Australian Government
Department of Agriculture, Water and the Environment

Using advances in technology for biosecurity risk detection

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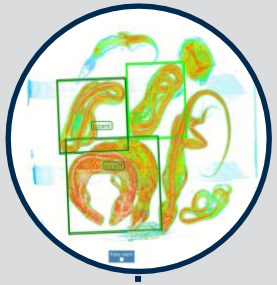
Pathway Policy, Cargo and Conveyances

Biosecurity Operations Division

Department of Agriculture, Water and the Environment

Emerging Technology Program



Wildlife Automatic Detection Algorithm

Biosecurity Algorithms, Software Networking

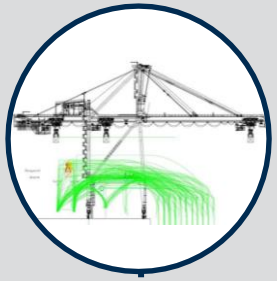
Pre-Screening of Passenger Baggage

Low Energy Xray for Seeds

Biosecurity Detector Dog Selection

New 3D x-ray (RTT) into an Air Cargo Facility

New 3D X-Ray (RTT) in Mail Centres



Automated Container Screening

Enhanced Marine & Freshwater Fish Screening

Hand-Held Hyperspectral Surveillance & Inspection Tool

Pyrethroid Residue on Internal Aircraft

AR/VR/3D Modelling for Training & Instructional Material

Hades-5 Vehicle Inspection Robot

RingIR Technology

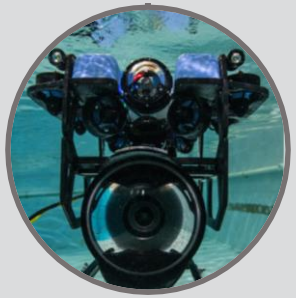
Environmental DNA (eDNA)

Spot the robotic dog

BMSB Artificial Intelligence App

Live Streaming – RealWear/Smart Glasses

Underwater ROVs to inspect biofouling



Our Investment in New 3D X-ray Technology

Technology Investment

3D Real Time Tomography (RTT) X-ray Unit

Decrease in threats entering Aust.

