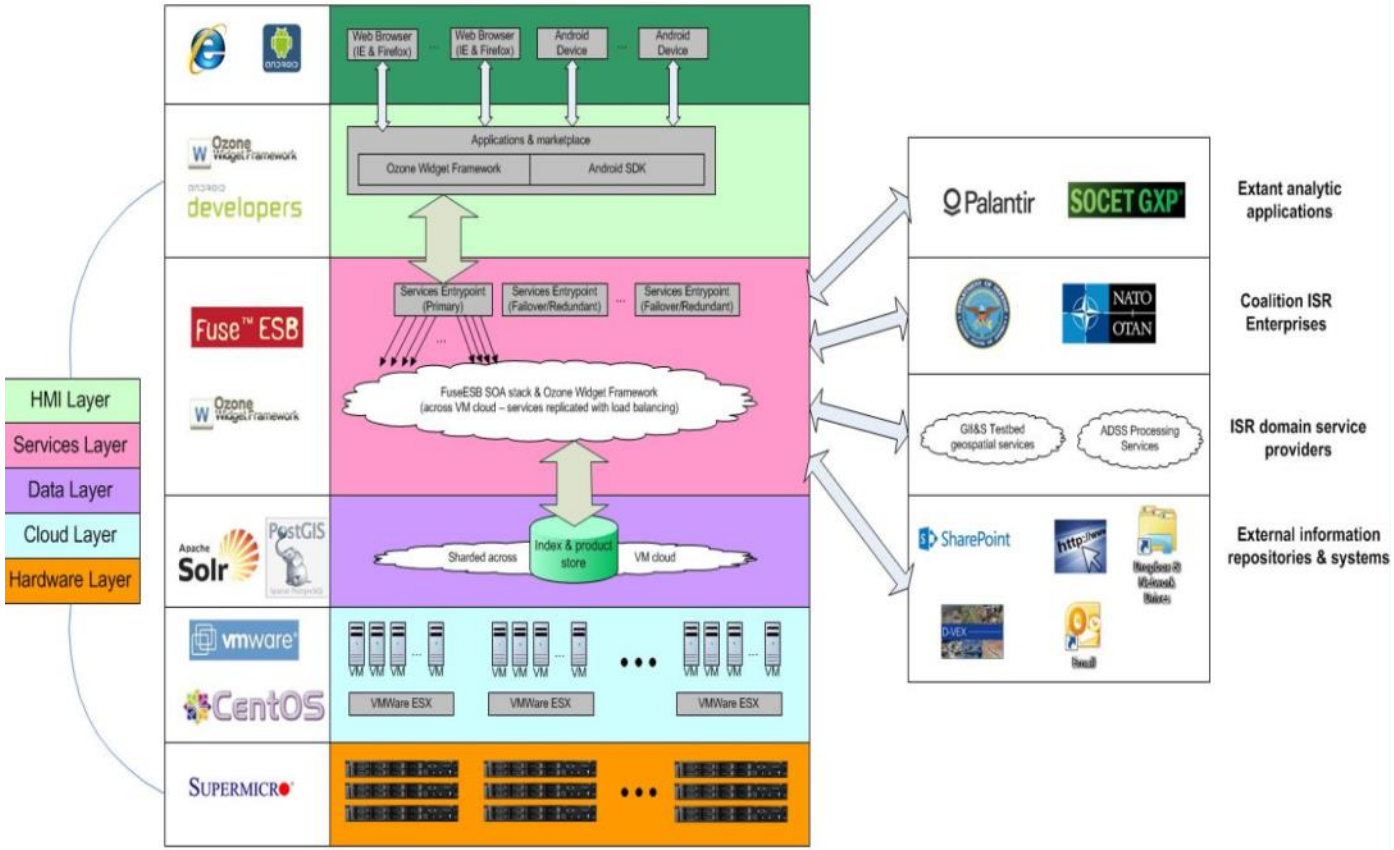
Defence Science and Technology Organisation

DSTO | Science and Technology for Safeguarding Australia

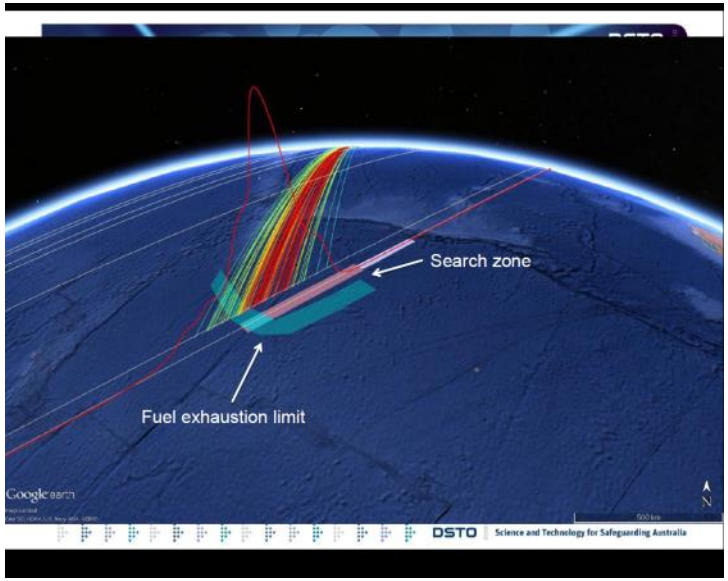
NSID MSTC Structure

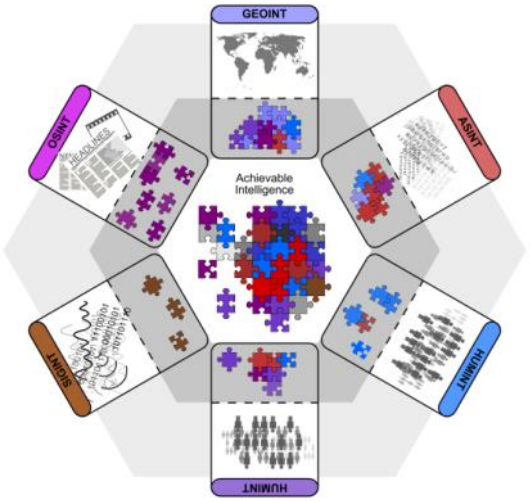


Evolutionary Layered ISR Integration eXemplar ARchitecture (ELIIXAR)

