Australian Government
Inspector-General of Biosecurity

Efficacy and adequacy of department's X-ray scanning and detector dog screening techniques to prevent the entry of biosecurity risk material into Australia

REVIEW REPORT NO. 2022–23/03

Cataloguing data

This publication (and any material sourced from it) should be attributed as: Inspector-General of Biosecurity 2022, *Efficacy and adequacy of department's X-ray scanning and detector dog screening techniques to prevent the entry of biosecurity risk material into Australia, Inspector-General of Biosecurity*, Canberra, [July] 2022–23/01.

ISBN 978-1-76003-544-0

This publication is available at igb.gov.au.

Inspector-General of Biosecurity
c/o Department of Agriculture, Fisheries and Forestry
GPO Box 858, Canberra ACT 2601
Email InspGenBiosecurity@agriculture.gov.au
Web igb.gov.au

Acknowledgements

Due Diligence Australia, Ms Clare Hamilton, Dr Carina Moeller, Dr Nazia Nisar and Ms Julia Darcy assisted the Inspector-General in this review. The Inspector-General gratefully acknowledges cooperation and advice of the Australian Government Department of Agriculture, Fisheries and Forestry.

Image credits

Cover image courtesy of Department of Agriculture, Fisheries and Forestry.

Contents

Tables

Figures

Executive summary

This review examined whether the Department of Agriculture, Water and the Environment's X-ray scanning and detector dog screening techniques are adequate and effective for preventing the entry of biosecurity risk material into Australia. After examining the department's evidence, the Inspector-General made 34 findings concerning issues the department should address and 14 recommendations for improvement for the Director of Biosecurity's consideration.

A critically important aspect of Australia's preventative biosecurity system is its ability to identify at-border biosecurity risk goods and the risks associated with the way those goods are transported to Australia – for example, containers, packaging, aircraft, and vessels. Difficulties in identifying biosecurity risks in different pathways (travellers, mail, conveyances, sea cargo and air cargo) arise due to the nature of the biosecurity risks; the volume of goods; limited pre-arrival information in non-commercial pathways; and the difficulties involved in identification and inspection.

For the past 3 decades, the department has used detector dogs and X-ray to identify potential biosecurity risk material at the border in and on imported consignments, as well as pre-arrival data-based profiling and manual inspection by biosecurity officers. For the most part, detector dogs and X-ray have been deployed in 2 risk pathways – travellers and mail. We have limited advance information about goods that come through these pathways, so high-volume screening must be used.

During this review, the Inspector-General was given evidence of planning and implementation of a number of major reforms under the department's Commonwealth Biosecurity 2030 strategy. These reforms will address various aspects of the biosecurity intervention in the traveller and mail risk pathways. Initiatives include:

- improved risk engines to enhance risk profiling and targeting
- advance data accessibility for incoming mail
- a major investment in a digital passenger declaration process
- digital availability of risk-related information and data capture for frontline biosecurity officers in international airports.

It is very positive to see that the department is engaging productively in these initiatives – noting that together they will create a significantly different operating environment for X-ray and detector dog deployment. These initiatives are likely to lead to substantial total benefits to all border security agencies, efficiency of use of biosecurity officer resources, and data capture and risk profile building. There will also be benefits for international travellers, airport operators and mail and express freight operators.

Noting these very positive developments, in this report the Inspector-General remains focused on assessing the department's demonstrated capability to mitigate biosecurity risk effectively and efficiently through deployment of detector dogs and X-ray machines. To the extent that evidence from the department enabled it, the Inspector-General has assessed the likelihood that these detection technologies, used effectively, will sustain an appropriate level of biosecurity risk reduction in the traveller and mail pathways in the future.

Detector dogs are a frontline detection capability for which there is no technological alternative. Dogs can be trained to detect commodities and specific insect odours and to screen items as diverse as envelopes, bags, cars, mining machinery, and warehouses. The department has utilised detector dogs since 1992. One of the major strengths of detector dogs is that they can be quickly deployed to many different biosecurity operating environments.

The department sources its detector dogs (currently the Labrador retriever breed) through the Australian Border Force (ABF) breeding centre – a centre of excellence in breeding and early development of detector dogs. This is a valuable whole-of-government asset. Given the significant lead times and costs in meeting current and future supply of detector dogs, more formal arrangements with ABF would be beneficial.

The department undertakes its own specialist detector dog and handler training and continues to explore the boundaries of detector dog capabilities in biosecurity, particularly in insect detection. This is very positive. Rigorous analysis of research and development (R&D) outcomes has shown that detector dogs are a highly adaptable detection tool. However, R&D must be translated into operational capability. For this to be successful, the department will need improved processes which integrate the different detection methods into risk mitigation strategies and operational practices.

The best available data to analyse the effectiveness of the department's use of detector dog deployment comes from immediately prior to dramatic impacts of the COVID-19 pandemic. This analysis identified that the department's detector dogs were under-utilised, particularly in the traveller pathway. With the return of high levels of international travel, the department needs to reconsider its operational deployment strategies. It should focus on maximising the detection of biosecurity risk material based on the most effective deployment of detector dogs. This may mean deploying a higher number of dogs in some regions and pathways and none in others, noting that the Inspector-General has not seen sound evidence to support detector dog deployment in environments where the minimum utilisation standard cannot be achieved. It should also be noted that there is no data or analysis to support arguments put forward for the 'deterrent' and 'promotional' effects of detector dogs on traveller compliance.

Most of the 2D X-ray fleet is deployed in the air traveller pathway, followed by mail and air cargo. Over 60% of the 29 2D X-ray units were commissioned in 2001. Despite the age of the 2D X-ray fleet, the Inspector-General was advised that there is no difference between the hardware of the unit procured 15 years ago versus that of the new units. Also, the department had no plans to replace the existing fleet – instead, it is undertaking ongoing user interface upgrades and maintenance work. The department has undertaken several projects to improve the useability of 2D X-rays, including updated training, instructional material, safety measures and early-stage exploration of biosecurity algorithms to automate screening and detection.

The Inspector-General notes that, in the documents submitted to this review, there appeared wto be a tendency to over-emphasise 3D X-ray as the primary detection tool. 3D X-ray is a new technology option that is still in its R&D phase. It is increasingly used in transport security and may eventually prove a suitable technology solution for certain biosecurity operating environments. There has been a very successful promotion campaign for 3D X-ray as a proof-of-concept (POC) technology. The Inspector-General appreciates the conceptual thinking and potential benefits of an automated high-speed screening capability to mitigate at-border biosecurity risk in selected pathways. It is also acknowledged that the investigation of 3D X-ray technology has led to other complementary R&D projects. For example, approximately $1 million to date has been expended on a new low-energy X-ray screening tool specifically for seeds. The project aims to develop technology that can reliably image small volumes of seed in mail, given it is difficult for current 2D and 3D X-ray units to do this.

While it is important that the potential benefits and deployment options of 3D X-ray are fully explored, it is essential that minds and resources are not diverted from optimising the biosecurity outcomes from 2D X-ray units and detector dogs. This is because evidence to the Inspector-General indicates that the best overall biosecurity risk mitigation will come from optimised deployment of 2D X-rays and detector dogs and parallel development and increasing, targeted deployment of 3D X-rays. It is evident that detector dogs and 2D X-rays will continue to play an important role in biosecurity risk management in the mail and traveller pathways, and a secondary role in parts of the cargo pathway, over the foreseeable future. The department must continue to maximise the detection performance and enhance the deployment strategies of these tools. To optimise biosecurity risk mitigation on a risk-return basis, it is likely that future operating models will involve a combination of different types of technology to suit specific operational requirements.

The analysis underpinning the performance of 3D X-rays has lacked the rigour that was evident in other aspects of the program. Evidence to the Inspector-General indicates that 3D X-rays may have been prematurely deployed, particularly given that the Biosecurity Algorithm, which enables automated detection and increased processing speeds, has not been delivered. To date, operationally deployed 3D X-ray machines have been used in essentially the same manner as the 2D X-rays they replaced.