Detection of biosecurity risk items with 3D x-ray screening

Unlocking the potential

Automated detection algorithms for fruit, meat, seafood, plants and vegetables

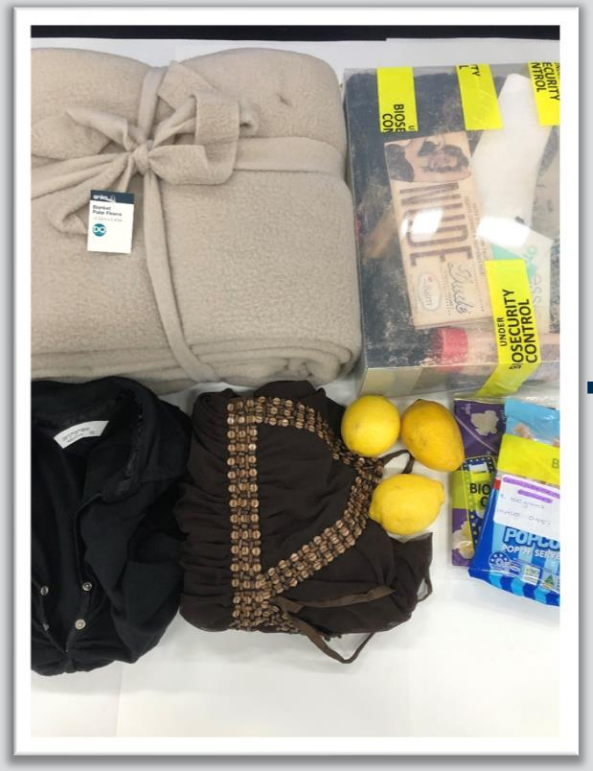
Rapiscan systems
An OSI Systems Company

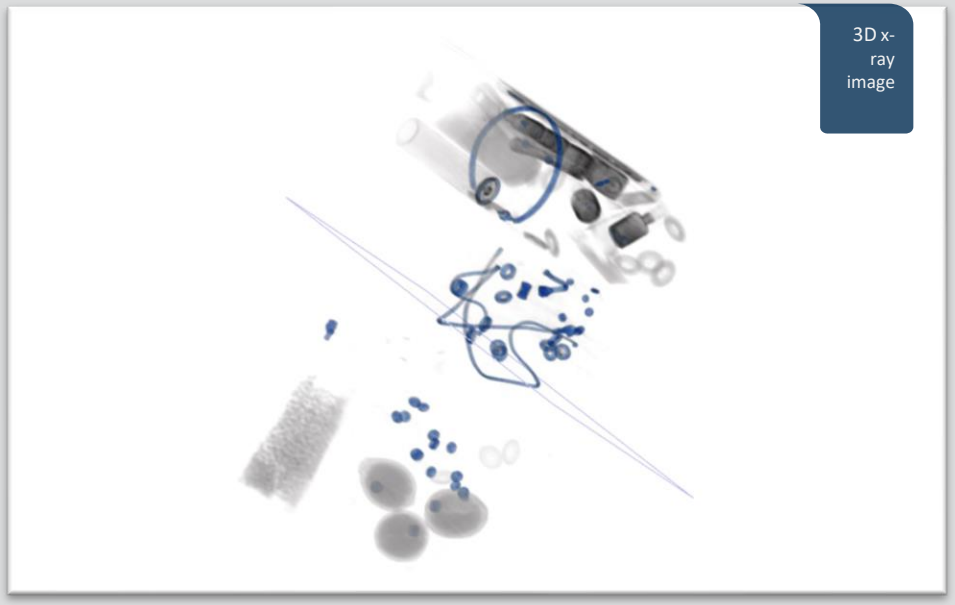
Our delivery partners

Ministry for Primary Industries
Manatū Ahu Matua

smiths detection
THE UNIVERSITY OF MELBOURNE
TARONGA CONSERVATION SOCIETY AUSTRALIA
Australia Post
BNE it all begins here
Australian BORDER FORCE
Synergy
MELBOURNE AIRPORT
AIRSIDE PROJECTS
ALSTEF GROUP

Our Investment in New 3D X-ray Technology





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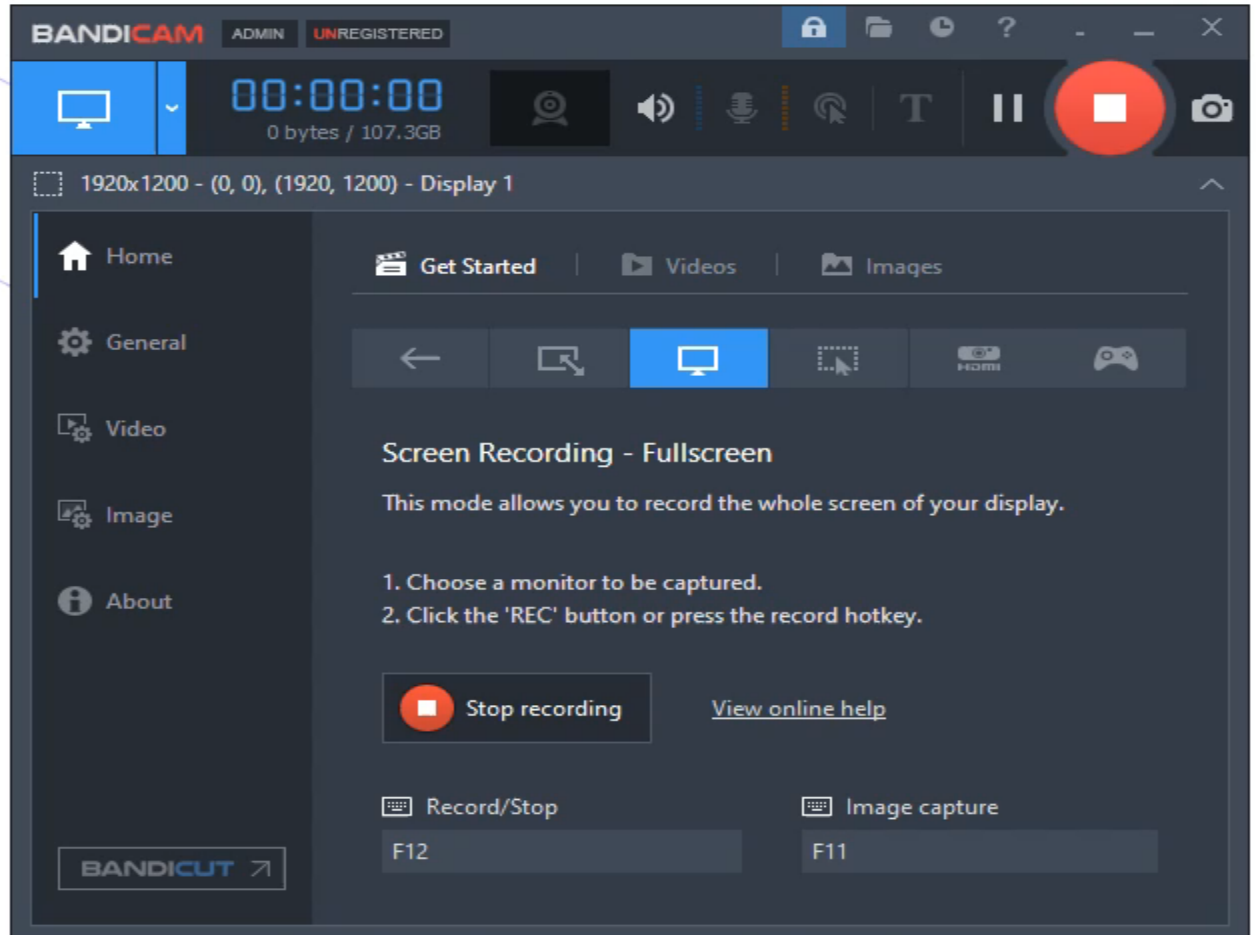
3D View



