Australian Government

Department of Defence

Defence Science and Technology Group

# National Security and Intelligence, Surveillance & Reconnaissance Division

Partnerships Week
2016

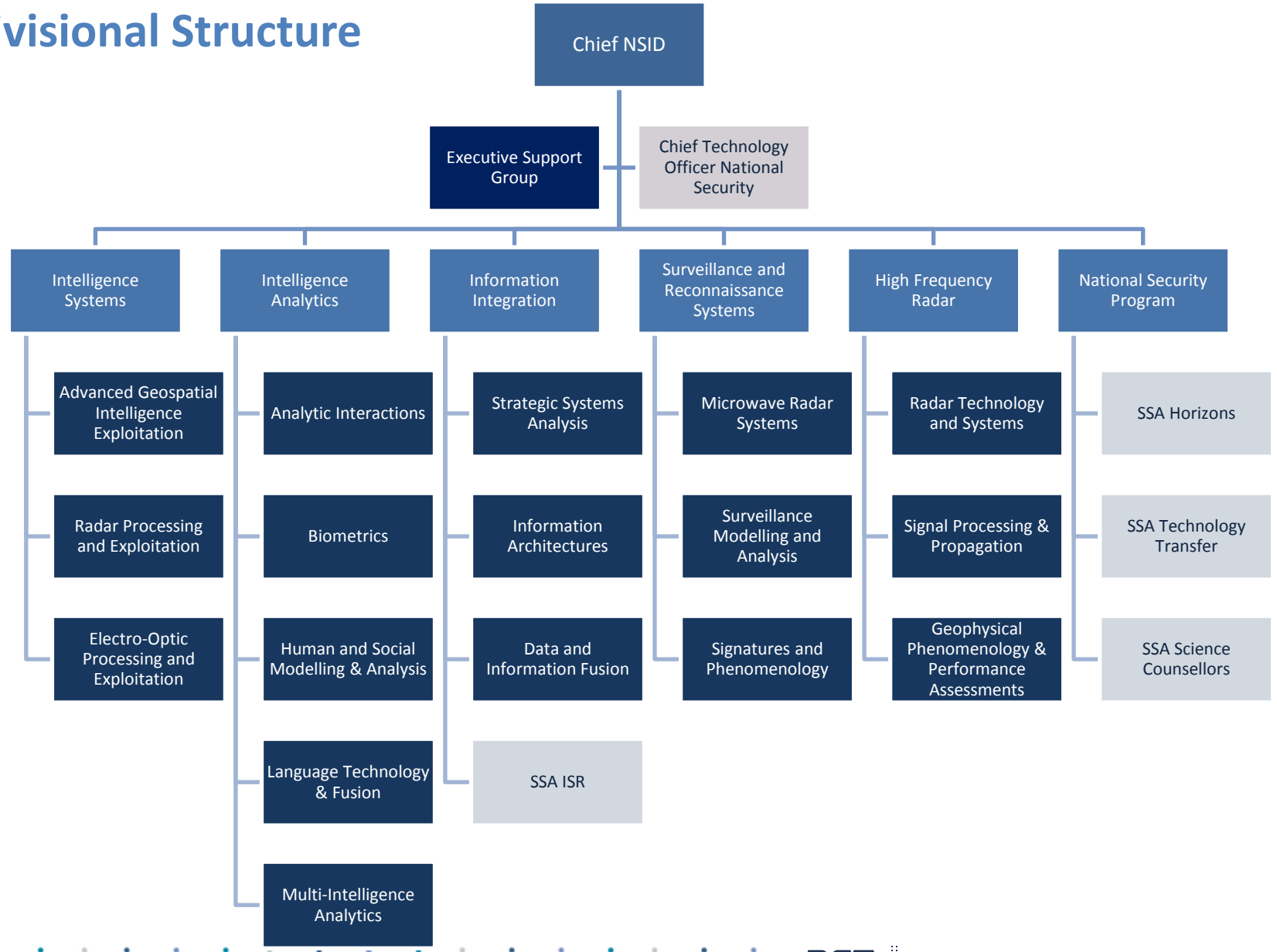
# National Security and Intelligence, Surveillance & Reconnaissance Division

National Security and ISR (NSI) Division undertakes internationally-recognised research and development into technologies aimed at enhancing the national capability to produce accurate, relevant and timely actionable intelligence for both Defence and national agency decision makers.

