Australian Government
Department of Defence

Defence Science and Technology Group Presentation to the CDM Annual Workshop

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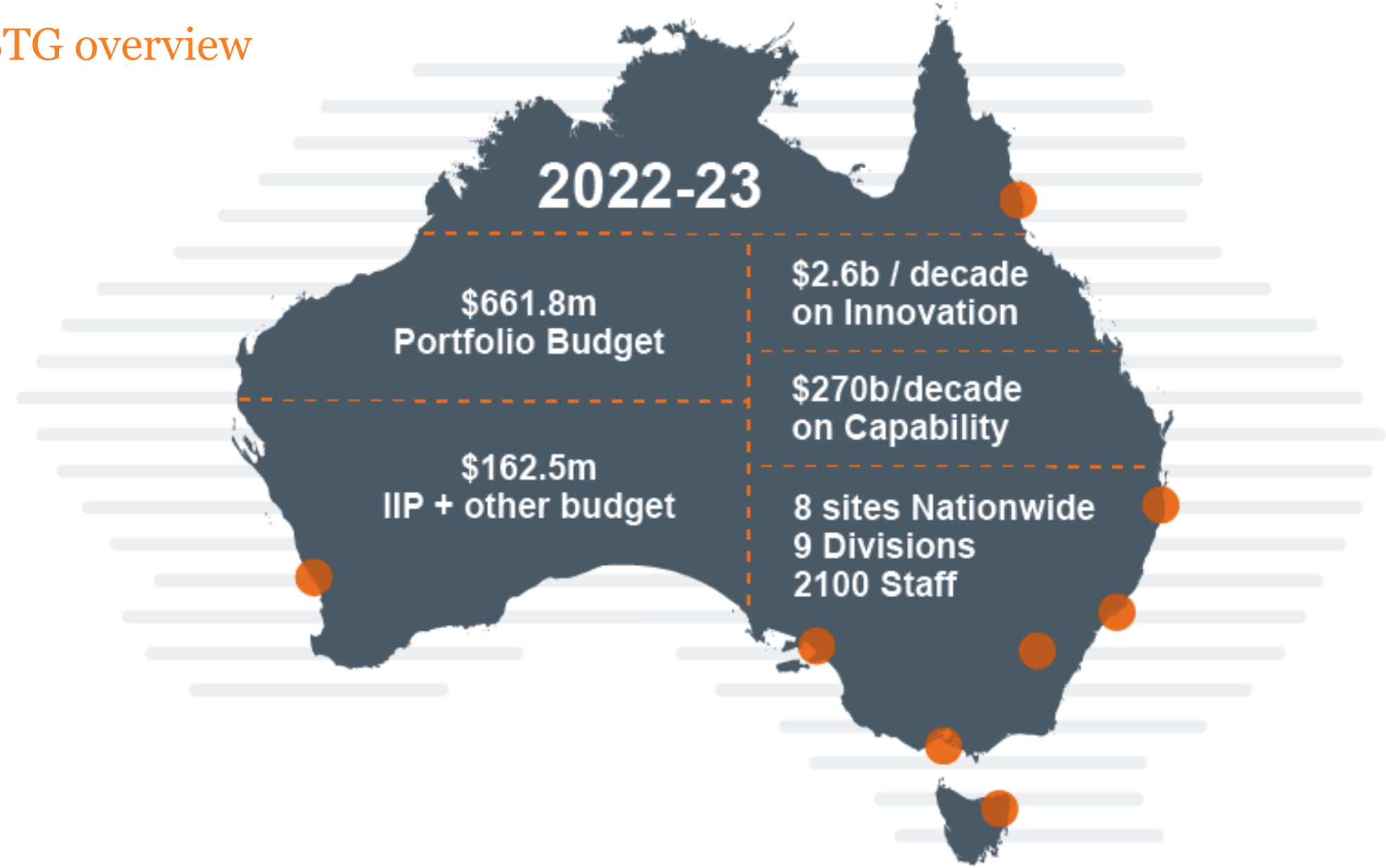
Defence Science and Technology Group

Our role

- Develop innovative technologies that can be delivered by industry and transitioned into Defence capability, and
- To shape innovation, science and technology within Defence and across the nation.