The department must ensure that, in addition to championing this new technology, it more strongly supports the modelled biosecurity outcomes and progresses towards them. For example, on the evidence available to the Inspector-General, there does not appear to have been appropriately detailed process modelling for the deployment of 3 additional 3D X-rays in mail gateway facilities and a POC trial in air cargo, where X-rays are currently not universally used.

A full and impartial assessment of the 3D X-ray capability should be conducted so that it can be evaluated for its suitability for the range of likely applications. With further 3D X-ray machines becoming operational by early 2023, the department needs to review its current 3D X-ray program and how this new technology will complement the proven but under-exploited 2D X-ray and detector dog capability. This review will need to address infrastructure, mail presentation, concept of operations, technology, and joint operational use of facilities; and be supported by a rigorous performance and return on investment (ROI) analysis.

The department must also perform rigorous analysis of the performance of its existing detection tools, R&D projects and operational models and then develop nuanced operational deployment plans that maximise biosecurity detection performance, relative to the estimated volume of biosecurity risk material in each pathway. In this respect, the Inspector-General emphasises the importance of understanding and applying preventative biosecurity performance (risk-return) and not simply activity performance (resource-return).

The Inspector-General does not suggest that 3D X-ray detection should not deployed for collective border security purposes at all new international airport development and major redevelopments, and new mail gateway facilities, particularly once the Biosecurity Algorithm is available. If the 3D X-ray detection technology platform is used in an integrated way, it will expand the immediate and potential future use of the 3D X-ray machines in protecting Australia from a diversity of threats.

For 3D X-ray to be used successfully, scanning and detection must be automated using highly accurate and reliable algorithms; and facilities will need the physical capability to handle the potentially much larger quantity of risk items identified. In the Inspector-General's evaluation of available evidence, the most critical component of the 3D X-ray program is the Biosecurity Algorithm development project. The Biosecurity Algorithm includes component algorithms for meat, seafood, fruit, vegetables, and other plants. An algorithm is also in development for wildlife (a separate multi-million-dollar project). For the 3D X-ray to achieve an acceptable ROI, the Biosecurity Algorithm will need to be used to automate detection and routing of selected risk material. After 3 years of development, an alpha-version of a Biosecurity Algorithm is being deployed into the operational environment for ongoing research. At the end of the current R&D phase, a fully operational Biosecurity Algorithm, covering all high-risk biosecurity material that could operate in a fully automated capacity, will be needed.

Several previous Inspector-General reviews have noted that program and project management within the Biosecurity Group has been inadequate. In multiple reviews the Inspector-General has recommended that the department increase its focus on these capabilities. The Inspector-General has seen strong recent improvements in program and project management in the Biosecurity Group, particularly within the Biosecurity Operations Division (BOD). This is a much-needed development given the breadth of program reform activity currently underway, noting that effective project management must go beyond getting the project implemented and must include rigorous gateway decision-making (including go/no-go performance decisions).

As the Inspector-General has observed in other recent reviews, the department's early work on development and deployment of advanced detection technologies has been hampered by the historical near-absence of continuous improvement strategic policy and delivery plans and good-practice program and project implementation methodology. This weakness has been exacerbated by short-term (often narrowly focused) budget allocations and staff turnover for key biosecurity personnel who have various levels of strategic and operational responsibility. The department must maintain and strengthen its current significant efforts to substantially address these organisational risks if it is to effectively deliver the sustained level of biosecurity risk mitigation necessary to protect Australia in the continually evolving biosecurity threat and risk environment.

1. Recommendations

Recommendation 1
The department should subject its current and future mail and traveller operating models to more rigorous operations research analysis as a priority.

Recommendation 2
The department should prepare multi-year resourcing plans to support current and future demands for detector dogs. The plans should include advanced formal commitment by the department to take at least the number of dogs needed to maintain the approved size of the dog fleet.

Recommendation 3
The department should finalise the supply of detector dogs annex to the Department of Agriculture, Fisheries and Forestry / Australian Border Force memorandum of understanding by December 2022.

Recommendation 4
The department should maximise detection outcomes by applying a cross-pathway and multi-detection technology perspective to the redeployment of existing and new detector dogs.

Recommendation 5
With the resumption of international traveller movements post COVID-19, the department must lift detector dog utilisation in the traveller pathway. If current traveller pathway deployment models cannot deliver adequate detector dog utilisation then alternative models need to be employed, either through a national process or as directed by airport-based operational risk managers.

Recommendation 6
Before traveller numbers resume to pre-COVID levels, the department should undertake a formal operational test of its traveller screening, detection and leakage survey functions to ensure their efficacy.

Recommendation 7
The department's traveller pathway assurance dashboard should include focus on understanding and evaluating the relative success of the department's risk-return measures additional to the efficiency of its resource deployment.

Recommendation 8
The department should seek to deploy its detection tools more actively and flexibly in the screening of travellers until data and systems enable a high level of effectiveness of cohort profiling.

Recommendation 9
The department should strengthen its use of noncompliance effectiveness (NCE%) reporting as the key measure of risk-return effectiveness in designing and managing the preventative biosecurity system. While activity performance (resource-return) has its place, it is not an effective measure in understanding the department's impact in mitigating the biosecurity risk.

Recommendation 10
The department should establish clearer processes for the consideration and integration of new or enhanced detector dog detection capabilities into operational biosecurity risk management.

Recommendation11
The department should develop a comprehensive metrics plan and data collection strategy to ensure availability of the data required to conduct a performance analysis of the component algorithm trials.

Recommendation 12
Consistent with recommendations 1 and 10, the department should complete a review of the technical and infrastructure outcomes being evaluated across POCs, to optimise the collective learnings from 3D X-ray testing across the express air cargo and mail pathways.

Recommendation 13
In order to optimise future decision-making and return on investment on the substantial capital and operational investment in 3D X-ray technology, the department should complete an independent analysis of the relative performance of the department's suite of detection technologies, including a detailed return on investment analysis.

Recommendation 14
The department should review legal questions relating to the department's current use of detection technology, proposed future use, and operational impediments stemming from its use; and, where necessary, pursue appropriate legislative amendments and procedural updates.

Mr Rob Delane

Inspector-General of Biosecurity

07 July 2022

2. Assessment summary

2.1 X-ray detection

Measures in place	Assessment	Recommendation no.
1. Biosecurity authorities to operate		
a. Legislation	Unsatisfactory	14
b. Memoranda of Understanding	Optimal	7
c. Facilities and data access	Marginal	11, 13
2. Core capabilities		
a. System strategies, operating plans, continuous improvement processes	Marginal	1, 5, 6, 10, 13
b. Current and future technology capability	Marginal	11, 12, 13
c. Government and industry cooperation	Optimal	
d. Resource levels, distribution and agility	Optimal	
e. Staff competency	Optimal	
f. Information management	Unsatisfactory	7, 9, 11
3. Pre-border controls		
a. Automated profiling accuracy and usage	Marginal	5, 7
b. Other intelligence informing strategies and tactics	Marginal	4, 5, 8, 11
4. Border controls		
a. Engaged industry partners	Optimal	
b. Passenger declarations	Optimal	
c. On-arrival X-ray screening processes	Marginal	4, 5, 8
5. Audit and verification and assurance activities	Marginal	1, 12
6. National consistency and regulatory maturity	Marginal	1, 14
7. System performance – intervention and leakage data, etc.	Marginal	6, 7, 9, 13
8. Implementation of relevant IIGB/IGB/internal improvement recommendations	Optimal	
9. Handling of issues and ideas reported by frontline officers and industry	Optimal	
10. Credible future scenarios for X-ray detection deployment	Unsatisfactory	1, 11, 12, 13

Note: The Inspector-General of Biosecurity applied 3 assessment ratings: 'optimal', 'marginal' and 'unsatisfactory'. The overall assessment rating for each measure, if not otherwise specified, integrates the ratings for sub-items.