Algorithm Development

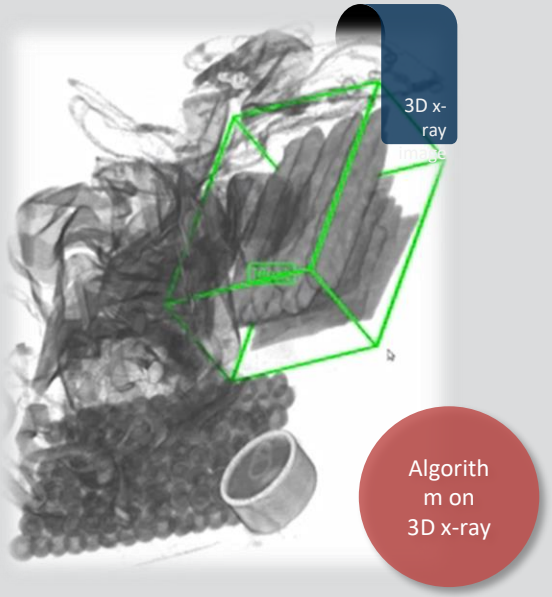
3D Algorithm Development

Current Algorithm Development

In partnership with NZMPI and Rapiscan we have developed algorithms to automatically detect biosecurity risks for:

Meat **Fruit**

Vegetables **Seafood**



Future Algorithm Development

Algorithms are now being expanded to incorporate automated detection of wildlife and trafficable animal parts such as:

Ivory **Rhino horn**

Turtle shell **Tortoise Shell**

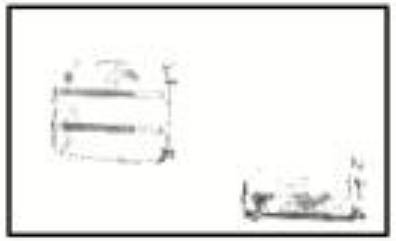
Activities Firefox Web Browser Thu 09:41