Navy
Army
Air Force
Defence
Government
Advice, Research, Assurance, Sustainment, Future-proofing
Defence Capability and Operations
Partnerships, Emerging futures, Outreach, Translation, Coordination
Industry
Academia
SMEs
International Partners

DSTG overview



Information warfare

Agile command and control

Resilient multi-mission space

Quantum assured position, navigation and timing

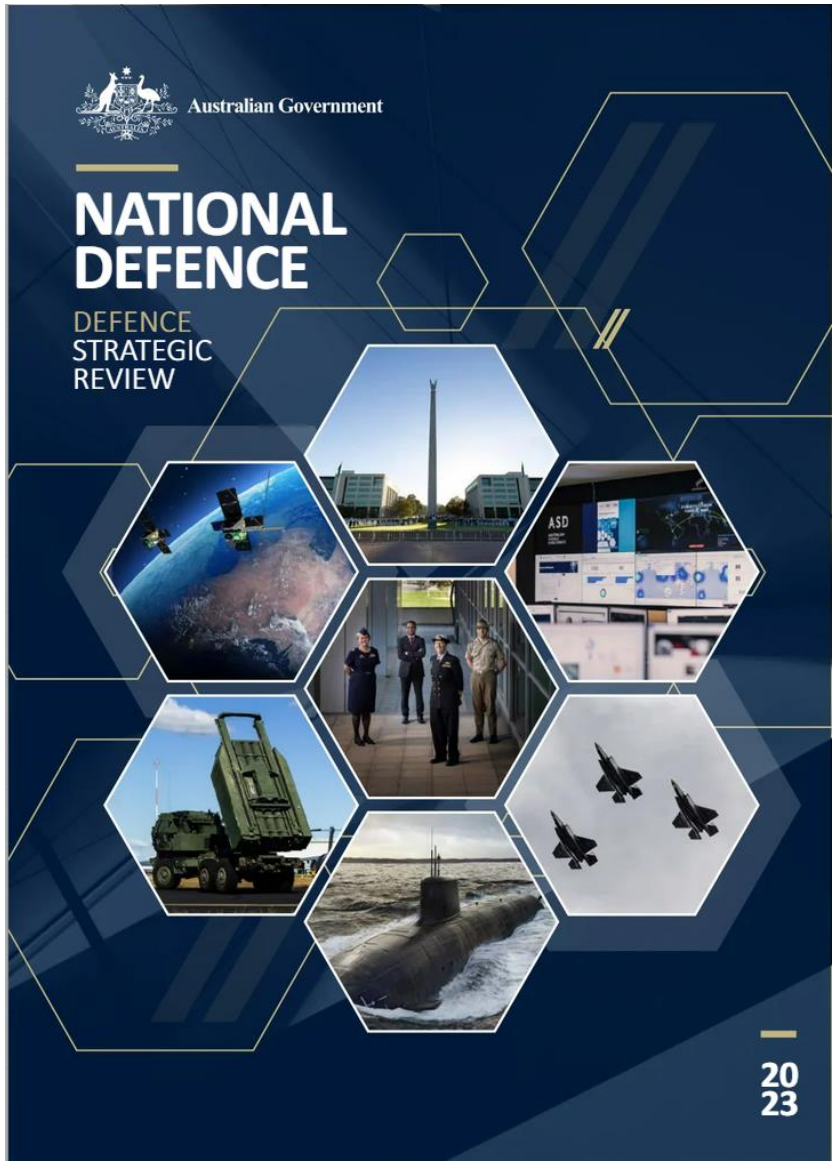
Disruptive weapon effects

Remote undersea surveillance

Operating in CBRN environments

Battle-ready platforms

AUKUS and the DEFENCE STRATEGIC REVIEW



Chemical, Biological, Radiological and Nuclear (CBRN) Defence Program

DEFENCE

Support to Operations

- Support to force sustainment
  - training, advice etc

Support to acquisition programs

- Land 2110 – Australian Defence Force CBRN capability upgrade
- Land 3025 – specialized CBRN regiment
- CBRN requirements for platform acquisitions