The research spans the range of advanced sensing and sensor processing through to the design of information integration architectures.

- National Security
- Intelligence Systems
- Intelligence Analytics
- Information Integration
- Surveillance and Reconnaissance Systems
- High Frequency Radar

# Divisional Structure

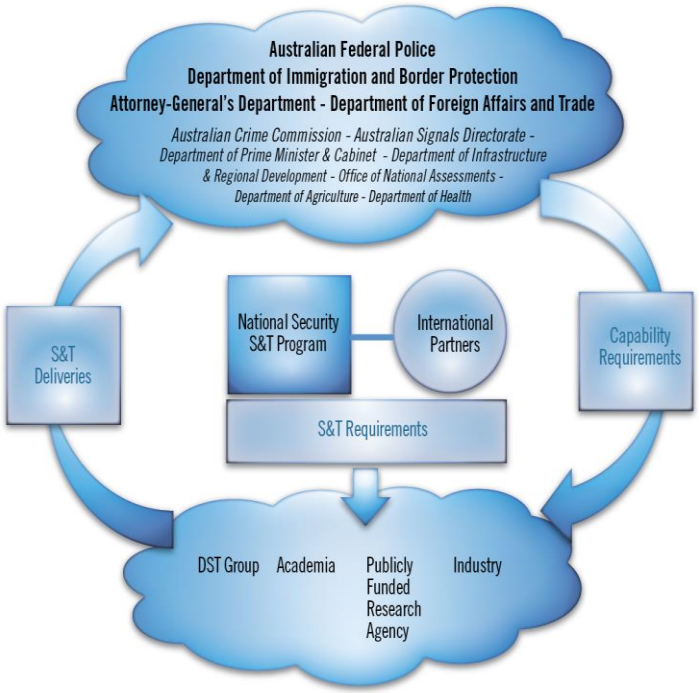


# National Security Science and Technology Centre

The National Security Science and Technology Centre coordinates and fosters the development of science and technology (S&T) to enhance Australia's national security.

**Our roles include:**

- *leading and coordinating the development and implementation of national security S&T policy;*
- *fostering international national security research collaborations;*
- *strategic analysis of national security priorities and resourcing; and*
- *integration of counter-terrorism technologies to benefit Defence and civilian agencies.*



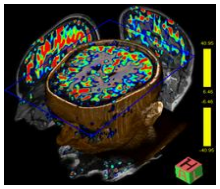

**NS S&T Priorities** :

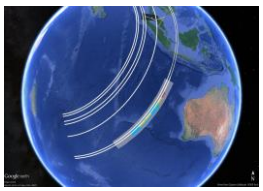
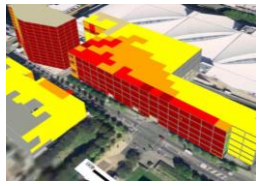
- *Cyber and electronic security*
- *Intelligence exploitation*
- *Border security and identity management*
- *Preparedness, protection and incident response*
- *Investigative support and forensics*

**Our S&T Thrusts:**

- *Computer Operations*
- *Advanced Analytics*
- *ChemBio Defence*
- *Biometrics*
- *Energetic Materials*
- *Countering Violent Extremism*





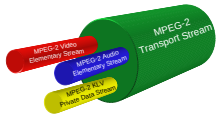
# Intelligence Systems

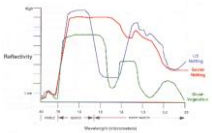
## Goal

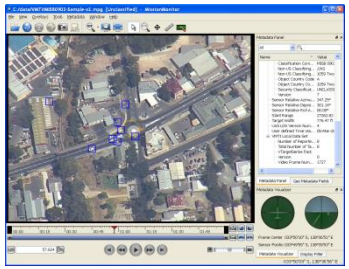
To support the Geospatial Intelligence (GEOINT), Measurements and Signatures Intelligence (MASINT) and Multi-INT capability objectives of Defence and National Security organisations.