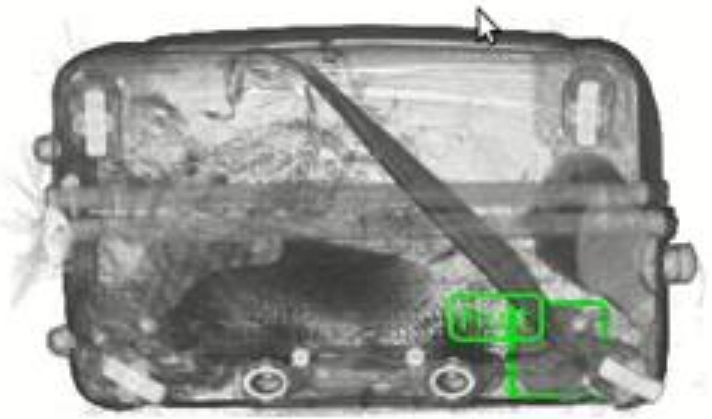
Malibu

https://localhost:8081/malibu-web/#/apps

Getting Started cQWER7890-

	Rapiscan systems	29/10/2020	09:41:29	11:06:35	1

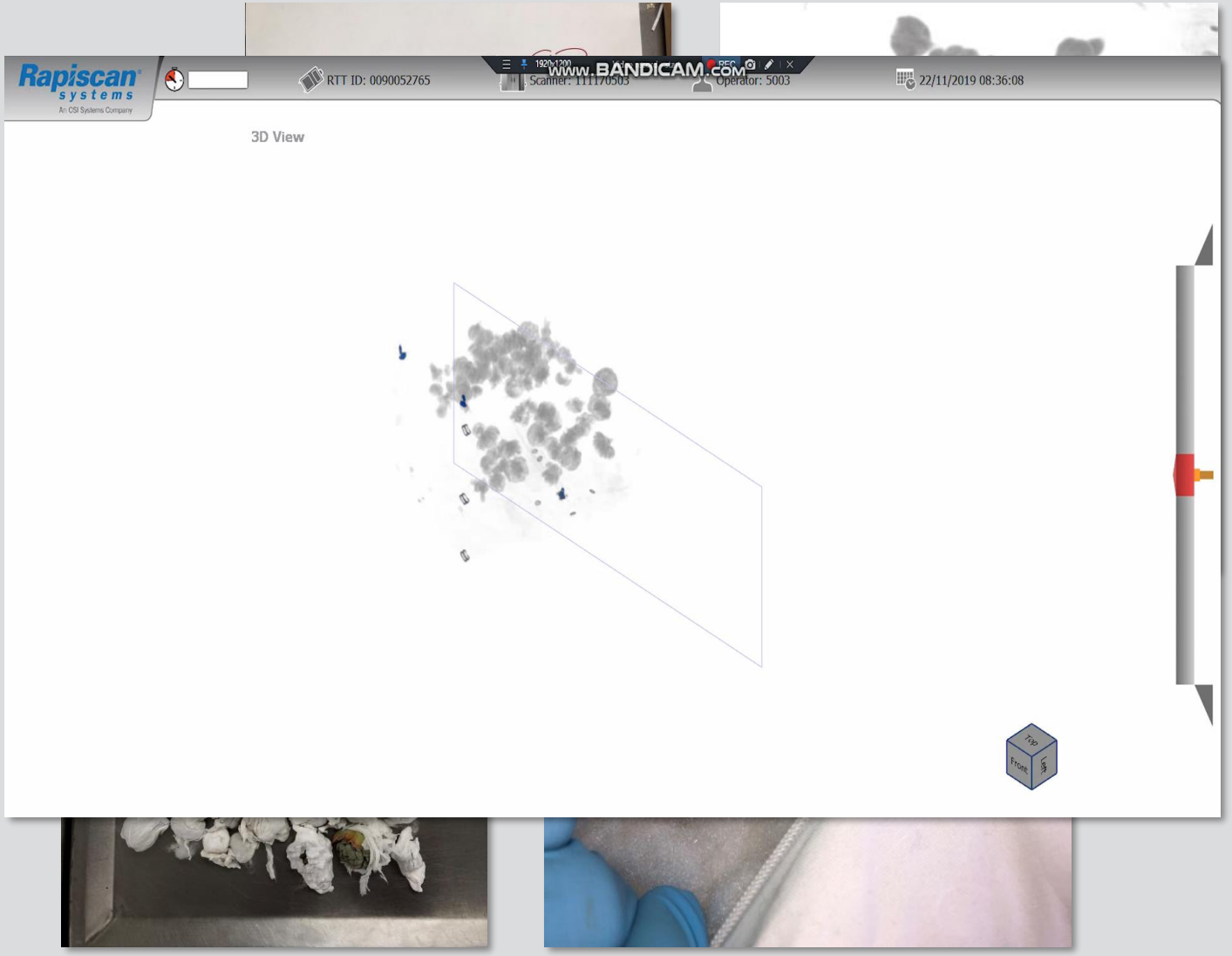




Concealed Succulents

The power of a 3D X-Ray

- In 2021 the 3D x-ray screened a parcel arriving from China labelled as ‘Clothes’.
- Following the initial 3D X-Ray scan the parcel was inspected and found to have 83 succulents concealed within decorative cushions.



3D Algorithm Development

Melbourne Jet Base Testing Facility

- An RTT 110 3D x-ray unit located at Melbourne Jet Base is being used to validate algorithms and build our image library.
- High risk commodities are scanned through the machine multiple times, in different positions, placed in bags and boxes with items of no concern.
- The more the commodity is scanned the stronger the algorithm becomes ensuring a higher rate of detection.

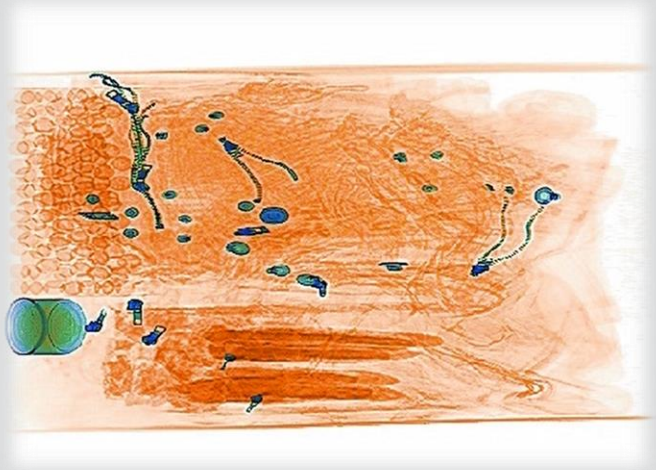
2D Algorithm Development

As well as our successful work on 3D x-ray, we continue to trial our 2D x-ray automated detection algorithms at our dog facility in Brisbane. The department is partnering with both Rapiscan and Smiths to inform our future 2D hardware and software strategy.

Rapiscan 927 DX 2D x-ray unit

- Trial commenced early 2021
- Building meat image library to provide data to inform algorithm development
- Meat detection algorithm is soon to be deployed on to the Rapiscan 2D x-ray unit