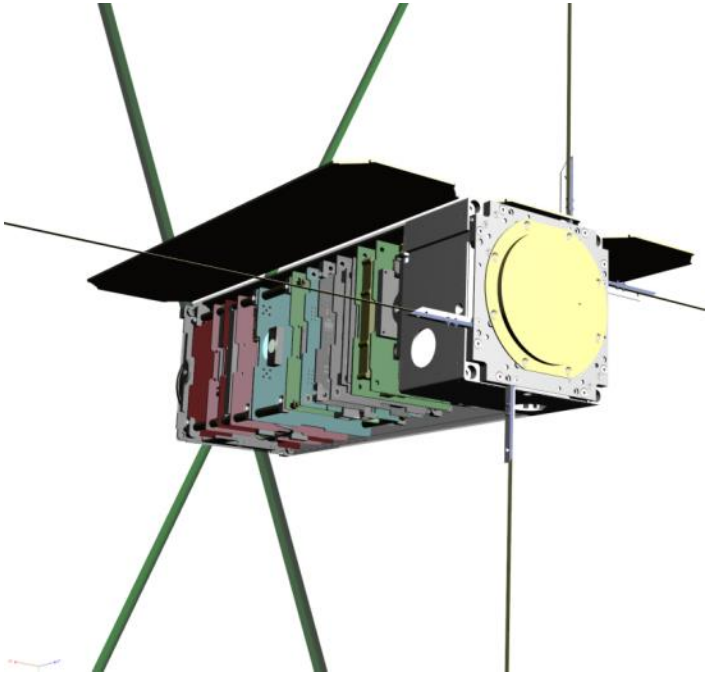


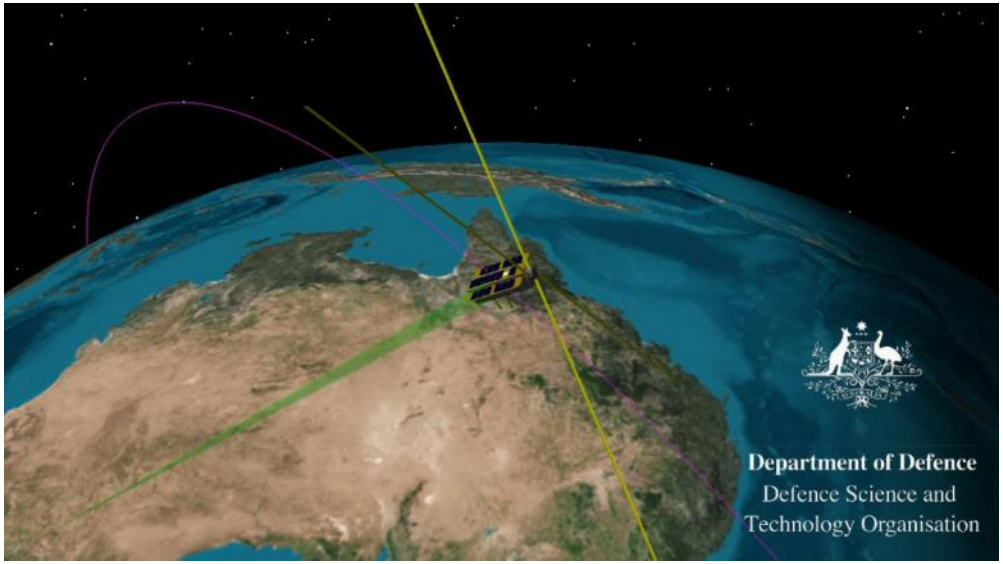
National Security Science and Technology



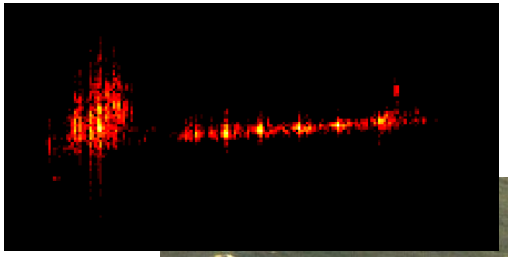


Space and small satellite programs

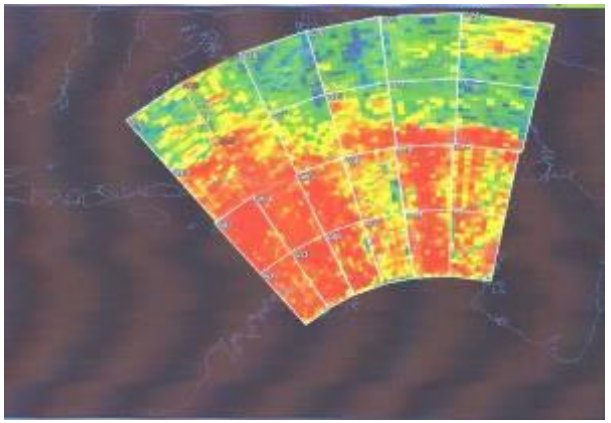


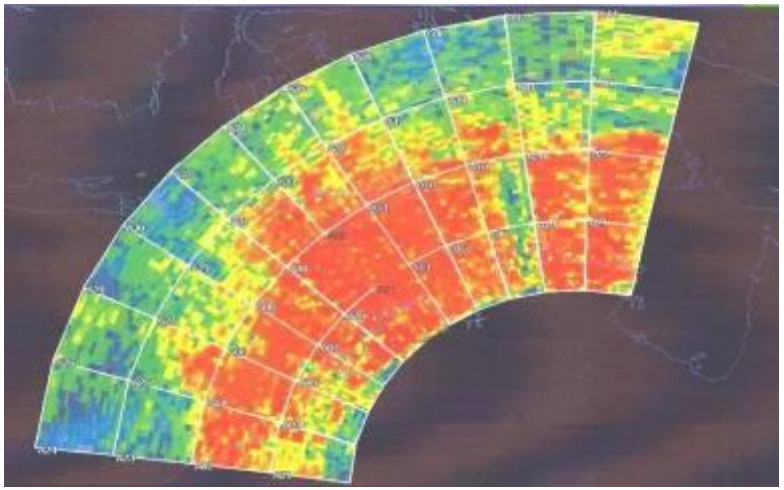


Advanced sensing and sensor processing



… and of course, JINDALEE





Thank You for Your Attention

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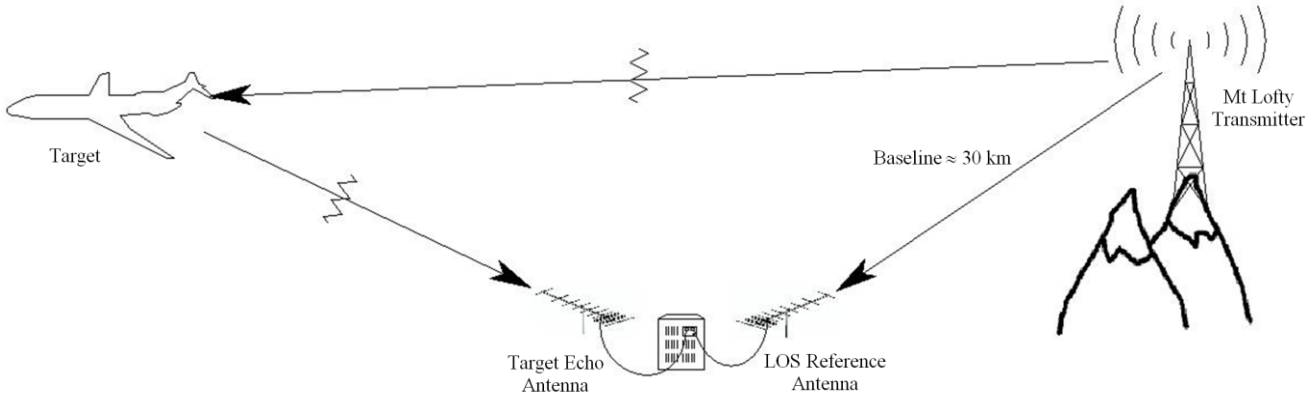
Passive Radar