R&D - short/medium term in direct support of ADF

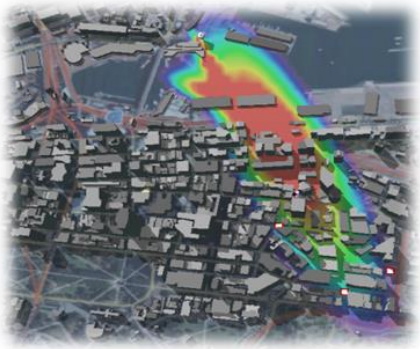
- longer term – capability edge for ADF

NATIONAL SECURITY

Threat assessments

Support to major events

- large sporting events (Olympics etc)
- other significant events



DSTG Radiological and Nuclear Defence R&D

Pre-event search for radiological sources in complex environments

complex physical environments (urban) | contested environments | signals weak against background

Focus is on finding the location of radioactive material from as far as away as possible in as short a time as possible.

Post-event operations in radiologically contaminated environments

Focus is on protecting personnel by establishing the extent of contamination from as far as away as possible in as short a time as possible

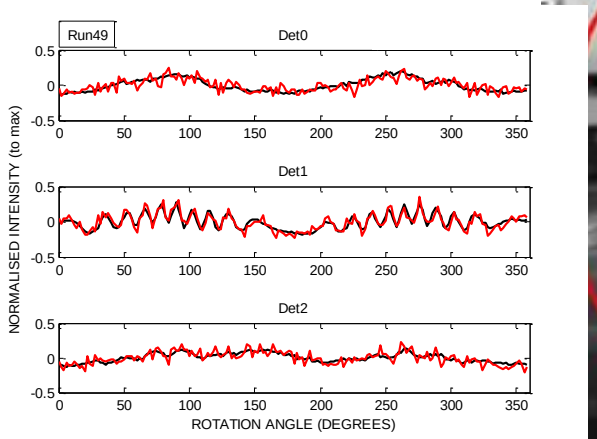
A proliferation of new sensing and search paradigms, including UAV/UGV sensors and standoff radiation imagers, are becoming commercially available. For ADF, introduces issues around:

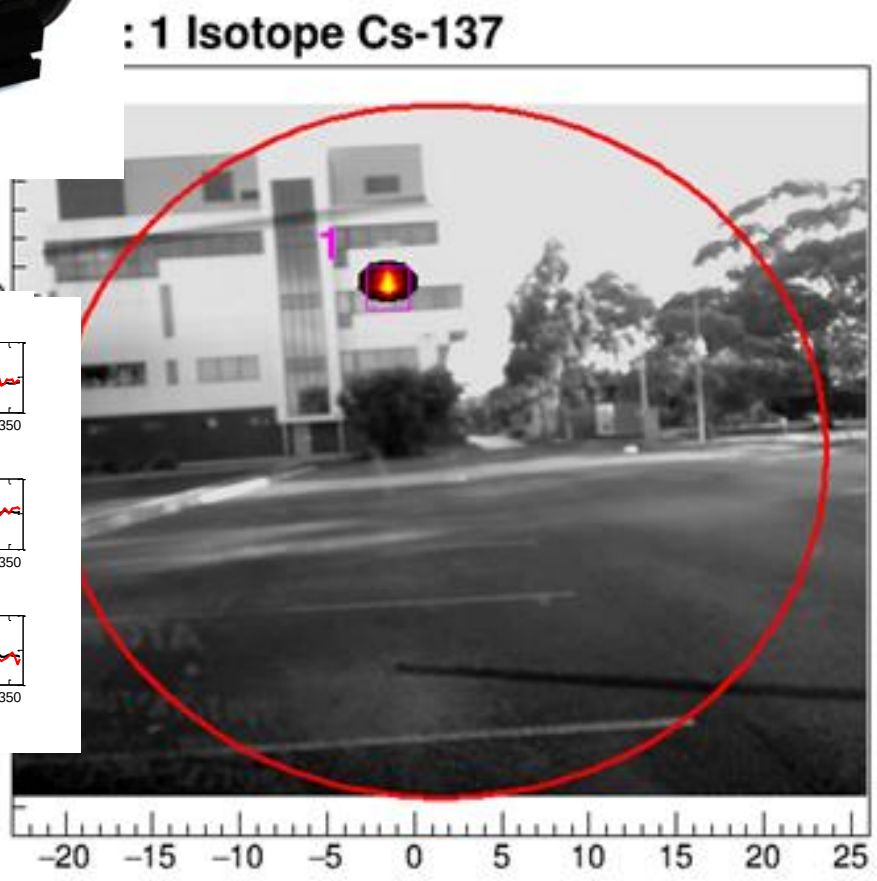
- Smart Buyer/User – what User requirements and Test & Evaluation standards are needed to guide acquisition
- Integration – how will new capabilities interface with existing rad search capability
- Data complexity – how will operators and decision-makers utilise the rich data from new detection systems