2.2 Detector dogs

Measures in place	Assessment	Recommendation no.
1. Biosecurity authorities to operate		
a. Legislation	Unsatisfactory	14
b. Memoranda of Understanding	Marginal	3
c. Facilities and data access	Optimal	
2. Core capabilities		
a. System strategies, operating plans, continuous improvement processes	Marginal	5, 6, 8, 10
b. Current and future detector dog capability	Optimal	
c. Government and industry cooperation	Optimal	
d. Staff competency	Optimal	2, 4, 5, 8
e. Resource levels, distribution and agility	Marginal	9, 11, 13
f. Information management	Marginal	
3. Pre-border controls		
a. Automated profiling guiding detector dog use	Marginal	5, 8
b. Other intelligence informing strategies and tactics	Marginal	8, 9
4. Border controls		
a. Engaged industry partners	Optimal	
b. Passenger declarations informing operations	Optimal	
c. Point of detector dog intervention	Optimal	
d. Evidence-based resource and method application	Optimal	4, 5, 8, 13
e. Appropriate deployment of dogs to different roles	Marginal	
5. Noncompliance handling and enforcement track record	Optimal	
6. System performance – intervention levels, leakage data, etc.	Marginal	8, 9, 13
7. Audit and verification and assurance activities	Optimal	
8. National consistency and regulatory maturity	Marginal	1, 12, 13, 14
9. Implementation of relevant IIGB/IGB/internal improvement recommendations	Optimal	
10. Handling of issues and ideas reported by frontline officers and industry	Marginal	8
11. Credible future scenarios for detector dog deployment	Marginal	4, 5, 8, 10, 13, 14

Note: The Inspector-General of Biosecurity applied 3 assessment ratings: 'optimal', 'marginal' and 'unsatisfactory'. The overall assessment rating for each measure, if not otherwise specified, integrates the ratings for sub-items.

3. Role of the Inspector-General of Biosecurity

Australia's biosecurity system is designed to minimise the risk of the entry, establishment and spread of exotic pests and diseases that could cause significant harm to people, animals, plants and Australia's unique environment. It operates through various government programs that ensure the safe international movement of people, vessels, and goods. The programs are mainly delivered by the Department of Agriculture, Fisheries and Forestry in cooperation with industry and other government agencies.

The Inspector-General of Biosecurity's role is to enhance the integrity of Australia's biosecurity systems by independently evaluating and verifying the performance of these programs across the biosecurity continuum – pre-border, at the border and post-border. The Inspector-General makes recommendations for system improvements and provides assurance to stakeholders.

The *Biosecurity Act 2015* defines the Inspector-General's authority and independent powers of review. The Act is principally applied to prevention of arrival of biosecurity risk material in Australia, and preventative biosecurity is the primary focus of the Inspector-General. The Inspector-General is responsible for reviewing the Director of Biosecurity's performance of functions and exercise of powers. The Secretary of the department is the Director of Biosecurity.

The Inspector-General is independent of the Minister for Agriculture and the Director of Biosecurity and is not subject to direction by the Minister or the Director of Biosecurity in relation to the priority to be given to a particular review (Biosecurity Regulation 2016, paragraph 91(4)). However, the Inspector-General may:

- consider the Minister's request for a review
- seek immediate action from the Director of Biosecurity (or senior departmental executives) and the Minister to protect or enhance the integrity of Australia's biosecurity systems.

On behalf of the Department of Health, the department undertakes certain biosecurity risk management measures and systems that relate to human health. The Inspector-General has the authority to review those measures and systems.

Under section 567(1) of the *Biosecurity Act 2015*, the Inspector-General may review the performance of functions, or exercise of powers, by biosecurity officials under one or more provisions of the Act.

The Inspector-General's scope does not extend to Australia's national biosecurity policies, international trade issues and market access opportunities.

4. Introduction

4.1 Background

The number and diversity of international passengers, cargo, conveyances and mail items arriving in Australia is growing, and this is placing increasing pressure on existing biosecurity strategies and detection technologies.

Manual inspection and surveillance for biosecurity risk material (for example, meat, fruits and seed) and high-risk pests (such as Khapra beetle, foot and mouth disease and brown marmorated stink bug) is a cumbersome, time-consuming and labour-intensive process. It is critical that the effectiveness of mail and passenger screening at first points of entry is improved for a large range of biosecurity risk material. The most practical methods of screening are X-ray machines and detector dogs.

It is an ongoing challenge to target the most appropriate biosecurity measures to address specific and overall risks. To optimise outcomes, some form of risk-return approach must be applied. The department creates profiles to identify high-risk international travellers that biosecurity officers should routinely screen on arrival at Australian ports. These travellers are directed for intervention, where various screening methods (such as X-ray scanning, detector dogs or manual inspection) are applied to detect biosecurity risk material they may be carrying.

Detector dogs have an excellent ability to discriminate specific odours and can detect at concentrations as low as one part per trillion. Internationally, they are generally used to detect specific (classes of) biological and non-biological substances, including items of biosecurity significance, illegal drugs, currency, tobacco, firearms, human remains and explosives. Detector dogs can provide a fast, versatile and mobile screening capability in a range of environments and play an important role in strengthening our biosecurity systems in response to changing biosecurity threats. There has been promising research on the potential use of robots or sensors (such as electronic noses) to detect pests in bulk carrier holds; however, as yet, no technological advancements (or devices) have been able to match the canine's capabilities.

Detector dogs were introduced into the Australian quarantine (biosecurity) system in 1992. Use of detector dogs complements other inspection methods, including X-rays. The department's detector dog teams, which are relatively costly (staff and dog recruitment, training, support and operations) are currently deployed at international airport terminals and mail facilities throughout Australia and in cargo pathways to target biosecurity risk material.

Since detector dogs were introduced there have been numerous changes, including variable support and resource allocation, and the department has viewed the detector dog capability with differing levels of importance. The Inspector-General notes that the department's detector dog program was significantly reduced from 80 dogs in 2012 to 43 in 2018 and to 39 dogs in March 2020 (IGB, 2020; IGB, 2019a), despite their proven efficiency in detecting a wide range of biosecurity risk material. The Inspector-General emphasises that this trend should be urgently reversed to improve cargo (and traveller) inspection efficiency (IGB, 2019a). Both the reviews by Nairn et al. (1996) and Beale et al. (2008) commented on the role and management of biosecurity detector dogs.

Several recent Inspectors-General reports specifically recommended urgent expansion of the detector dog program, and the department agreed with each of these recommendations:

> **IGB, 2019a – Recommendation 1**
> *The department should improve the rate and effectiveness of screening mail and passengers, by both X-ray and by detector dogs. The department should increase the number and prioritise the use of detector dogs to fully use the mobility and versatility of dogs to screen across a range of environments including carousels, cargo and conveyances for targeted and random screening.*
>
> **IGB, 2019b – Recommendation 8**
> *The department should urgently expand the detector dog program to increase training and numbers of dogs (and their handlers) to detect high-risk pests, including brown marmorated stink bugs, for deployment in high BMSB risk cargo pathways for next season.*
>
> **IGB, 2020 – Recommendation 6**
> *The department should urgently expand the detector dog program, consistent with the increase in traveller numbers and mail volumes, to minimise entry of all undeclared meat and meat products into Australia.*
>
> **IGB 2020 – Recommendation 18**
> *The department should expand the detector dog program consistent with the increase in SAC [Self-Assessed Clearance] consignment numbers to utilise dogs in targeted surveillance and verification operations minimising entry of biosecurity risk material into Australia.*

The department has used X-ray detection for biosecurity risk material for 25 years. The review by Nairn et al. (1996) recommended that:

> *Quarantine Australia make increased use of X-ray technology to improve the efficiency and effectiveness of quarantine delivery at the border including airports, seaports, mail exchanges and courier depots. (Nairn et al., 1996)*

The review by Beale et al. (2008) noted that, under the 2001 Increased Quarantine Intervention (IQI) initiative, an additional 64 X-ray machines were added to border biosecurity operations.