Introduction to Passive Radar

Geographically separated Illuminator of Opportunity transmitter and passive receiver



Advantages

- Passive System
  - No new RF emissions
  - Covert surveillance
  - Difficult to jam
- Multitude of signal sources

Disadvantages

- Increased complexity
- Dependence on transmitter

Capability & Technology Demonstrator

Delivered as a 3-party partnership with:

BAE Systems Australia

Daronmont Technologies

Progress

Two Channel

Course AoA estimation

TRL 5

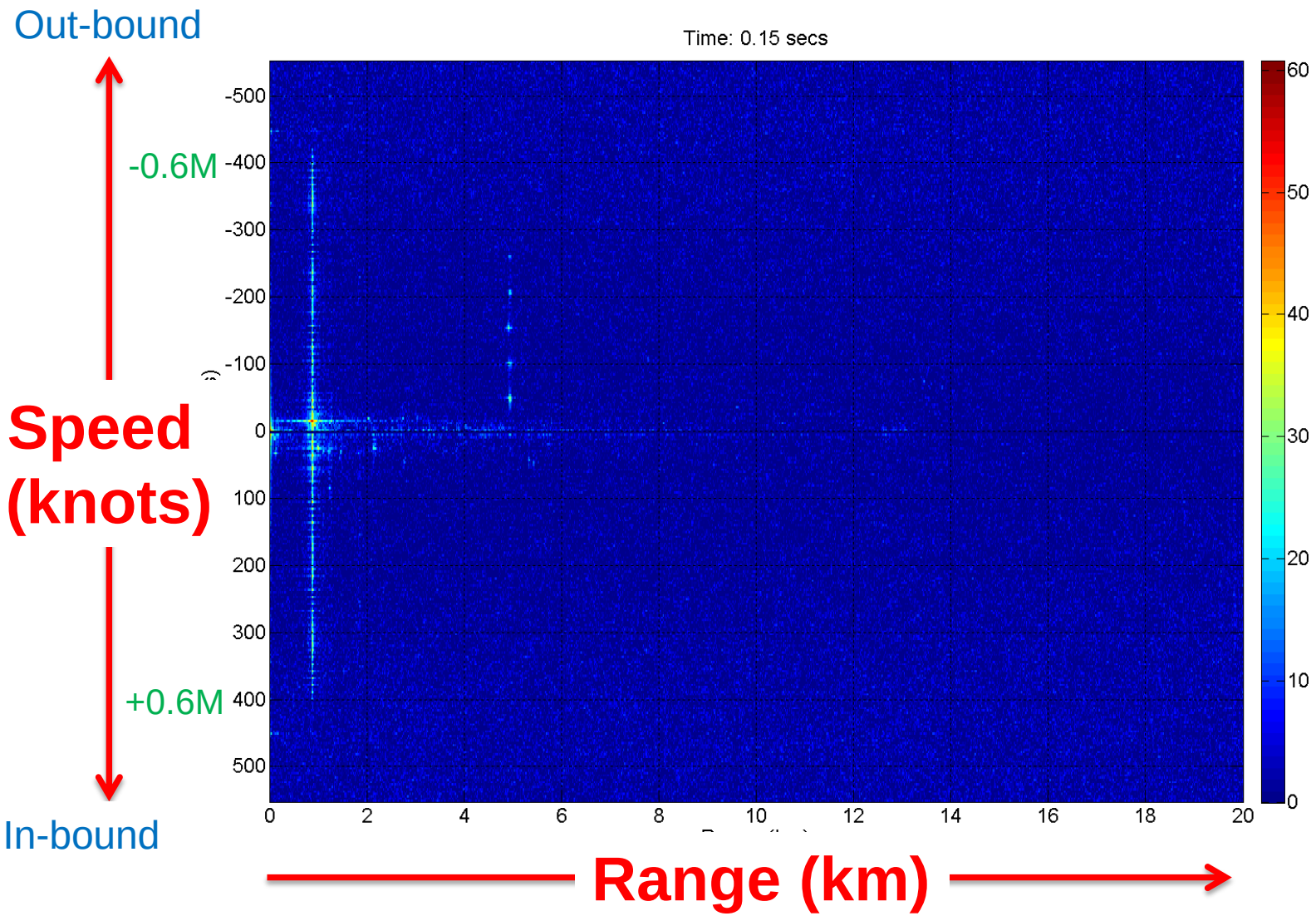
Multi-Channel

Accurate AoA estimation

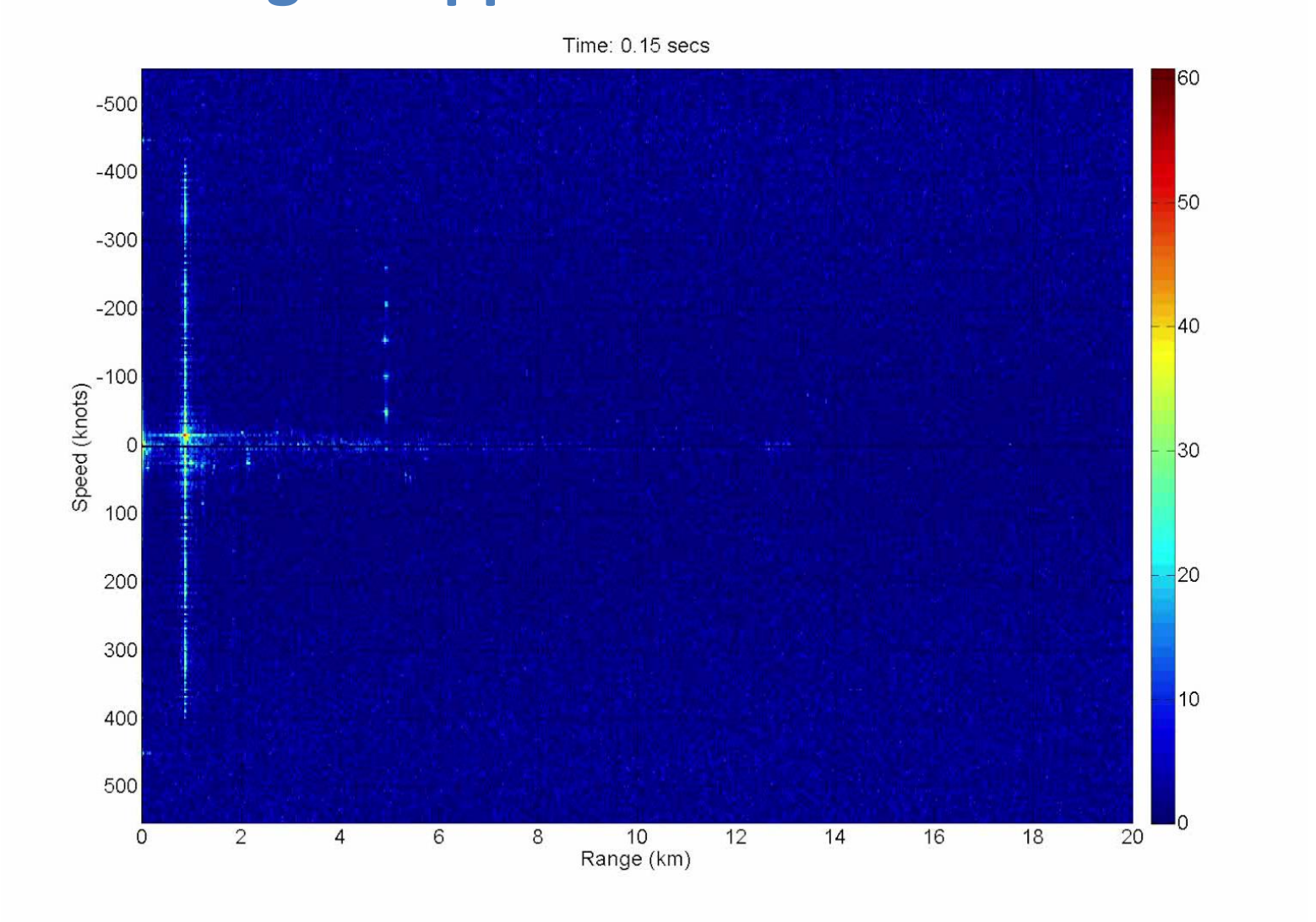
360° continuous coverage

TRL 6+

DVB-T Range-Doppler Frame



DVB-T Range-Doppler Movie



Current Scientific Collaborations

- **Fraunhofer FHR**
  - Moving platform motion compensation
- **University of Queensland**
  - Detection theory and Space Situational Awareness (SSA)
- **University of Pisa**
  - Multi-channel signal processing
- **Institute for Telecommunications Research (Uni SA)**
  - Waveform ambiguity signal processing
- **US Naval Research Laboratory**

Collaboration Areas

- Real-time signal Processing and algorithm development and interfacing to adjunct processing
- Wideband, multi-channel RF hardware design and development
- Data management and pre-processing design and development for implementation in FPGA
- Antenna design and development
- Human machine interface development for both scientific system and operators

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Future Intelligence Exploitation

Dr. Dale A. Lambert
Research Leader Intelligence Analytics MSTC
National Security & ISR Division

Overview

1. The Intelligence Mission
2. The Humpty Dumpty Intelligence Challenge
3. S&T to Address the Intelligence Challenges

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Department of Defence
Defence Science and
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1. The Intelligence Mission

The Intelligence Mission

- Australian intelligence is asked to deal with a diversity of questions.

Is the KI terrorist organisation contemplating an attack at the AFL grand final?

The Intelligence Mission

- Australian intelligence is asked to deal with a diversity of questions.

Is a military coup imminent in the South Pacific nation of Kamaria?

The Intelligence Mission

- Australian intelligence is asked to deal with a diversity of questions.

Is the Desperado bikie gang responsible for the latest heroin shipment arriving from Kamaria?

The Intelligence Mission