## Impact

- Advance imagery-based sensing and persistent surveillance
- Automation architecture for the community providing computer assisted processing & exploitation to address the data deluge
- Multi-source ISR integration
- Biometric capabilities to support secure boarders
- Capability transition to partners & operations

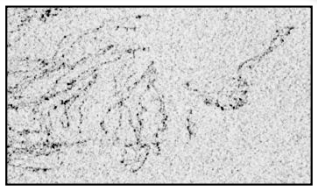




**Electro-Optic Processing & Exploitation**

$$\gamma = \frac{\langle I_1 I_2^* \rangle}{\sqrt{\langle |I_1|^2 \rangle \langle |I_2|^2 \rangle}}$$



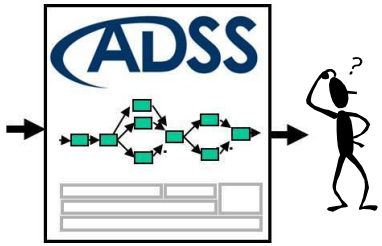
**Radar Processing & Exploitation**

## Partnerships & Outreach

| Universities | Industry | International |
|---|---|---|
| Adelaide University | Rheinmetall | Square Dance |
| University of New South Wales | BAE Systems | TTCP ISTAR |
| UTS Sydney | Hawker Pacific | AIR & SPACE (ANSR) |
| D2D CRC | NEC, Cognitec | ONIR DETT |
| | | AAMOST (UK), NATO SET |
| | | CTTSO (US) |
| | | DHS (US) |
| | | SF Equipment Cap |

**Advanced GEOINT Exploitation**

**Imagery**
SAR
ISAR
Electro Optic
Hyperspectral
Video
etc



# Information Integration

## Goal

To demonstrate advanced ISR integration concepts, including sensing technologies, exploitation algorithms and enterprise integration approaches

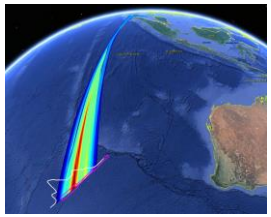
## Impact

- Exploitation of advanced sensing technologies including transition to
  - AEW&C; JORN; Intel agencies
- Automated sense-making from large heterogeneous ISR data
- Modelling, designing and trialling exemplar enterprise ISR integration systems for the ADF
- Capability acquisition methodologies for complex systems
- Definition of search area for MH370
- Exploratory space systems

## Partnerships & Outreach

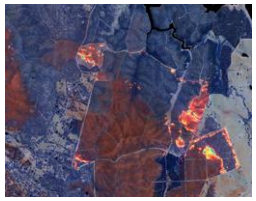
| Universities | Industry | International |
|---|---|---|
| Uni of Qld | Bayesian Intel | TTCP ISTAR |
| UniSA | Boeing Defence Aus | AAMOST (UK) |
| RMIT | BAE Systems | FGAN (DE) |
| University of Melbourne | Agent Oriented Software | Square Dance |
| Monash | Lockheed Martin (USA) | |
| Uni of NSW | Northrop-Grumman (USA) | |
| | Boeing Defense (USA) | |
| | Airbus Defence and Space (DE) | |

**Data and Information Fusion**

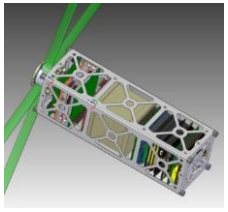


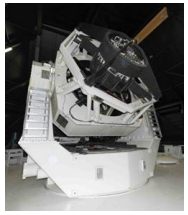
**Information Architectures**

ELIIXAR



**Strategic Systems Analysis**





# Surveillance & Reconnaissance Systems

## Goal

To provide Australia with a sustainable surveillance and reconnaissance edge:

- Radar signature prediction, measurement, treatment plans and exploitation
- Microwave radar systems
- Surveillance modelling and analysis

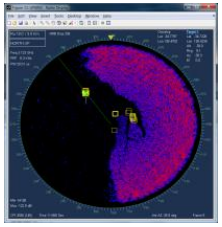
## Impact

- Wedgetail operational performance improvements.
- Enhanced electronic protection in current and next generation ADF radar systems.
- Sustainment of ADF radar signatures

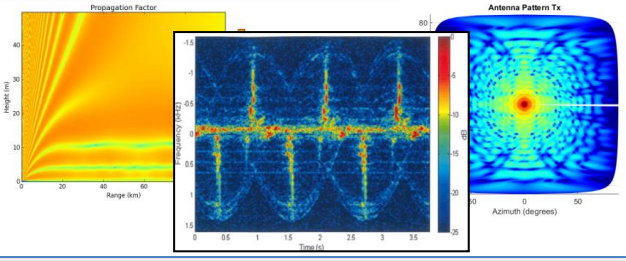
## Partnerships & Outreach

| Universities | Industry | International |
|---|---|---|
| Adelaide University | CEA Technologies | TTCP ISR |
| University of South Australia | BAE Systems | NRL (USA) |
| RMIT | Daramount Technologies | AFRL (USA) |
| Curtin | Northrop Grumman | Franunhoffer Ins (Ger) |
| Pisa (Italy) | Boeing | CNIT (Italy) |
| Pennsylvania (USA) | | US Navy |
| Colorado State (USA) | | NATO |
| Arizona State (USA) | | NZ Navy |
| Duke (USA) | | |