There have been many improvements in X-ray technology over recent decades, with 3D computed tomography X-ray units now available, and being trialled, for biosecurity risk material detection.

The 3D X-ray unit produces images in real time as each item passes through the X-ray unit. Since 2019, in collaboration with New Zealand Ministry for Primary Industries (MPI), the department has been trialling 3D X-ray technology. The agencies have partnered with the machine manufacturer for algorithm development for auto-detection of biosecurity risk material such as fruit, meat, seafood and plant/vegetables. The agencies are developing an image library of biosecurity risk materials. It is expected that, by late 2022, algorithms would be ready for trialling auto-detection in an operational setting.

In Australia, the department has installed 3D X-ray units at the Melbourne and Sydney international mail gateway facilities. The department has claimed that preliminary results have shown 2–3 times more detections than detector dog screening and 2D X-ray scanning combined. The department recently received funding for 3 more 3D X-ray units to be installed.

4.2 Review objective and scope

The objective of this review was to examine the efficacy and adequacy of the department's X-ray scanning and detector dog screening techniques to prevent the entry of biosecurity risk material into Australia.

In enabling the Inspector-General to provide an assurance assessment of the robustness of biosecurity X-ray and detector dog detection capability, the review sought to have the department demonstrate to the Inspector-General, through documented evidence (information and data) and interviews, that a positive assessment should be made. Any recommendations for improvement would be made as part of the assurance assessment.

To complete this work, the Inspector-General examined:

1. the status and performance (efficacy) of the department's current strategies and scanning technologies deployed at the border to intercept goods that do not meet biosecurity import conditions across major entry routes
2. recent developments in X-ray scanning technology, its application by governments and businesses, and potential opportunities for adoption in co-regulatory arrangements by relevant industries
3. the status and performance of the department's detector dog program, including comparisons with other detector dog programs within Australia and elsewhere.

The review covered activities the department has undertaken to intercept biosecurity risk material at the border using detector dogs and X-ray technology. This included reviewing:

1. the deployment and effectiveness of current technology and the newer and more current technology (for example, 3D X-ray)
2. how the department:
    a. operationally manages detector dogs and X-ray technology (referred to jointly as 'detection technology') to effectively target and detect biosecurity risk
    b. utilises detection technology to target existing and emerging risks (for example, African swine fever (ASF)) and seasonal pests in commercial cargo (for example, brown marmorated stink bug)
3. the adequacy of current training and verification of biosecurity staff competency in utilisation of relevant detection technology
4. compliance strategies and actions to support operations where noncompliant detections of undeclared/prohibited biosecurity risk material have been made
5. national consistency and regulatory integrity of application of detection technology
6. efficiency of utilisation of detection technology in commercially owned/operated facilities
7. threats and vulnerabilities to the effectiveness and integrity of operations involving detection technology

8. what improvements are required to detect and manage biosecurity risks more effectively
9. via targeted site visits, the conducting of relevant regulatory processes (and meeting with relevant companies and frontline departmental officers).

4.3 Out of scope

This review did not examine:

- established government policies
- policy and activities that are the responsibility of stakeholders other than the Department of Agriculture, Fisheries and Forestry, including state/territory agencies/ governments, individuals and biosecurity industry participants
- commercial considerations
- technical procedures involved in treatment, destruction and re-exportation
- any post-border use of detection technology.

4.4 Impact of the COVID-19 pandemic

International air travel was suspended from March 2020, and the few travellers who did arrive were subject to pandemic clearance processes. Traveller pathway detector dogs were redeployed as a result, while 2D X-rays remained idle in-situ. In the mail pathway, the volumes of mail also declined and there was a change in offshore logistics, which impacted dispatch origin profiling from mid-2020. Many of the redeployed detector dogs were used in the mail pathway. Due to this, analysis of utilisation and performance of detection technologies in this review are largely focused on the pre-pandemic period – that is, before March 2020.

5. Risk-based approach at the border

5.1 Mass screening to risk-return

The Increased Quarantine Intervention (IQI) required the department to 'achieve a national average of at least 81 per cent of passengers arriving in Australia, using X-rays, detector dog teams and baggage inspection' (DAFF, 2001).

Operationally, this involved mass X-ray and detector dog screening of bags at airports, with quarantine officers supported by contracted staff to lift baggage on and off X-ray belts to manage throughput. As traveller and mail numbers increased and funding remained static, the department's ability to maintain this level of screening declined.

By 2009, and following the publication of the Beale review *One biosecurity* (Beale et al., 2008), the department's concept of operations for border quarantine was changing from mass screening to a risk-based approach, referred to as 'risk-return'. In its 2012 update on the implementation of the Beale review's recommendations, the department stated:

> *Consistent with the Beale review, the department is moving to a risk-based approach to biosecurity operations in which resources are focused on the risks of greatest biosecurity concern. Implementation of a risk-based approach is a central component of the reform program; and will allow the allocation of effort and resources on the highest biosecurity risks, while maintaining assurance on lower-risk items and pathways. (DAFF, 2012)*

The update noted that:

> *The department has moved away from mandatory intervention targets for international passengers and mail, arriving international sea vessels, sea and air cargo containers and for high volume low value consignments. With advice from the Australian Centre of Excellence for Risk Analysis (CEBRA) it has introduced risk-based intervention methodologies in order to optimise the interception of material that poses a high biosecurity risk.*
>
> *Changes have been made to the use of detector dogs at airports and mail centres in order to maximise their effectiveness at detecting quarantine risk material. Instead of working around the baggage carousels at airports, quarantine detector dogs are now used in dedicated dog channels to screen passengers who have been assessed as being more likely to be carrying high risk material. (DAFF, 2012)*

The risk-return concept of operations focuses on higher risk biosecurity materials and more targeted use of detection technologies. It remains the department's operating model for at-border biosecurity operations.

5.2 Risk-return – a work in progress

Unlike a mass screening approach, which aims to screen as many of the arriving goods (baggage, mail, or cargo) as possible without officer discretion regarding targeting, the risk-return concept of operations relies on the availability of information about differentiated risk to inform what is screened. In 2013 the Interim Inspector-General noted that:

> *As DAFF services are focused on a risk-return approach, a lack of complete, accurate and useable data will make it difficult to make informed decisions on risk. The risk-return approach is based on and underpinned by quality data and information. Risks are evaluated using scientific and economic consequence evidence and projections as well as operational experience. Under the risk-return model, resources, including staff, are allocated to areas that pose the highest biosecurity risk. (IIGB, 2013)*

The absence of appropriate data to underpin a comprehensive risk-return concept of operations was noted in the Beale review:

> *The transition to a risk-return approach will take some time, as much of the data and analysis on which crucial decisions depend do not yet exist. (Beale et al., 2008)*

In 2022, the effective application of the risk-return concept of operations is impeded by inadequate availability of comprehensive accurate data and systems. As noted by the Inspector-General in a recently published review report:

> *the replacement of key biosecurity systems for processing and data capture commenced in 2015 and is yet to be fully delivered, with work continuing across several new program streams. (IGB, 2021)*

Significant progress has been made. However, the Inspector-General was advised that details about what potential risk material has been screened or inspected in the mail and traveller pathways is not routinely captured; therefore, assessment of relative risk, profile development and evaluation of effectiveness is problematic. There continue to be gaps in data, and this reduces the accuracy of risk assessments and thus the effectiveness and efficacy of current operating models for the effective deployment of detector dogs and X-rays.

In cooperation with other agencies, the department continues to pursue improvement to the technical and operational capabilities of at-border biosecurity interventions. The department's Future Traveller strategy seeks to encourage voluntary compliance, reward voluntary compliance with low-touch intervention, and detect and deter noncompliance. The aim is to do this through the efficient management of biosecurity risks using innovative, evidence-based policy which enables the effective regulation of arriving international air and sea travellers.