- Intelligence is critical to ensuring Australia's defence and national security. But what is intelligence?
- Intelligence is

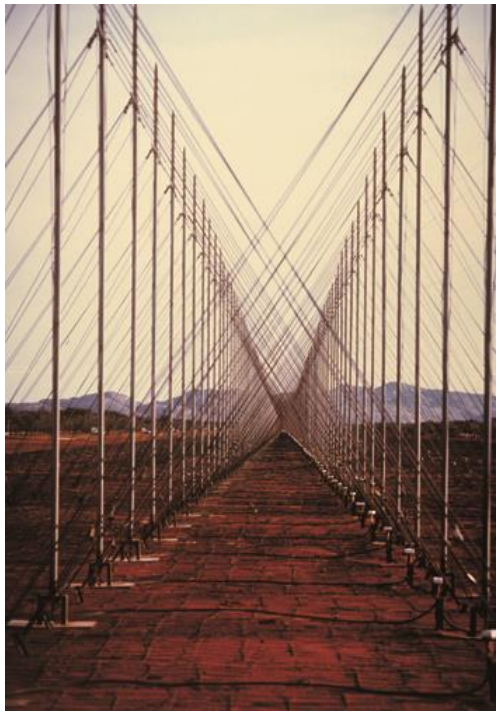
  "*Information that enables you to protect your interests or to maintain a valuable advantage in advancing your interests over those posing threats to them.*"[1]

- Any piece of information counts as 'intelligence' in the right context.
- So the scale of the intelligence mission is enormous when the diversity of questions and breadth of information is considered.

[1]R. Cornall and R. Black, "2011 Independent Review of the Intelligence Community Report", p. 6, 2011.

The Intelligence Mission

- To cope with the scale, the intelligence mission is decentralised across a number of organisations.



NAVY
ARMY
AIR FORCE

Military Intelligence

The Intelligence Mission

- To cope with the scale, the intelligence mission is decentralised across a number of organisations.

Non-Military Defence Intelligence

The Intelligence Mission

- To cope with the scale, the intelligence mission is decentralised across a number of organisations.

Australian Government
Australian Secret Intelligence Service

Australian Government
Australian Security Intelligence Organisation

ONA
OFFICE OF NATIONAL ASSESSMENTS

Non-Defence Intelligence

The Intelligence Mission

- To cope with the scale, the intelligence mission is decentralised across a number of organisations.

Law Enforcement

The Intelligence Mission

- The intelligence mission is addressed by a large number of organisations.
- DSTO was not in the previous list
  - DSTO is not an intelligence organisation
  - DSTO does not do intelligence, it develops science and technology
- So this presentation does not discuss any of the previous organisations and what they do
- This presentation does discuss DSTO science and technology that *could* be used by intelligence organisations

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2. The Humpty Dumpty Intelligence Challenge

The Humpty Dumpty Intelligence Challenge

- The decentralisation of the intelligence mission across different organisations engenders the Humpty Dumpty Intelligence Challenge.

The Humpty Dumpty Intelligence Challenge

1. Documents: like any organisation, we would expect any intelligence organisation has:
   - most of the organisation's information is stored in different kinds of documents;
   - some of these documents are electronic and some are not;

Is a military coup imminent in the South Pacific nation of Kamaria?