Our 2D X-ray Trial Machines help to develop algorithms for future deployment



Smiths 100 100 V-2IS 2D x-ray unit unit

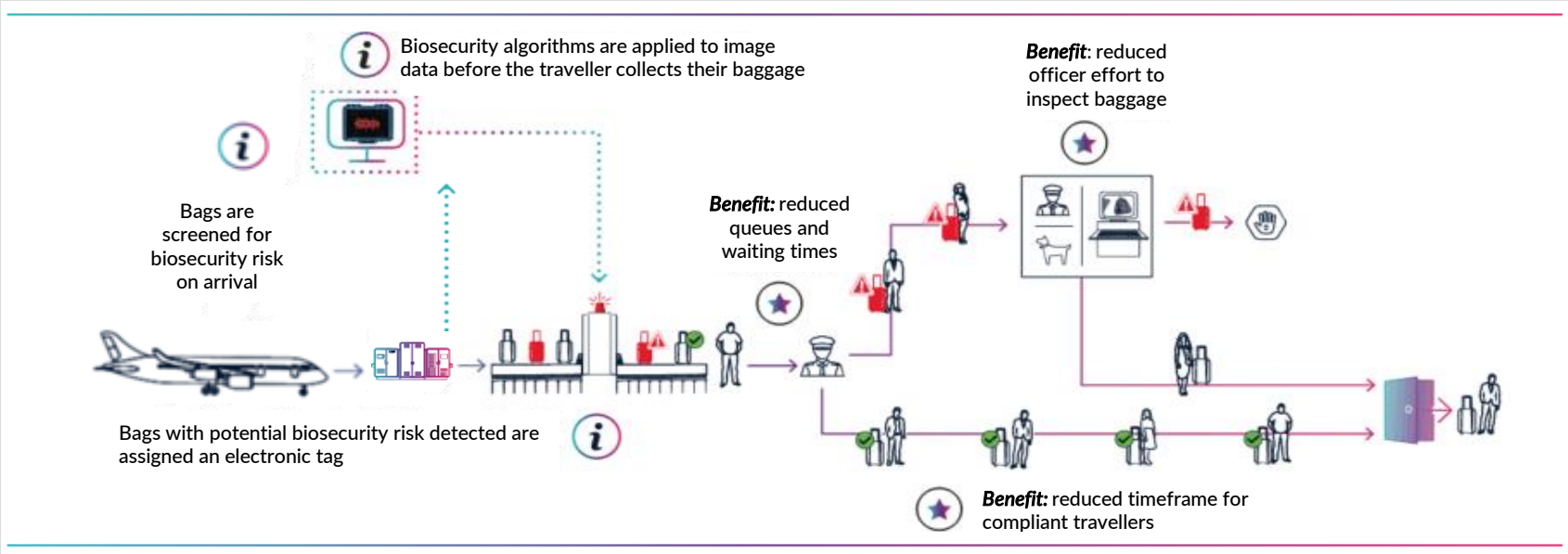
- The trial for the Smith's unit is in early stages of data gathering and validation
- Focus is on validating algorithms and building the image library

Passenger Baggage Pre-Screening Trial

Passenger Baggage Pre-Screening Trial

Onshore Pre-Screening

- Test onshore operations in 2 locations
- The onshore trial will screen hold baggage after arrival but prior to the passenger collecting their baggage
- As bags are unloaded onto the baggage handling system they will be scanned by the 3D x-ray unit
- 3D x-ray images will be sent to a control room where biosecurity officers will assess the contents for biosecurity risk material



Passenger Baggage Pre-Screening Trial

Concept and Design

Concept and design stage for installation of an RTT110 3D X-ray unit into Brisbane airport.

What's next:

- Detailed scoping of technology solutions
- Investigate baggage tracking concepts
- Concept of operations for remote screening and passenger flow

Installation of RTT110 3D X-ray unit into Brisbane airport.

3D X-Ray in Mail Centres

Our Investment in New 3D X-ray Technology

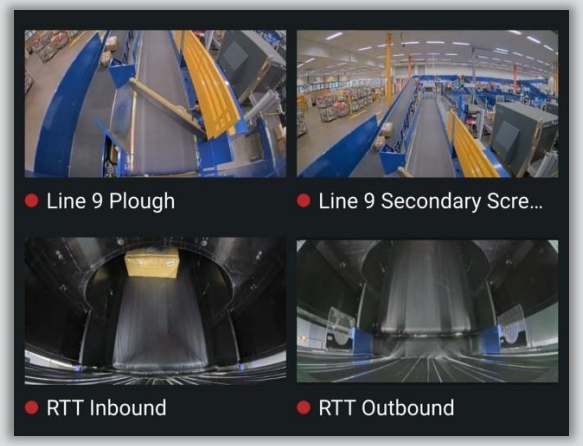
3D X-ray in Mail Centres

- The purpose of the project is to build on the early benefits that have been realised through existing RTT installations at SGF & MGF mail centres
- Three additional RTT 3D x-ray units will be installed at international mail centres
- The additional RTT units will further enhance and streamline the detection of biosecurity risks