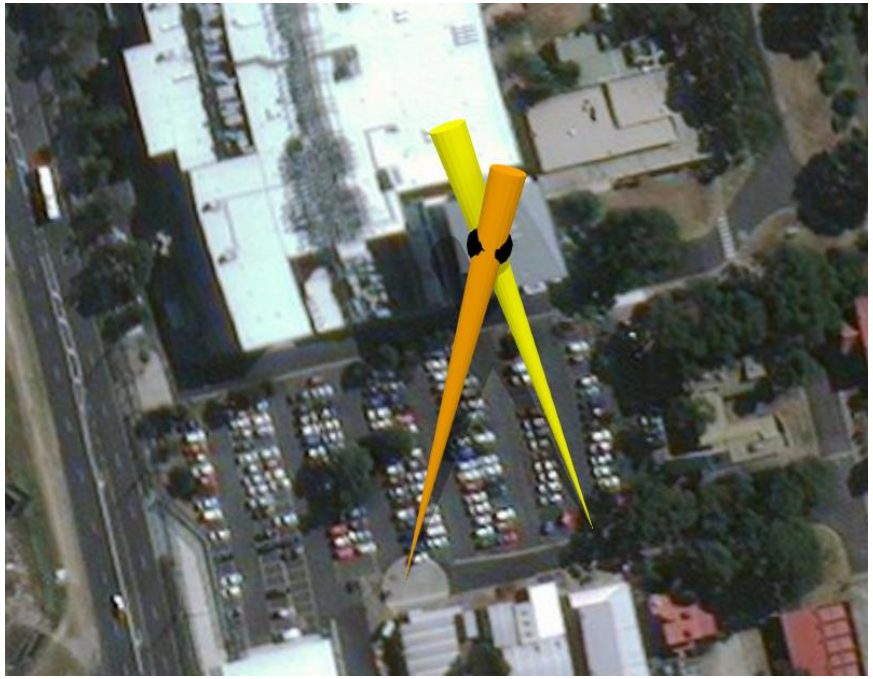
Tackling these problems via two interlinked work programs:

- Development and assessment of concept demonstrator systems
- Development and employment of a synthetic radiation simulation capability