A pile of documents

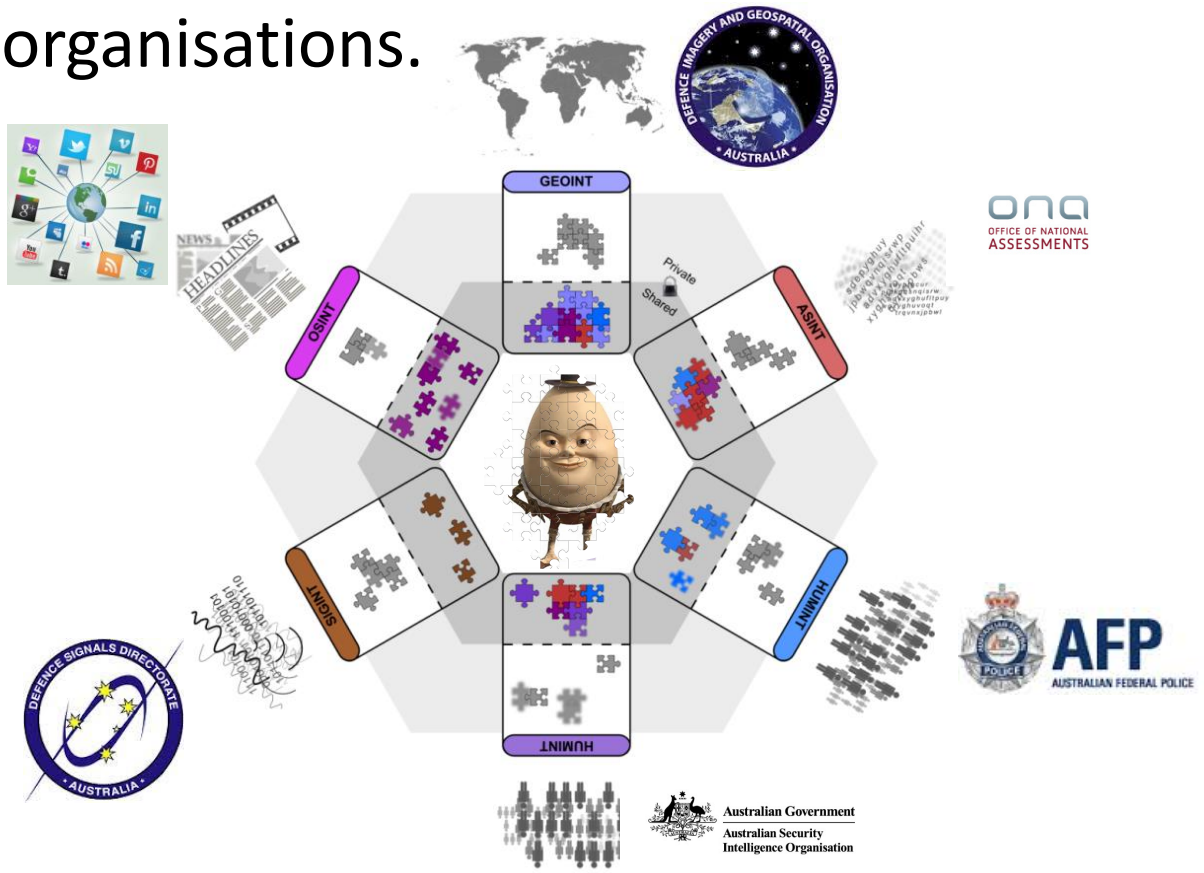
Analyst finds and reads documents to respond

Analyst writes a document in response

Results in an even bigger pile of documents

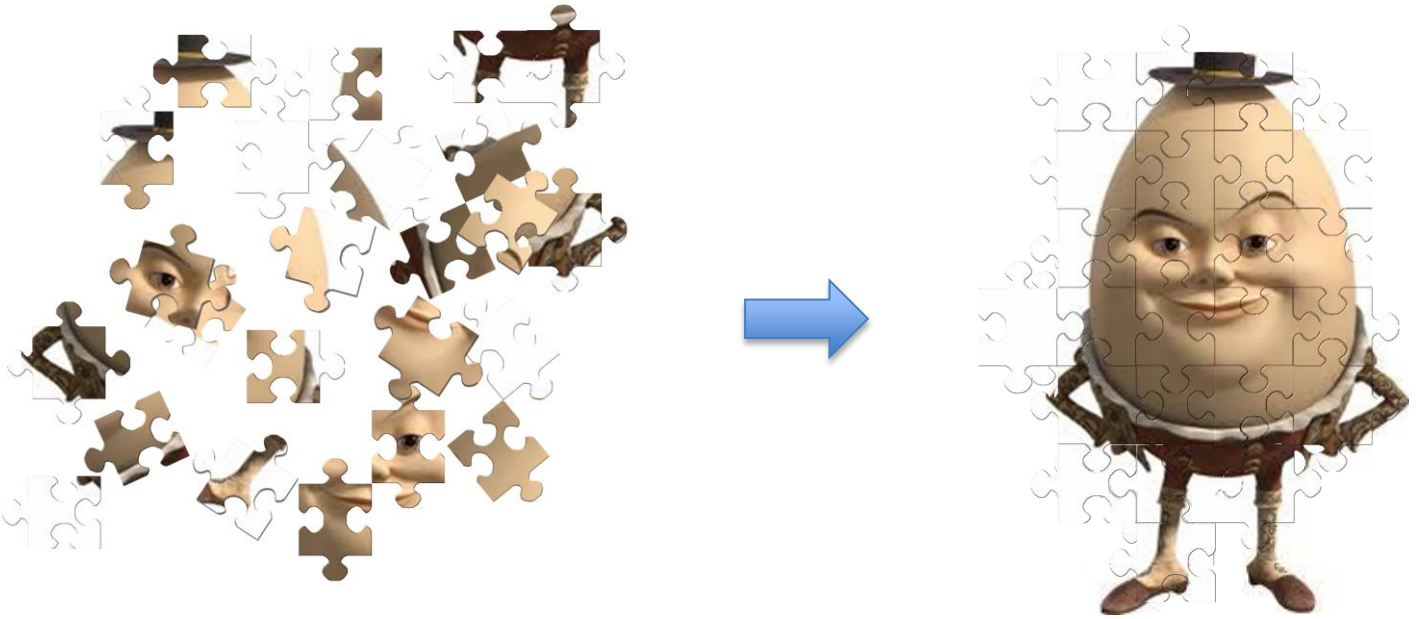
The Humpty Dumpty Intelligence Challenge

2. The overall intelligence picture is dispersed across these document jigsaw pieces developed by the different organisations.