Remote Screening

Sydney Gateway Facility

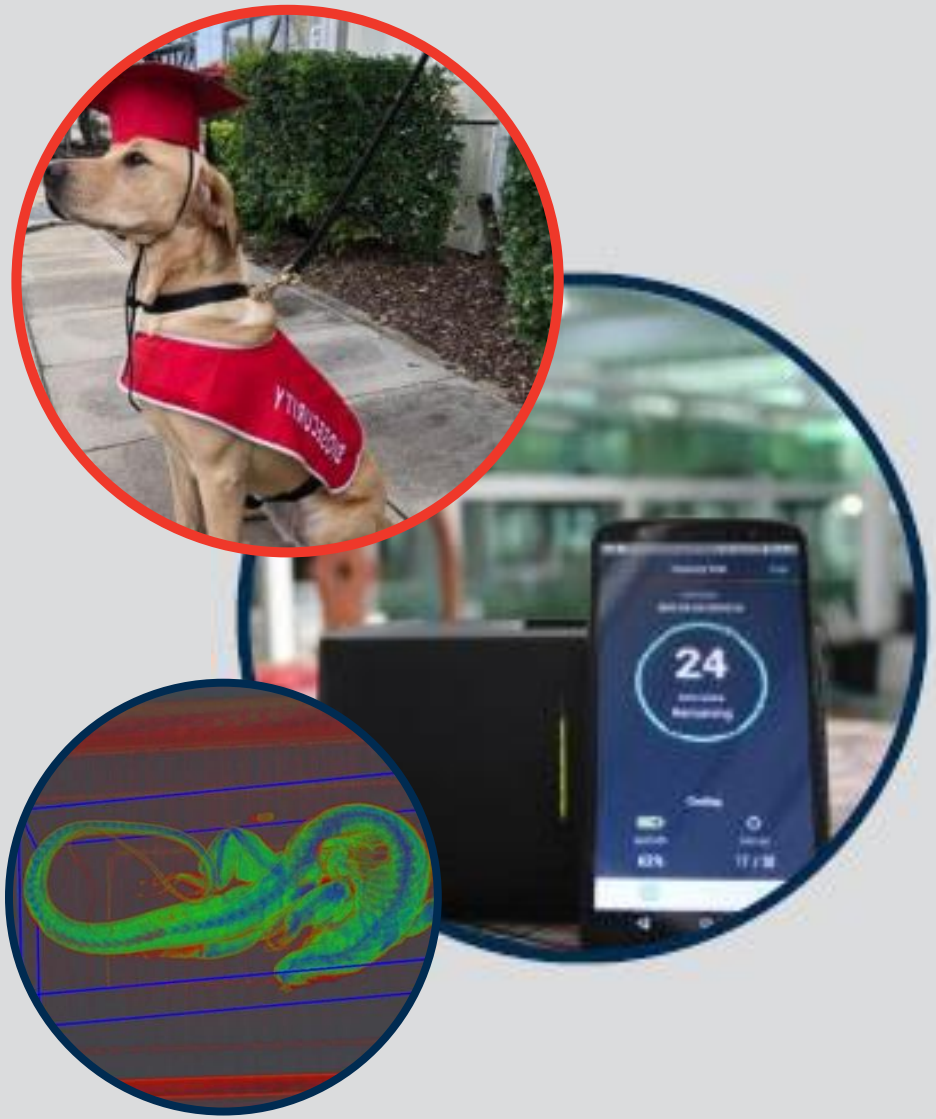
- Our first remote screening room has been set up at the Sydney Gateway Facility.
- Biosecurity Officers will have the ability to screen incoming mail without physically having to be on the operational floor.
- Screening rate increased over traditional screening method



New and Emerging Technologies

Biosecurity Innovation Program

The Biosecurity Innovation Program invests in new technologies and approaches to enhance Australia's biosecurity system.



BIOSECURITY INNOVATION

Low Energy X-ray for Seeds

Seed Automated Algorithm

- Current 2D or 3D x-rays are too high energy resulting in them not detecting small seeds.
- High energy x-ray is likely to penetrate through the item resulting in no image being produced.
- Low energy, high resolution x-ray technology is currently in stage three of the project.
- It is expected the prototype will be trialled at a mail gateway facility following the conclusion of phase 4.

Phase 1

Phase one successfully tested the prototype and proof of concept on a stand-alone unit.

Phase 2

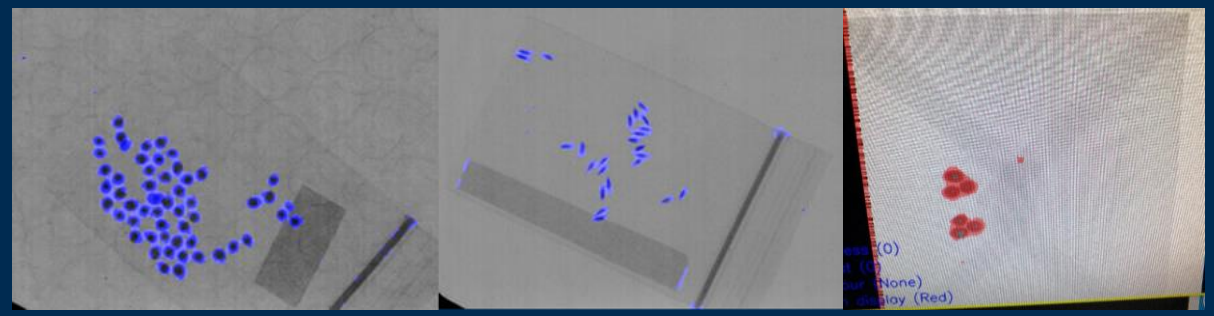
Phase two of the project had Rapiscan prove the concept of auto-detection of seed packets and their contents using video cameras, low energy x-ray and computer algorithms on a moving conveyor system.

Phase 3

Validating the bespoke solution to prove high algorithm efficacy rates with increased throughput levels.

Phase 4

Phase will deploy a full prototype unit at Melbourne Jet Base to test conveyors and robot pickers in a final trial. Currently scheduled to conclude in late 2022.