The Inspector-General was informed about work being undertaken as part of the Traveller and Mail Modernisation (TMM) program, including the delivery of the Traveller and Mail System (TAMS) and digital passenger declaration (DPD). The TMM program is making inroads on data issues. Over the next 18 months it is scheduled to deliver some long-awaited enhancements that will provide improved data and systems to support the decade old risk-return concept of operations.

Phase 1 of TAMS allows biosecurity officers to scan a traveller's passport using a mobile scanner and access the passenger's DPD (TAMS App). This improves the speed and accuracy of data capture and allows the department to better understand who it has interacted with, the purpose of the interaction and the outcome. This type of information is a leap forward in providing data for profile development and in understanding intervention flows and detection technology utilisation and effectiveness. The department advises that, at the time of writing, there had been more than 200,000 interactions using the TAMS App. During the Inspector-General's regional visits for this review, operational staff commented positively on the delivery of improvements through the project and the TAMS project team.

Similarly, in the mail pathway, in 2021 the department began to receive Electronic Advance Data (EAD) from Australia Post (through the Department of Home Affairs) to assist early screening activities. The quality and coverage of this data has been improving and border agencies have been analysing it to understand its value in better managing risk. Ongoing improvements to the quality of this data will support data-driven interventions through automated risk profiling. EAD features prominently in border agencies' future mail blueprint and operating model and will address some of the long-term limitations of the risk-return model in the mail pathway (ABF, 2021; ABF, AP, DAWE and DoHA, 2019).

Finding: Risk-return will remain the operating concept for at-border biosecurity operations for the foreseeable future. The future operating models that are currently in development in the traveller, mail and self-assessed air cargo (SAC) pathways will frame biosecurity operations for the next 5–10 years, including the use of detection tools (DAWE, 2021a). Given this direction it is important that the concepts developed are subject to rigorous operations research that develops the advanced analytical methods for improved decision-making.

The work of the Australian Centre of Excellence for Risk Analysis (CEBRA) on a revised risk profiling methodology in the traveller and mail pathways is critically important and goes some way to addressing this requirement, but it represents only part of the operational analysis required to provide confidence in the current and evolving future operating models.

Recommendation 1

The department should subject its current and future mail and traveller operating models to more rigorous operations research analysis as a priority.

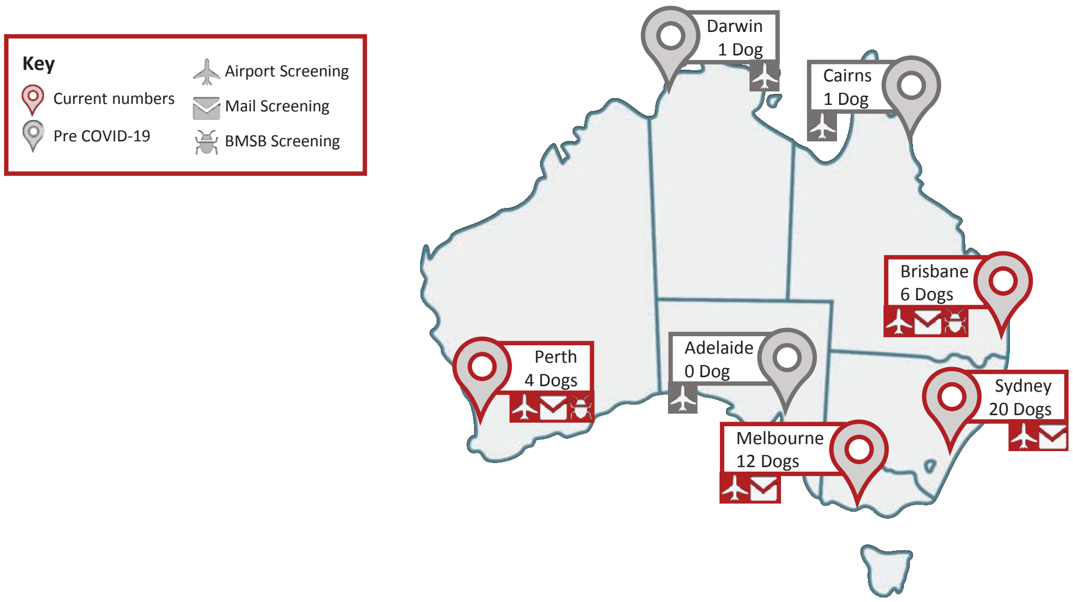
6. Detector dog operations

6.1 Detector dog fleet

As at March 2022, the department's detector dog program consisted of 42 dogs and 43 accredited handlers operating in 4 regions – Sydney, Melbourne, Brisbane, and Perth (reported in June 2022 to be 43 and 49 (DAWE, 2022a)).This fleet number was achieved at the end of 2020 after an Inspector-General review of African swine fever (ASF) preventative border measures recommended increasing detector dog numbers (DAWE, 2021b; IGB, 2019a)

Before the COVID-19 pandemic, detector dogs were also operating in Cairns, Darwin and Adelaide for the clearance of air travellers. Due to international border closures, detector dogs from these locations were redeployed to screen mail and/or cargo in operational centres with larger throughput (Figure 1).

Figure 1 Detector dog locations and screening activities, May 2021



Note: BMSB: brown marmorated stink bug.

Source: DAWE, 2021d

When Norfolk Island came under federal government control in 2017, the department deployed a detector dog to the island when establishing its biosecurity operations. During the COVID-19 pandemic this dog was removed due to a lack of utilisation and infrastructure challenges such as kennelling arrangements. The department has advised that there is currently no demand for a detector dog on Norfolk Island, and reinstatement of the dog has not been recommended on technical and operational grounds (DAWE, 2021c).

6.2 Detection capabilities

Biosecurity detector dogs are trained to detect 7 target groups:

1. fresh fruit
2. fresh vegetables
3. fresh plant (including cuttings)
4. viable seeds and bulbs
5. fresh meat
6. eggs
7. brown marmorated stink bugs.

Training to detect these target groups provides the detector dogs with the ability to detect over 250 different biosecurity risk commodities, the majority of which are categorised as high biosecurity risk goods. Detector dogs are not trained to detect canned or retorted biosecurity risk goods, as the dogs would be reacting to the packaging rather than the goods inside the packaging. Detector dogs are not currently trained to detect bark or wood, although the department advises that this could occur (DAWE, 2021d).

6.3 Strength, limitations and uses

The department has utilised detector dogs since 1992, taking advantage of their strengths as an agile frontline detection capability. For many years, the detection capability was provided predominantly by the beagle dog breed. which has been replaced by the Labrador Retriever. Detector dogs provide the flexible ability to perform broad screening activities on a large or small scale, as well as more focused screening of individual consignments from container to packet level. This flexibility allows detector dogs to be deployed across a range of biosecurity operating environments.

The department has identified detector dogs' strengths as:

- efficiency – they are able to screen large volumes and areas in a relatively short period of time
- effectiveness – they offer a high likelihood of detection for target odours
- mobility – they are able to deploy across multiple pathways within a single shift
- traveller compliance promotion – they deliver a strong compliance message.

It also notes that these strengths can be impacted by a variety of factors (DAWE, 2021d), including:

- presentation of goods
- quantity of items to be screened
- speed of item throughput
- handler competency.

The department currently deploys detector dogs in 3 operational contexts to:

- detect the presence of biosecurity risk materials in arriving international mail and in travellers' baggage
- assess the absence of biosecurity risk materials in break-bulk cargo
- provide broad-area surveillance of risk locations, such as approved arrangements or as part of pest delimiting activities.