Development of capability demonstrators





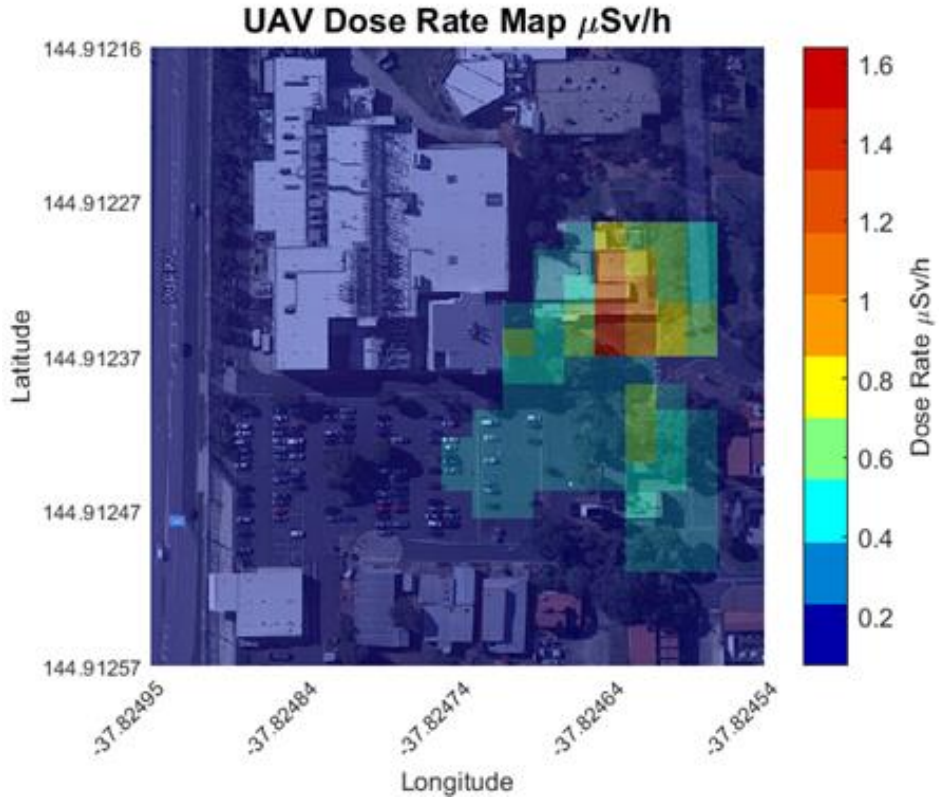


Development of a synthetic radiation simulation capability

Geant4 Radiation Simulation Development

- Simulation where experimental trials are too difficult, dangerous or expensive
  - Support detector development and evaluation
  - Test concepts of use for equipment
  - Assess new radiation source search methodologies

- Full synthetic environment requires
  - validated radioisotopic source terms
    - including realistic background distributions
  - transport of radiation through complex environments
    - realistic terrain and building models
    - efficiency methods to manage compute times
  - Detailed and validated detector models



Personnel protection from high intensity radiological sources

Time, Distance and Shielding are the primary protection principles

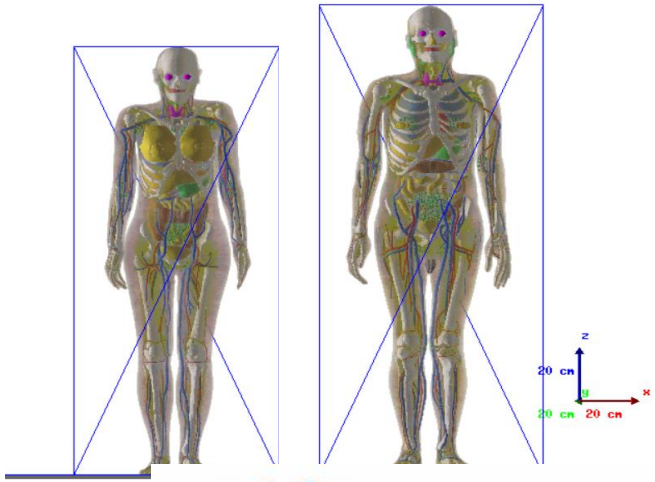
Where time and distance can't be applied, necessary to rely on shielding

- Close-in Render-Safe activities
- Constrained locations e.g. small watercraft

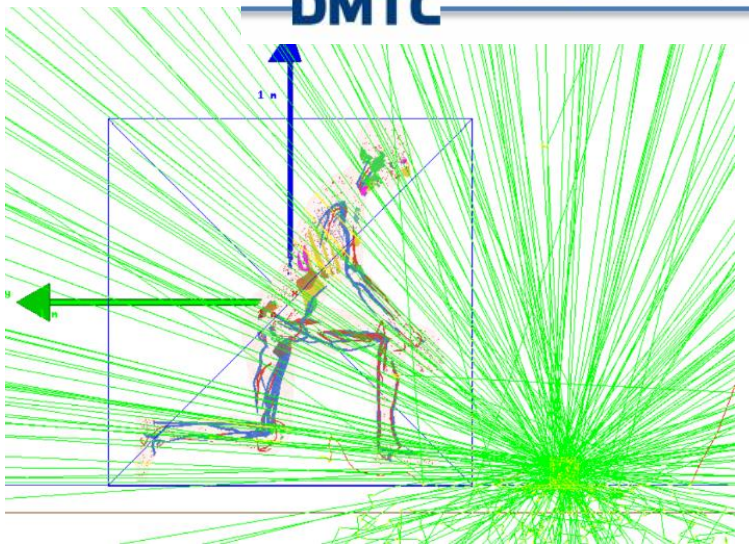
Program goals: assess the amount of personnel shielding required and the possible means to implement