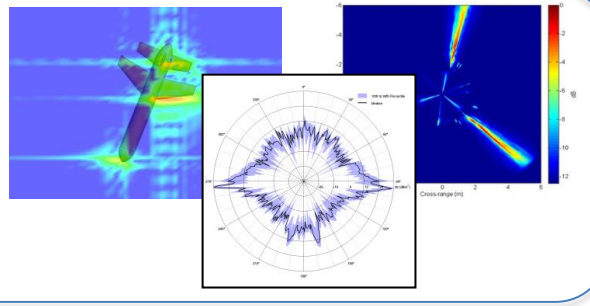
Microwave Radar Systems



Surveillance Modelling & Analysis




Radar Signatures & Phenomenology



# Intelligence Analytics

## Goal

Apply scientific discipline of Analytics to enhance the intelligence analysis capabilities of Defence, National Security and Law Enforcement agencies.

- Data analytics is a scientific discipline relating to the extraction, fusion and dissemination of meaningful content from data
- Multi-disciplinary field drawing on Computer Science, Mathematics, Linguistics, Psychology and the Social Sciences

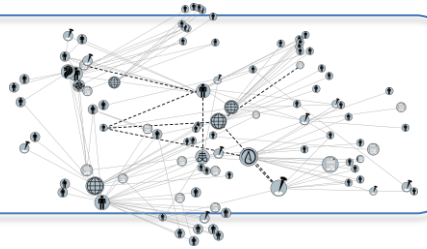
## Partnerships & Outreach

| Universities | Industry | International |
|---|---|---|
| Adelaide University | SME | TTCP |
| University of South Australia | | Defence |
| University Melbourne | | Government |
| Victoria Uni | | |
| Swinburne Uni | | |
| ANU | | |
| D2D CRC | | |

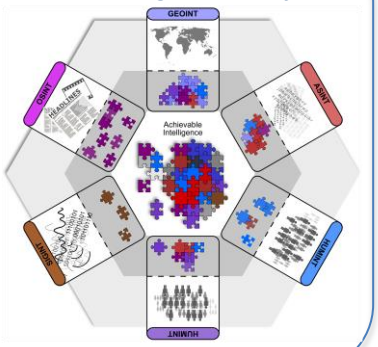
## Impact

- Provide tailored advice, develop and transition advanced analytic technologies to INT analysts
- Support to operations and participation in international research programs (e.g., Square Dance, TTCP)
- SNA tool integrated with UK IC capability and provided to AS Govt
- Bidirectional exchange of language technology & resources with, and courted for collaboration by, US IC

**Analytic Interactions**

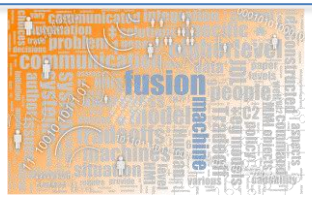


**Multi-Intelligence Analytics**




**Biometrics**

**Language Technology & Fusion**




**Human and Social Modelling & Analysis**

# High Frequency Radar

## Goal

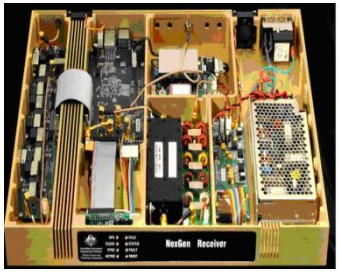
Conduct R&D into high-frequency over-the-horizon radar to enhance and sustain Australia's wide-area air and surface vessel surveillance capability.

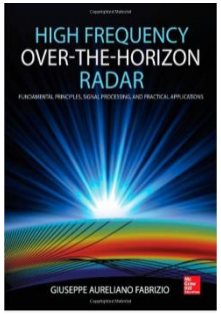
## Impact

- R&D transitioned to capability with extended coverage, improved detection sensitivity, clutter and interference rejection, EW suite.
- Developed specialised equipment design options.
- Providing system design and assessment; modelling; experimentation and demonstration. Including concepts for new radar design and high-fidelity instrumentation aiming for significant detection sensitivity and persistence improvement.