Finding: The detector dog is a valuable detection asset for which there is no technological alternative. This is because of the detector dog's ability to be trained on imported goods of biosecurity concern and specific insect target odours; quickly screen a very wide range of items (from a letter envelope to a piece of machinery) and situations (such as a warehouse); and be deployed geographically at short notice across biosecurity operating environments. Detector dogs should be treated as an indispensable frontline detection tool, the capability and deployment of which needs to be fully optimised by the department.

7. Detector dog capability delivery

7.1 Breeding

Detector dogs are sourced from the Australian Border Force (ABF) breeding program. The ABF breeds dogs for several domestic and international partner agencies, including the ABF, Australian Federal Police (AFP) and the department. The ABF breeding program provides dogs at 12 and 24 months old and delivers approximately 160 dogs per year, of which between 50% and 65% meet the required standard for use as detector dogs. Approximately 45–50 of the 80–100 dogs that meet the standard each year are required simply to maintain federal agency fleet levels.

The ABF breeding, training and kennelling centre in Bulla, Victoria, is an important asset for the Australian Government's detector dog programs. With increasing use of detector dogs for biosecurity and other law enforcement purposes, it will be important that appropriate funding is made available to enable the centre to meet requirements for new dogs and the increased replacement of dogs in coming years. This needs to factor in infrastructure requirements and not merely the marginal cost of individual dogs.

The marginal cost of delivering an ABF-bred dog after 18 months to an agency ready for specialised training is estimated at $50,000 per dog for each of the 160 dogs. The department currently pays $5,000 per dog. The department's access to training-ready dogs is being significantly cross-subsidised by the ABF as a federal resource provider. Having a federal provider of detector dogs, with a focus on genetic and early development excellence, is a preferrable model but needs appropriate recognition and funding arrangements. Where the department seeks additional detector dog resourcing, these supply chain costs also need to be appropriately reflected in funding submissions.

Finding: New funding submissions that include additional detector dog resources should include relevant funding to cover the ABF dog breeding centre costs.

There are significant lead times and costs in meeting the current and future supply of detector dogs. Approximately 15% of the dog fleet requires replacement every year due to dogs being retired. Currently there is limited advanced resource planning based on apparent funding uncertainty and anticipated operational requirements. The Inspector-General considers the informality of arrangements governing future dog requirements and acceptance arrangements by the department as suboptimal – overall risks to biosecurity detection would be better managed with improved forward commitment.

There is currently no formal arrangement between the ABF and the department for the supply of dogs. The ABF's breeding program now supports a relatively large pool of both federal and state agencies, and the need for a more formal arrangement is overdue. The development and timely finalisation of an annex to the department's and ABF's memorandum of understanding on access to suitable dogs based on the department's requirements is important.

Finding: From a whole-of-government perspective, the Inspector-General supports the model of Australian Border Force (ABF) as the national breeding and early development lead. However, with an 18-month development time to deliver a dog ready to commence specialised detection training, there is a need for the department to provide ABF with greater certainty in demand forecasting and funding commitment.

Recommendation 2
The department should prepare multi-year resourcing plans to support current and future demands for detector dogs. The plans should include advanced formal commitment by the department to take at least the number of dogs needed to maintain the approved size of the dog fleet.

Recommendation 3
The department should finalise the supply of detector dogs annex to the Department of Agriculture, Fisheries and Forestry / Australian Border Force memorandum of understanding by December 2022.

The detector dog training course was brought into the department in 2016. Since then, it has been run by the department. Once a dog is delivered to the department it undergoes a 6–8-week training program at the Brisbane detector dog training facility. The course has an average 60% pass rate (3 out of 5 dogs). Dog training courses were previously run twice per year, but future training courses are now being planned based on the expected delivery time of new dogs in consultation with the ABF breeding centre.

The dogs are trained as multipurpose dogs, meaning they can work across different operating environments, such as airports, mail centres and cargo environments. The department moved to multi-purpose dogs in 2012 to provide greater flexibility in deployment. Before this, dogs were trained as either passive, for work with travellers at airports; or active, for working in mail and cargo environments. This limited deployment options and therefore utilisation. After dogs successfully complete the training course, they are assigned to experienced handlers across Australia the country. The effective working life of a dog is approximately 6.5 years. They are assessed for continued service at 8 years of age.

Finding: The more flexible approach to training delivery, which reflects an alignment with the supply chain for detector dogs, is a positive development. This linkage to breeding cycles would be further strengthened if the department made a stronger forward commitment on dog numbers needed over the forward 18–24 months.

7.2 Handler availability

Handlers are recruited by, and report to, their respective regional management groups, not the detector dog program. The Inspector-General supports this alignment. It is most likely to deliver an effective integrated operational detection and intervention capability. Details of handler training are given in chapter 11.3.

Based on the proposed increase in detector dogs through to June 2023, an additional 32 detector dog handlers are required. Recruitment has already commenced and will continue throughout 2022 (DAWE, 2021c). The Inspector-General was concerned to learn that, despite the decline in operational activity in the traveller and mail pathways over the preceding 18 months, one major centre had insufficient dog handlers to deploy its available detector dogs. With passenger and airfreight volumes now increasing rapidly, a significant risk detection gap seems highly likely.

This gap might be alleviated if a larger cohort of biosecurity officers were trained as handlers, but not necessarily handling dogs daily, so they could be activated at short notice. In suggesting this, the Inspector-General also notes that this imposes costs on the department, with handler training courses costing approximately $10,000 per trainee. However, this cost is likely to be warranted if it means that detection capability is maintained at a high degree of operational readiness. Currently, it is easy to conclude that operational convenience dominates over a sustained high level of detector dog availability and risk mitigation by this valuable detection tool.

Finding: Because of the lead times involved in training dog handlers, if there are insufficient available handlers, some dogs cannot be deployed. This means that a costly detection asset is idle and biosecurity risk is potentially being undetected. The department needs improved forecasting of the number of handlers required, more timely recruitment, flexibility in when training is delivered and possibly a larger pool of handlers.

7.3 Kennelling and transport

The department currently has mixed arrangements for kennelling and transport in different regions. Some dogs are housed at joint Commonwealth facilities, as in Sydney, while others are housed in private facilities.

The Inspector-General was advised that the Australian Government Canine – Detector Dog Facilities Reference Group had recommenced. The group's aim is to establish common strategies, site selection, lease finalisations, infrastructure design and fit-out, site commissioning, relocation and any ongoing maintenance and upgrade works of all canine and detector dog facilities in the AFP, ABF and the department (DoHA, ABF, AFP and DAWE, 2022). The Inspector-General supports joint Commonwealth facilities where operationally practical.

Transport of detector dogs from the kennel to the workplace is undertaken by contracted transport providers in Sydney and Melbourne and by departmental staff in other regions. The Inspector-General was advised that proximity of kennels to the operating environment and whether dogs moved between operational areas during the working day were key determinants of whether dogs were transported by departmental staff or by private providers.

7.4 Proposed expansion of dog fleet

Based on anticipated workload with the reopening of the borders after the peak impact of COVID-19 pandemic, the department estimated that 66 dogs will be required over the coming 2 years. This will be and dependent upon, the recruitment, training and retention of detector dog handlers, operational priorities, changes to policy settings, biosecurity risks and kennelling facilities. The department estimated that 66 dogs will be required over the coming two years. The department plans to increase the fleet by 12 dogs in 2022, with a further 8 dogs in the first half of 2023 (DAWE, 2021c). The department advised that dogs would be regionally deployed as shown in Table 1 (DAWE, 2021e).

Table 1 Detector dog locations and numbers, and proposed expansion to June 2023

Location	Current	Additional	Total
Sydney	20	5	25
Melbourne	12	0	12
Brisbane	6	2	8
Perth	4	1	5
Cairns	0	1	1
Darwin	0	1	1
Adelaide	0	1	1
Gold Coast	0	1	1
NAQS	0	4	4
Unallocated	0	8	8
Total	**42**	**24**	**66**

Note: NAQS: Northern Australia Quarantine Strategy.