Partnership with DMTC Ltd and University of Wollongong to assess the doses to internal organs using detailed human anatomical models and radiation simulation

- Estimate the Acute Radiation Sickness effects
- Determine optimal shielding to protect radiation-sensitive organs



CENTRE FOR MEDICAL RADIATION PHYSICS
UNIVERSITY OF WOLLONGONG AUSTRALIA
DMTC



DSTG in the CDM

- DSTG is a partner organisation in the CDM.

- Annual cash contribution to support research that is of interest and relevance to Defence.
  - Funding can support PhD students, internships, seed funding for pilot projects of up to $10,000 per proposal. Higher amounts will be considered.

- Funding is primarily aligned with the CBRN Defence and Operations in CBRN Environments.
  - An initial set of research priorities have been published to which applications can be aligned.
  - This is not a definitive list and other projects will be considered if they align with Defence research areas.

Radiological Defence Priority Themes

- **Neutron Detection and Detectability**
  - Neutron source and detection simulation: development and validation of models within Geant4
  - Directional detection / imaging of neutron sources
  - Spectral analysis
  - Fast neutron detection: alternatives to detection using thermal neutron detectors with thick moderators.

- **Computational Efficiency in Radiation Simulation**
  - Enhanced computational efficiency with no reduction in physics-modelling:
    - Statistical considerations are required but full physics models are used.
  - Reduced precision in the physics model:
    - Statistical completeness may be retained with sufficient speed.

- **Reconstruction and Sensor Data Fusion**
  - Combining information from multiple detectors (spectroscopic, directional, imaging etc) to enhance sensitivity/detection performance requires reconstruction/inference. Use experimental and/or simulated data to:
    - Explore the problem-space.
    - Generate reconstruction algorithms for currently used detection devices.
    - Extend existing reconstruction algorithms to consider multiple posed devices and heterogeneous systems.

Radiological Defence Priority Themes

- **Novel Detection Devices**
  - The domain of source search and survey is emerging from a simplistic paradigm consisting of disconnected point-like measurements to the development of technologies such as gamma-ray imaging and networked devices that offer enhanced situational awareness, reduced search times and increased detection distances.
  - Projects under this theme would explore the potential for novel detection devices for use in a Defence or National Security context.

- **Standoff Detection of Alpha/Beta Radiation**
  - UV Radioluminescence has been identified as a potential means for detecting alpha and beta radiations at standoff distances, well in excess of their range in air. But the radioluminescence signature has not been well characterized for use within radiation transport simulations. Projects under this theme could investigate:
    - Characterisation of the UV radioluminescence signal
    - Development and validation of Geant4 models of the radioluminescence signature

Working for Defence / DSTG

- Defence offers a wide range of entry level career pathways and programs for students, including Graduate Pathways.

  https://www.defence.gov.au/jobs-careers/graduate-program

- Jobs working for Defence (incl. DSTG and the ASA) are available in the Australian Public Service

  https://www.defence.gov.au/jobs-careers/defence-aps-jobs

  https://www.apsjobs.gov.au

  - Selection is based on the abilities, qualifications, experience, standard of work, that are relevant to the requirements of the job.
  - This criteria will be expressed in the applicant information pack.

Working for Defence / DSTG

- In the APS jobs are structured around Levels with an associated Work Level Standard related to the responsibilities/duties of the role.

  - S&T 3 – 4 (APS 4 – 6): Typical entry point for Graduate/PhD. Approx. equivalent to Post-Doc Researcher/Associate Lecturer
  - S&T5 (EL 1): Approx. equivalent to Lecturer/Senior Lecturer

  - S&T6 (EL 2): Team/Discipline Leader, lead small team of staff
  - S&T7 (EL 2): Group Leader, lead multiple teams
  - S&T8 (EL 2): MSTC/Branch Leader, lead multiple Groups

  - Senior Executive Service, SES: Chief of Division, Chief Defence Scientist

Thank you

dst.defence.gov.au