Hades-5Z Inspection Robot

TECHMATICS NZ
CUSTOM INSPECTION ROBOTS

Purpose

- Conduct vehicle (used and new) and used machinery inspections
- Reduce WHS risk for biosecurity officers
- Safer inspections for Biosecurity Officers

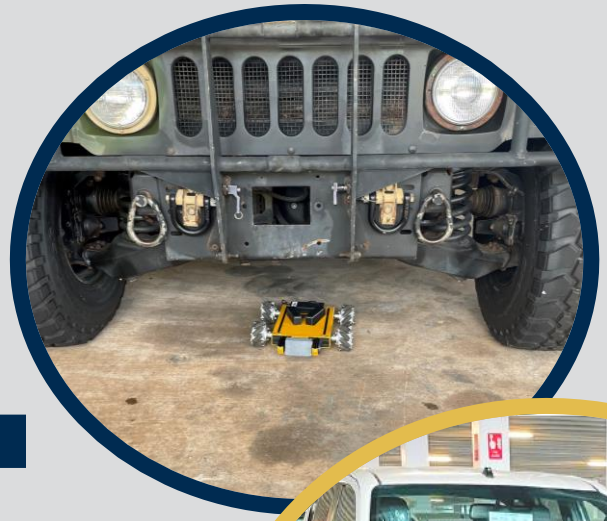
The Technology

- Remote-controlled device
- Fitted with both a thermal & high-definition camera
- Specialising in crawl space inspections

The Trial

The trial will test the robot's ability to:

- Maneuver across a range of surfaces
- Provide accurate images identifying biosecurity risk materials under a range of environmental conditions
- Undertake safer and more efficient inspections



RingIR

About RingIR

Detecting fumigants using real-time vapour detection

Phase 1 of this project confirmed that the RingIR technology can detect all three fumigants of concern - methyl bromide, sulfuryl fluoride and phosphine.

Phase 2 has commenced and is split into two sub-projects.

1. To develop a portable prototype to detect all three fumigants that could be trialled in our operations by 30 June 2022.

2. To test whether RingIR technology can be expanded to identify hitchhiker pests associated with containers.

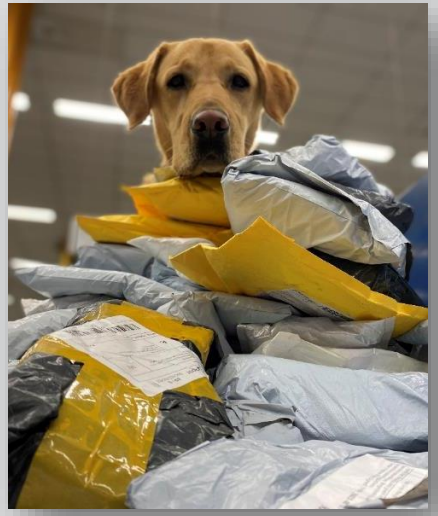
Benefits of RingIR

- Biosecurity officers can work in a safe environment.
- Reduction in delays caused by possible Photo Ionisation Detector false alarms.
- Reduction in unnecessary treatment of containers where no pests are present.

BIOSECURITY INNOVATION

Biosecurity Detector Dogs

Biosecurity Detector Dogs



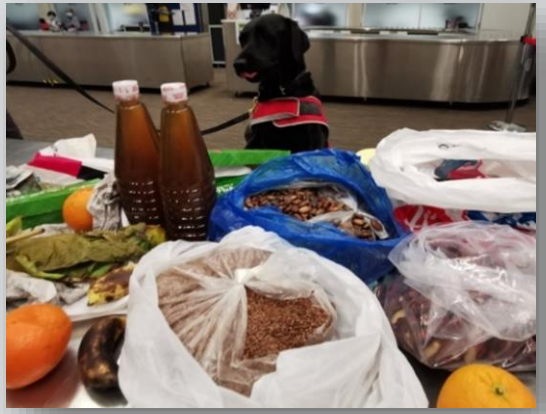
Detector Dog Fleet

- The current detector dog fleet consists of:
  - 42 Operational Dogs
  - 47 Handlers
  - 2 Dogs in training
- Latest dog to complete training “Finlay” is trialling a “Passive” response across all deployment scenarios.

Target Commodities

Detector dogs are trained to detect seven commodity groups, which are estimated to contain 200+ individual commodities:

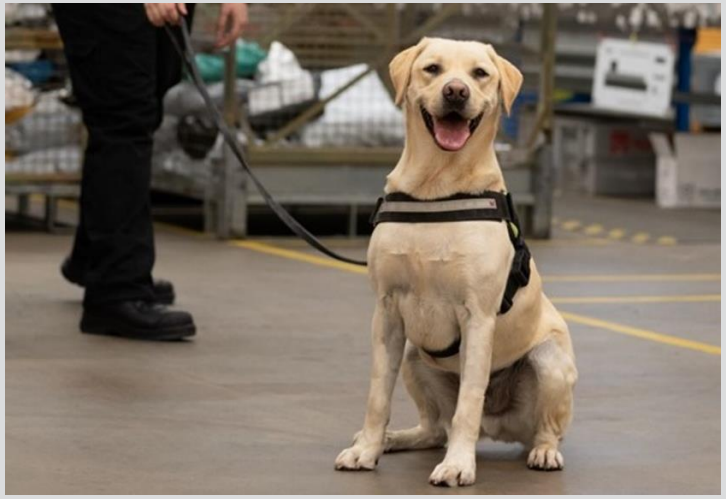
- Fresh fruit
- Fresh vegetables
- Fresh plant material (including cuttings)
- Viable seeds and bulbs
- Meat (excluding fish)
- Eggs
- Brown Marmorated Stink Bugs (BMSB)