Source: Data supplied by the department for this review

The Inspector-General notes that the department has made a commitment to leverage whole-of-government kennelling arrangements at all ports. This will address canine wellbeing issues previously associated with solitary kennelling and increase environmental enrichment opportunities. The department is also providing additional resources to support sustainment of detector dog proficiency across all deployed locations. Decisions around deployment should be based on risks and workloads at each location (see discussion on utilisation in chapter 9.1).

The Inspector-General would expect that, with a genuine commitment to a risk-return approach, detector dogs would be deployed in a way that maximises the overall national detection of biosecurity risk material within the context of risk pathways and the suite of detection tools available to the department. The advice provided to the Inspector-General on the deployment of the additional 20 dogs being brought online through to June 2023 is that there continues to be uncertainty about the best way to deploy them to maximise biosecurity risk management. It seems very likely that optimised deployment of 2D X-rays and biosecurity officers will be the correct risk-return option for small, remote centres.

Finding: The siloed use of detection tool specific approaches within single pathways, but constrained deployment strategies across pathways and inadequate application of detection tools in integrated ways, reflects an insufficiently detailed analysis of import pathway risk and the best deployment options of available detection resources to mitigate the risk (a risk-return approach).

Recommendation 4

The department should maximise detection outcomes by applying a cross-pathway and multi-detection technology perspective to the redeployment of existing and new detector dogs.

8. X-rays

8.1 X-ray fleet

The department has been using X-ray machines as a screening tool for biosecurity risk material for over 2 decades, primarily within the travellers and mail pathways. The last major acquisition of X-rays occurred in 2001 under the Increased Quarantine Intervention (IQI) program response to the foot and mouth disease outbreak in the United Kingdom. A total of 64 new X-rays were purchased, 18 of which are still being used as the core of the department's current X-ray capability.

The department currently has 29 2D X-ray units and 4 3D X-ray units. Eighteen (62%) of the 2D units were commissioned in 2000 (DAWE, 2021e). The department also has an agreement in place with the Department of Home Affairs (DoHA) / Australian Border Force (ABF) for the reciprocal use of X-ray machines as operationally required. DoHA/ABF replaced 44 of its 45 2D X-ray units in 2020 and 2021.

Twenty of the department's X-ray units are in the traveller pathway at airports, and 5 2D and 3 3D units are used in the mail pathway. The remaining units are in air cargo premises and at the department's research and development (R&D) sites (Table 2).

Table 2 Number of 2D and 3D X-ray units deployed by the Department of Agriculture, Fisheries and Forestry

Deployment	2D	3D
Airports	20	–
Mail gateways	5	3
Air cargo	3	–
Research and development	2	1

Source: Data supplied by the department for this review

8.2 Detection capabilities

The department advised the Inspector-General that the X-ray penetration and image presentation of its older 2D X-ray fleet is equal to that of DoHA/ABF's newer fleet of 2D X-ray units. The department advised that:

- There have been many verbal conversations with Smiths Detection – the company that provides the department's 2D X-ray machines – in the past discussing refurbishment as opposed to replacement of the units.

- Smith has apparently stated that there is no difference between the hardware of the units procured 15 years ago and that of the new units now. The only difference is newer screening LCD monitors, which make marginal difference to image output.
- The refurbishment of units would use original equipment specification which has not changed to date.

Appropriately trained officers using 2D X-ray units use composition and image analysis to detect the targeted range of biosecurity risk materials. With 2D X-rays, different commodities are colour coded based on their density (atomic weight) and thickness. Using this colour coding (for example, organic commodities appear orange), the image can be further analysed to determine the risk of the specific item or can be used as a flag for further manual inspection. By comparison, 3D X-rays provide greater clarity and manoeuvrability (ability to rotate the image on the screen) of the X-ray image, which enhances item-specific identification of suspected biosecurity risk materials.

Both 2D and 3D X-rays have limitations in detecting small items, such as individual packets of seeds, within a larger bag or package. This is because the X-ray machines are too powerful to detect very small items. The department has undertaken a proof of concept (POC) trial using a low-energy X-ray unit with the aim of developing a functional seed detection X-ray. This is discussed in more detail in chapter 13.11.

8.3 Strengths, limitations and uses

The department's operational deployment of X-rays is different in each pathway. In the mail pathway, profiled cohorts of mail are mass screened, with mail items being sent down a conveyor belt with an inline X-ray unit in place. Where there is a single 2D X-ray on the line, the images are screened by a biosecurity officer and/or an ABF officer.

Where a 2D X-ray and a 3D X-ray are located on the same conveyor belt (Express Mail Service (EMS) line at Sydney Gateway Facility (SGF) and Melbourne Gateway Facility (MGF)), ABF screening is done using a 2D X-ray and the department screenings using a 3D X-ray. Dual screening may also occur, with detector dogs being used after X-ray screening. Detector dogs can also be used as the sole screening method, most frequently on the Other Articles (OAs) line.

Within the traveller pathway, the department uses X-ray units as a mass screening tool for profiled travellers. In the traveller pathway, X-rays are also selectively used to screen baggage (for example, to screen multiple bags of a declarant) at the discretion of biosecurity officers to verify the presence or absence of risk material and as an aid when the baggage of a risk-profiled traveller is being manually inspected.

In the air cargo pathway, the department previously undertook mass screening of selected cargo cohorts when high resource levels were available under IQI until 2008. The department's ability to mass screen in the air cargo pathway has declined and was made more difficult with the introduction of the *Biosecurity Act 2015*, as items that have not been profiled as risk material are automatically released from biosecurity control. Where the department has received the goods documentation before the goods arrive in Australian territory, the goods are automatically released in the electronic processing systems (Agriculture Import Management System (AIMS) or Self Assessed Clearance (SAC)) once they enter Australian territory – 12 nautical miles from the Australian coast. Once the goods are released, officers have no legal authority to screen the goods (see chapter 90). As a result, several of the newer X-ray units (2013 commissioning) installed in express freight facilities are not regularly used as part of the department's biosecurity operations.

9. Utilisation of detection technology

9.1 Detector dogs

Detector dogs provide a flexible detection capability, but to be effective they need an appropriate minimum level of training and utilisation. Concepts of operation and deployment models have significant impacts on the level of utilisation of detector dogs. This is less of an issue within the mail pathway, where the volume of mail exceeds the ability of the department's resources to screen. In the traveller pathway there is greater variability and consistency in the volume of arriving travellers, particularly in small airports. This has led to significant under-utilisation of detector dogs.

Utilisation in the travellers pathway

The department's National Detector Dog Deployment Standards (NDDDS) for the travellers pathway states:

> *each detector dog must have the capacity, and is expected, to screen 400 travellers per day. The NDDDS also states that detector dogs need to achieve at least 75% of this expectation in order to maximise their effectiveness and to ensure appropriate resourcing. The table below shows the utilisation of detector dogs as a percentage of the capacity outlined in the NDDDS (400 travellers per dog per day).*

As shown in Table 3, before the COVID-19 pandemic detector dogs at Australia's major airports were routinely not meeting the target utilisation of 75%, or at least 300 travellers per day, as set out in the NDDDS (DAWE, 2020a). At smaller airports (for example, Darwin and Canberra), detector dogs were not routinely deployed over the full month.

In August 2018, Perth undertook a detector dog deployment trial, *Screening of Non-alert/Non-declarant Passengers Using Detector Dogs* (known as the K1 trial (DA, 2019)), in response to decreasing detector dog utilisation. When the trial began, Perth's utilisation had dropped to 33.2% in August and 35.1% in September 2018 (Table 4).

Over the following 8 months (October 2018 to May 2019), Perth was able to meet target utilisation of 75% in 4 months and achieve utilisation above 50% during the trial period. The trial also resulted in an increase in undeclared seized items and increased enforcement actions (see Table 4). As utilisation increased, seizures of undeclared items and enforcement actions increased concurrently for the cohort of travellers screened using detector dogs, while these numbers remained relatively steady for the traveller cohort screened using auto-profiling (Table 4).