The Humpty Dumpty Intelligence Challenge

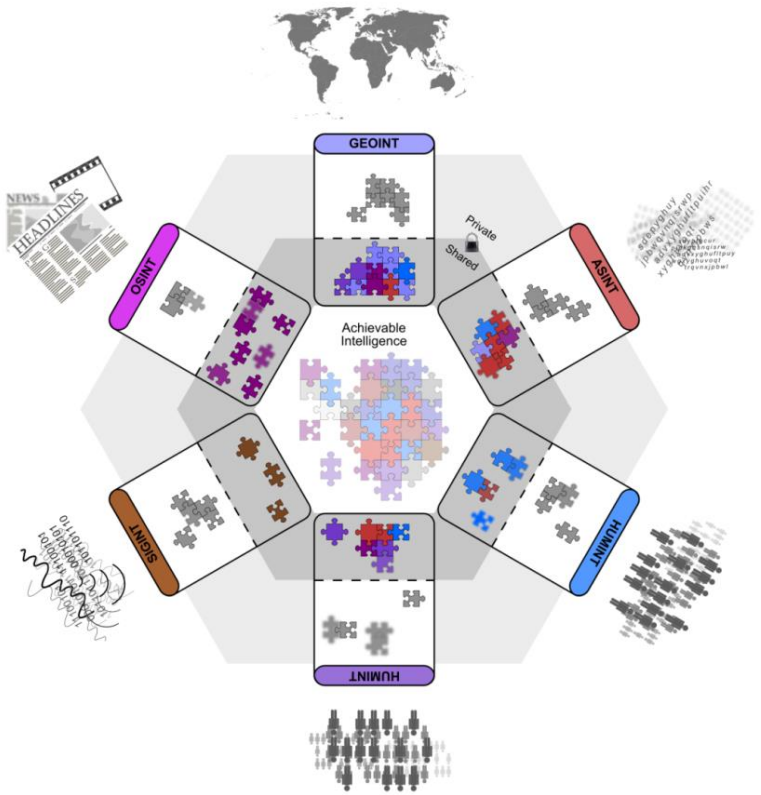
- Putting the relevant intelligence pieces back together again is a non-trivial task.



- There are at least 6 reasons for this.

1. Informed Consent

- The relevant documents might be held elsewhere and access to them may require informed consent on a case by case basis.



2. Needle in Haystack

- Documents make it difficult for analysts to find the information they need.
- Analysts firstly need to be able to find the right documents, and then locate the relevant content buried within each document.

3. Information Behind Bars

- Intelligence document security classifications could prohibit analyst access to information that an analyst is entitled to see.
- An intelligence document can contain a variety of security classifications across its content, with the document classified by the highest security level appearing in the document.

SEKRET

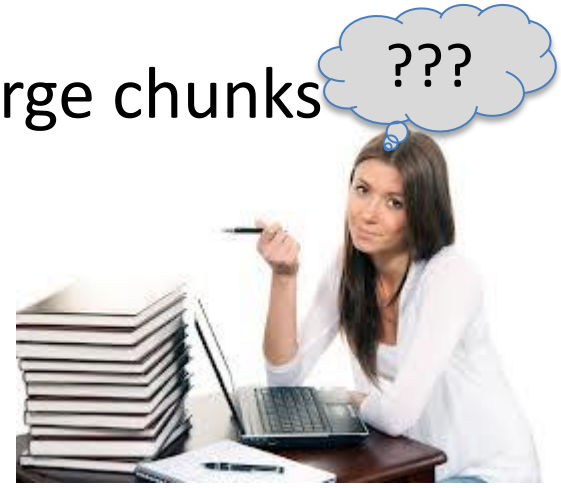
Information Behind Bars

(U) Intelligence document security classifications often prohibit analyst access to information that they are entitled to see.

(S) An intelligence document can contain a variety of security classifications across its content, with the document classified by the highest security level appearing in the document.

4. Writer's Block

- The production of documents by analysts will often be a time consuming process, resulting in delays in access by others to that information.
- Documents delay the release of *all* information in the document until *all* the conclusions have been formed.
- Documents hold information in large chunks



5. Reader's Block

- Documents only disseminate content to human analysts and only once those analysts have read those reports.
- Documents are at best an electronic form of products derived from 15th century printing presses.

6. Unknown Knowns

"There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know."

- Donald Rumsfeld

- But there is also a fourth logical possibility.
- There are unknown knowns. These are the things that can be inferred from known information, but no-one has made those inferences.
- Analysts are currently required to find relevant documents, comprehend their content, and make all the relevant inferences.

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3. S&T to Address the Intelligence Challenges

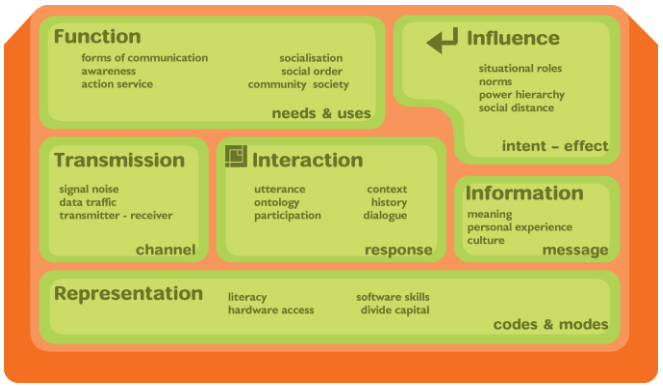
Informed Consent

Solution:

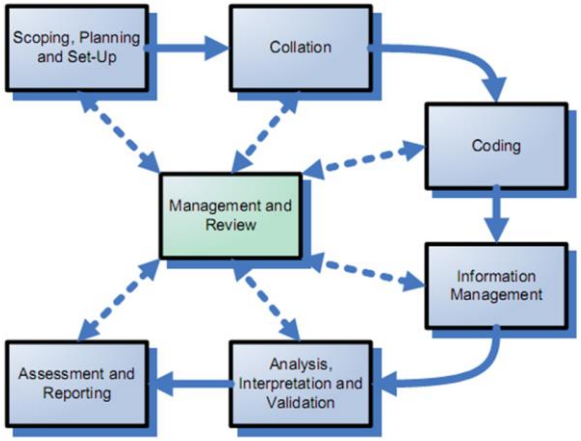
- Develop a *unified intelligence analysis policy framework*.
- It requires an *understanding* of the *cultural, legal, privacy, security and technical* requirements of each organisation.
- This provides a basis for constrained automated exchange.

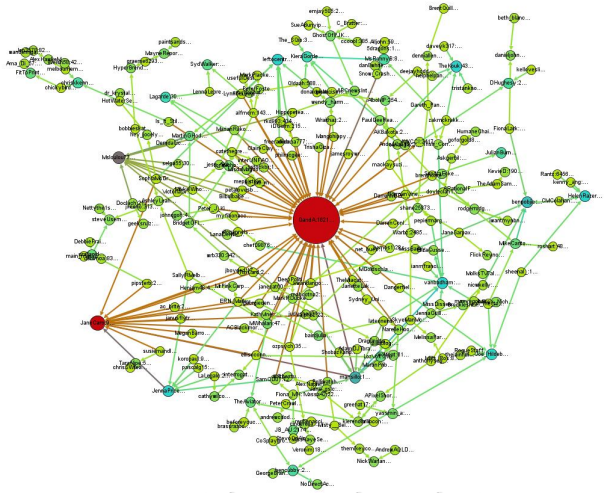
DSTO Capability:

- DSTO has human scientists that study:



social and cultural modelling





social network analysis

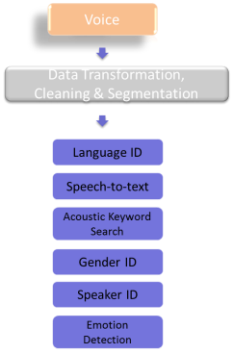
Writer's Block

Solution:

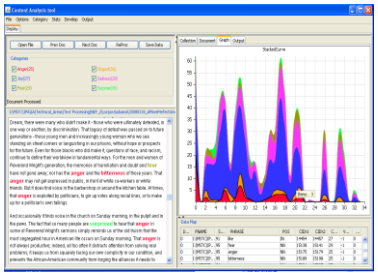
- Shift the emphasis from human readable documents to machine readable 'analytic products'.
- Store all intelligence information as common machine processable 'analytic products', not as human readable documents

DSTO Capability:

- Where possible, perform automatic translations from information sources into a common machine processable format:



speech analytics



text analytics

signal analytics

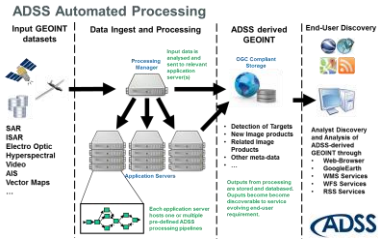


image analytics

facial analytics

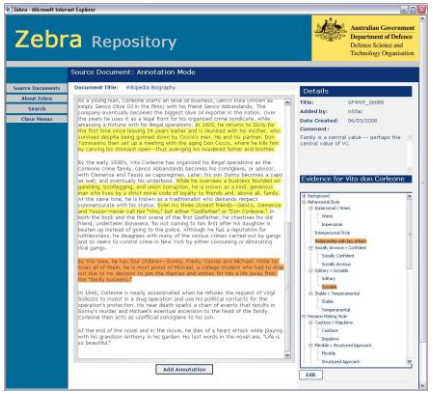
Writer's Block

Solution:

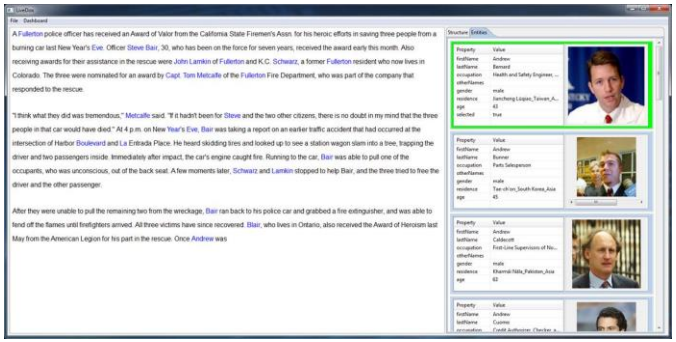
- Shift the emphasis from human readable documents to machine readable 'analytic products'.
- Store all intelligence information as common machine processable 'analytic products', not as human readable documents

DSTO Capability:

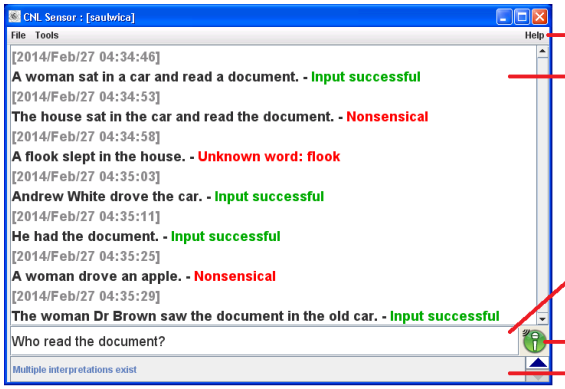
- Where automatic translation is not possible, mechanisms to assist analysts to generate machine processable content are required.



structured document markup



documents with live links



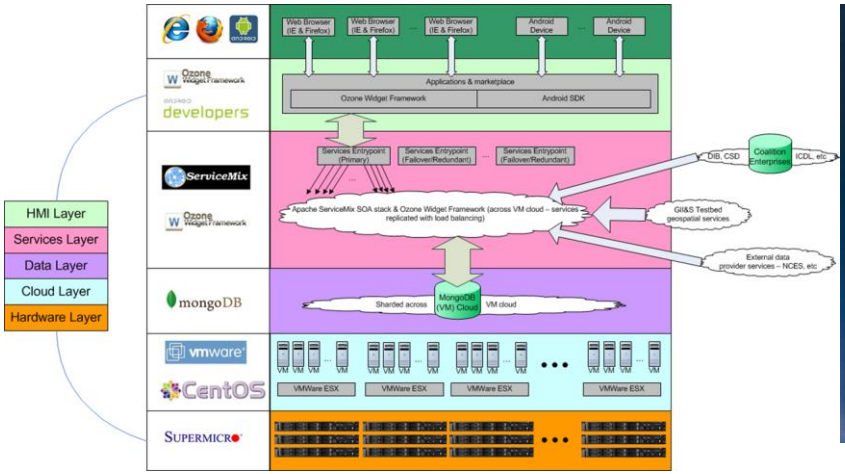
controlled natural language

Information Behind Bars

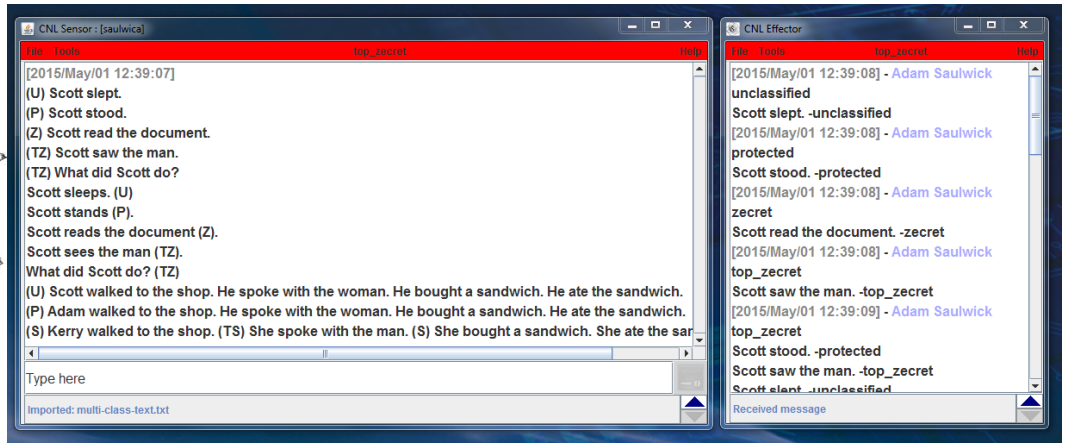
Solution:

- Develop a distributed information management capability that provides discriminated multi-level security access to ‘analytic products’.
- Visibility of an ‘analytic product’ occurs only if the user’s electronic security credentials comply with the electronic security description of the ‘analytic product’.