## Partnerships & Outreach

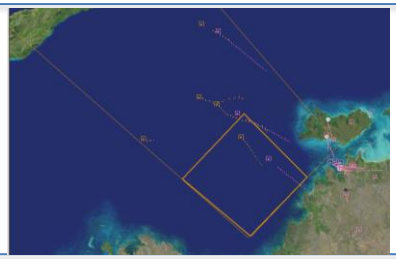
| Universities | Industry | International |
|---|---|---|
| Adelaide University | Lockheed Martin | US ROTHR Program Office (CWP and PA on HF R&D) |
| La Trobe University | BAE Systems | US Intel Community |
| RMIT | | US Naval Research Lab |
| | | AFRL (US) |

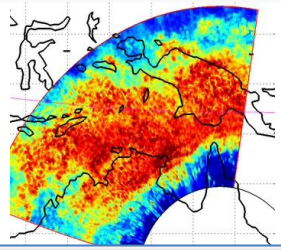



**Geophysical Phenomenology & Performance Assessments**

**Signal Processing & Propagation**



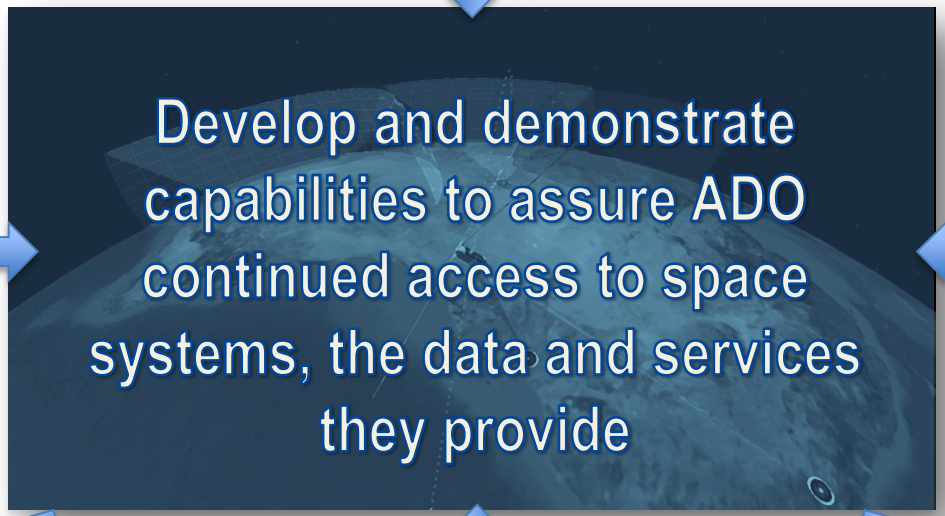


**Radar Technology & Systems**

# Strategic Research Initiative: Space Systems

**Intelligence Systems MSTC**
- Niche sensing and characterising the low earth orbit space environment

**High Frequency Radar MSTC**
- JORN Calibration




**Information Integration MSTC**
- CubeSats
- Space situational awareness fusion

**Universities/CRC**
- UNSW, Sydney & Canberra
- ANU,
- University of Queensland
- Curtin University

**Industry**
- EOS
- General Dynamics (NZ)
- BAE Systems

**International**
- Square Dance
- SST Data Sharing Agreement
- TCP ISTAR, SEEP MOU

# Strategic Research Initiative: Integrated ISR Systems

## Intelligence Analytics MSTC

- Multi-INT
- Big data methods
- Intelligence exploitation tools

## Information Integration MSTC

- ELIIXAR DGS-AUS exemplar
- Geospatial information infrastructure

**Develop and demonstrate advanced integrated ISR concepts**

## Intelligence Systems MSTC

- WASABI,
- Analysts Detection Support System
- DEAP and Ground Based Systems

## Surveillance Reconnaissance Systems MSTC

- Long range Passive Coherent Radar

## Universities/CRC

- Adelaide Uni
- D2D CRC

## Industry

- Rheinmetall
- Hawker Pacific

## International

- Square Dance, Air & Space (ANSR)
- TCP ISTAR
- C3I AAMOST

# Thankyou