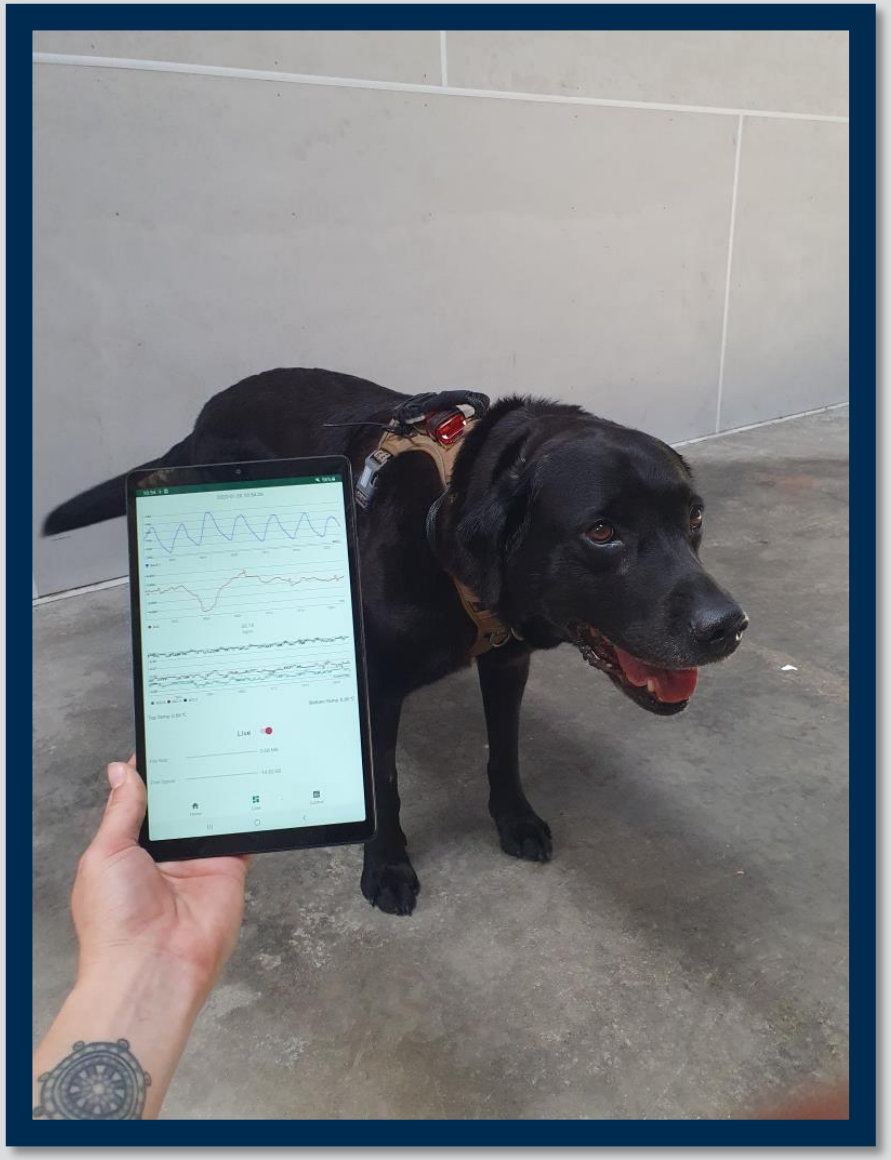


Detector Dogs Innovation

Detector Dog Innovation – Canine Character Assessment

- The department is partnering with the University of New England to identify the traits and behaviours inherent in our top performing detector dogs.
- This work will inform the development of future detector dog selection processes.
- Researchers fit each dog with a specialised harness equipped with a variety of sensors, including an accelerometer and ECG monitor.





Velvet – the first dog to sniff out BMSB

Sniffing out BMSB through the cargo pathway

- In 2018 we began an innovative project with the University of New England to train our detector dog fleet to sniff out Brown Marmorated Stink Bug (BMSB).
- In November 2021 Velvet was the first detector dog to find a live BMSB.
- During a cargo inspection of over 800 vehicles and over 150 bulk break items Velvet sniffed out a single live BMSB on an off highway Caterpillar Truck.
- This live sample was confirmed as a BMSB and subsequently used to train and test the entire Brisbane detector dog fleet.

Questions

Dog Room
NO ACCESS
AUTHORISED
PERSONNEL ONLY
MAXIMUM
ROOM CAPACITY
PERSONS
BIOSECURITY