DSTO Capability:



Eliixar distributed IM



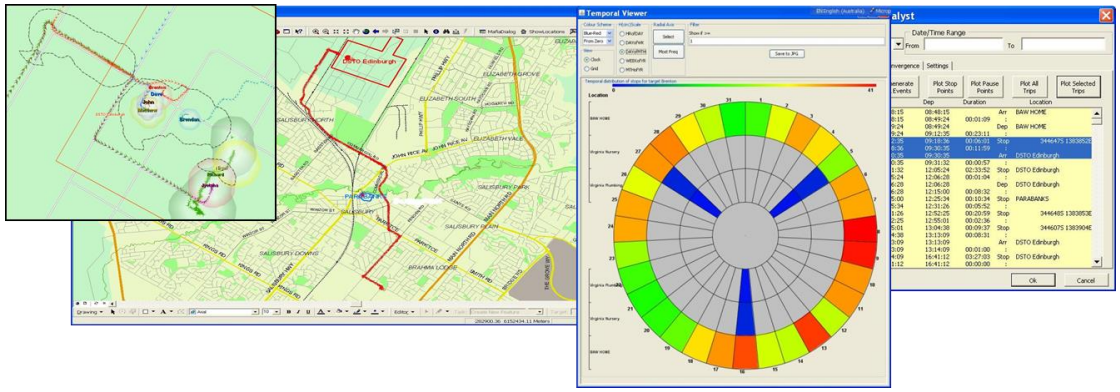
Consensus security inference

Unknown Knowns

Solution:

- Ensure the common machine processable content format supports automated inference.

DSTO Capability:



Partial Automated Inference: visual analytics

```
| ?- show_why(true(environmental_disaster(When, Where))).
1. [environmental_disaster(t3,s6)] is derived from modus ponens by 2 and
[missile(@(m1+m2,t3,s5))] by 3 and [oil_tanker(@(tgt3,t3,s6))] by 4 and
[strikes(@(m1+m2,t3,s5),@(tgt3,t3,s6))] by 5
2. [environmental_disaster(t3,s6) if ((missile(@(m1+m2,t3,s5)) &
oil_tanker(@(tgt3,t3,s6)) & strikes(@(m1+m2,t3,s5),@(tgt3,t3,s6))))] is
derived from told([], all([_6456, _6458, _6460, _6462, _6464],
((missile(@(_6456, _6458, _6460)) & oil_tanker(@(_6462, _6458, _6464)) &
strikes(@(_6456, _6458, _6460),@(_6462, _6458, _6464))) =>
environmental_disaster(_6458, _6464)))
3. [missile(@(m1+m2,t3,s5))] is derived from told([], all([_6784, _6786],
missile(@(m1+m2, _6784, _6786)))
4. [oil_tanker(@(tgt3,t3,s6))] is derived from told([], all([_7109, _7111],
oil_tanker(@(tgt3, _7109, _7111)))
5. [strikes(@(m1+m2,t3,s5),@(tgt3,t3,s6))] is derived from told([],
strikes(@(m1+m2,t3,s5),@(tgt3,t3,s6)))
When = t3, Where = s6 ? yes
```

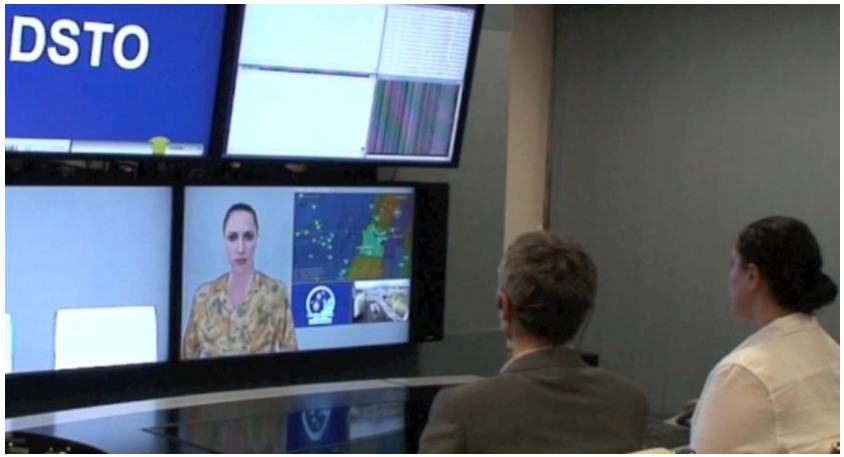
Full Automated Inference: cognitive software

Reader's Block

Need:

- Develop interactive natural interfaces to machine oriented analytic products.

DSTO Capability:



Speaking with Virtual Advisers

Immersive Environments

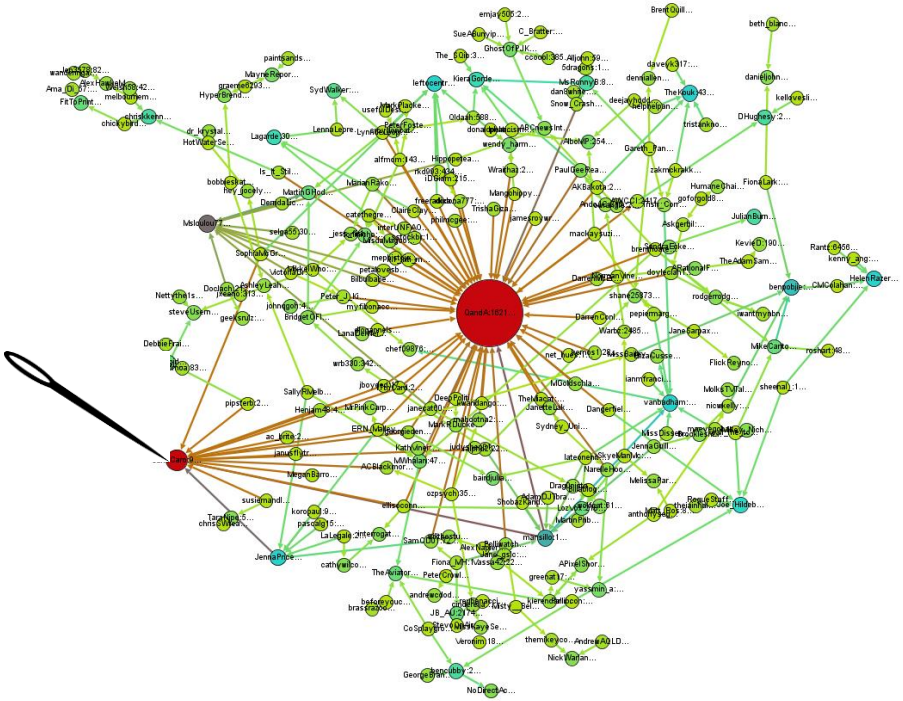
Virtual Advisers

Needle in a Haystack

Solution:

- Develop a science of analysis, a tradecraft for data enabled analysts engaged with all of the aforementioned solutions.

DSTO Capability:



behaviour and cognition

Intelligence Exploitation Outcome

- **Integrated data-enabled analysts** are able to access relevant information more easily and share their products more efficiently in a common machine processable form within and across organisations.