Table 3 Monthly detector dog utilisation (%), June 2019 to January 2020, for airports where detector dogs were routinely deployed

	Jun 2019	July 2019	Aug 2019	Sept 2019	Oct 2019	Nov 2019	Dec 2019	Jan 2020
Adelaide	46.6	43.6	39.7	30.6	28.4	30.3	43.3	53.4
Brisbane	60.6	76.4	58.0	47.3	54.3	61.1	45.0	57.9
Cairns	–	–	–	–	–	49.3	6.5	27.1
Darwin	–	–	–	–	28.7	56.2	50.8	94.5
Melbourne	69.8	73.8	77.8	62.9	78.8	54.1	62.4	71.0
Perth	77.9	56.4	34.3	47.6	43.1	27.7	59.2	64.6
Sydney	57.9	56.8	53.5	46.5	51.3	48.9	51.9	57.7

Note: Highlighted in bold are the percentages that meet the minimum expectation of 75% utilisation. An en rule (–) shows that the airport did not have detector dogs routinely allocated over the whole month.

Source: DAWE, 2020a

Table 4 Results of detection method screening trial for travellers, August 2018 to January 2019, Perth

	Aug 2018	Sept 2018	Oct 2018	Nov 2018	Dec 2018	Jan 2019
Dog utilisation (%) against national standard[1]	33.2	35.1	42.9	55.3	109	56
Traveller screening using detector dogs						
Undeclared items seized[2]	5	4	16	30	61	49
On-body detections	0	0	0	3	1	5
Infringement notice	0	0	0	5	6	6
Written warning	1	2	10	10	32	18
No compliance action	3	2	6	8	14	16
Traveller screening using auto-profiling						
Undeclared items seized2	29	23	23	33	22	29
On-body detections	1	0	0	0	1	1
Infringement notice	3	2	2	2	1	3
Written warning	10	9	8	13	10	12
No compliance action	6	6	6	7	8	5

Notes:

1. The national standard (100%) is 3,000 non-letter items per dog and day.

2. Several undeclared items may be seized per traveller.

Source: DA, 2019

When questioned on the reason for continuously low detector dog utilisation, the department responded:

> *These results provide an averaged indication of passengers screened per dog in each location but do not account for significant variances across and within locations that limit the ability of teams to meet established targets.*

> *Passenger flow through detector dog screening lanes is impacted by multiple factors including time of day, flight arrivals, passenger profiles and available resources and assistants. Even during peak periods where passenger presentation is continuous and uninterrupted the ability to measure utilisation across locations is difficult to measure via this metric as infrastructure also plays a part in passenger flow, for example: Brisbane Airport SEA consists of a single lane whereas Sydney Airport consists of multiple screening areas with 3 lanes in each. This means dogs deployed in Sydney can be presented with 3 times the number of passengers during each search when compared to dogs based in Brisbane. For these reasons, the KPI reports are referenced only as high-level indicators and decisions on dog.*

There may be operational impediments to the continuous achievement of performance against the required standard. However, the levels of utilisation reported show that operational deployment of detector dogs is seriously suboptimal; more rigorous analysis and reporting appears to be needed.

The detection method trial also estimated the number of undetected travellers based on leakage (endpoint) survey results (see also chapter 10.1.1). The estimate of undetected travellers is shown in Table 5. Because a sample (rather than all travellers) is surveyed, variations occur between the results of the survey and the results that would have been achieved if all travellers had been surveyed. This variation can be addressed by calculating confidence intervals. Table 5 provides a 95% confidence interval for each airport. This means the department can be 95% confident that the true number of undetected travellers is between the range shown in the table.

Table 5 demonstrates how important it is that detection resources are effectively applied in a way that, to a practical extent, increases the level of detection of noncompliant travellers. The number of detections increases with increasing dog utilisation (Table 5), so there is scope for detector dogs to be deployed more actively to identify high-risk biosecurity goods outside the current profile referrals (see also Figure 5). It is noted that broader deployment may result in lower numbers of detections per traveller screened, but the Inspector-General considers that this still provides important increases in biosecurity risk mitigation and is preferrable to detector dogs consistently being under-utilised.

Table 5 Detected and undetected noncompliant travellers in January 2020

Airport	Actual number of detected travellers	95% confidence interval for estimated number of undetected travellers
Adelaide	216	1,053 – 4,839
Avalon	54	80 – 677
Brisbane	446	2,123 – 9,964
Canberra	7	0 – 209
Cairns	74	48 – 1,488
Darwin	53	47 – 1,425
Melbourne	570	21,076 – 37,673
Gold Coast	131	492 – 3,149
Perth	469	3,019 – 8,404
Sydney	961	11,197 – 22,667
Total	**2,981**	**39,134 – 90,494**

Source: DAWE, 2020a

Finding: There is significant underutilisation of detector dogs in the traveller pathway, and this is a serious gap in biosecurity risk mitigation. Their operational deployment must be reconsidered. The level of undetected biosecurity risk material in the traveller pathway is directly associated with the level of utilisation of available detection resources.

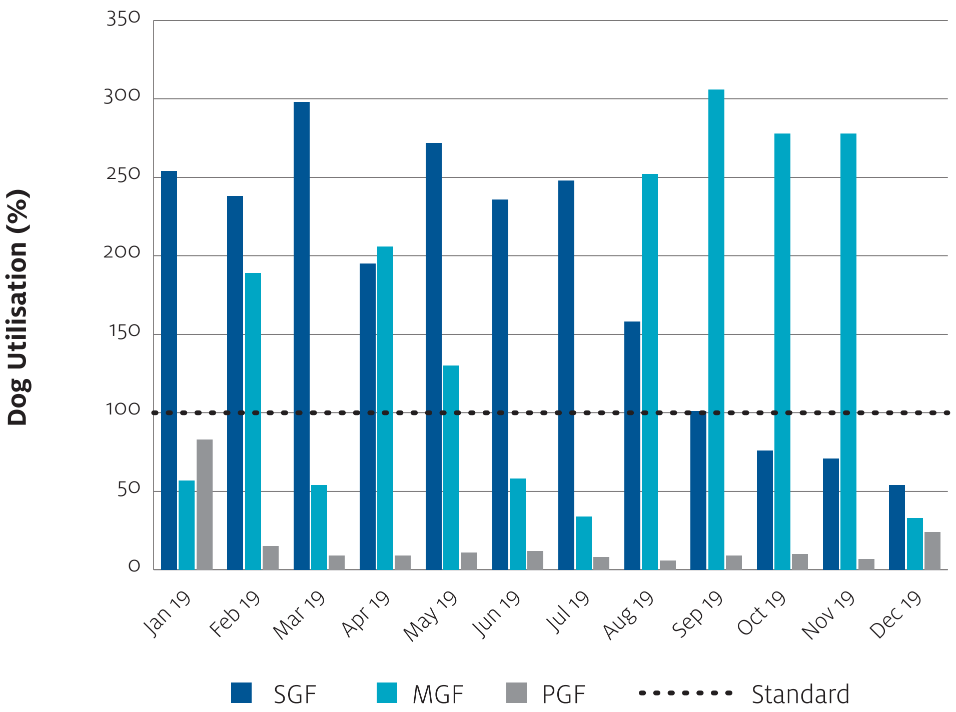
Recommendation 5
With the resumption of international traveller movements post COVID-19, the department must lift detector dog utilisation in the traveller pathway. If current traveller pathway deployment models cannot deliver adequate detector dog utilisation, then alternative models need to be employed, either through a national process or as directed by airport-based operational risk managers.

Utilisation in the mail pathway

In the mail pathway, detector dogs operate in international mail gateway facilities in Sydney (SGF), Melbourne (MGF), Brisbane (BGF) and Perth (PGF). The Inspector-General has assessed pre-COVID utilisation data because dogs were redeployed during the height of the COVID-19 pandemic, when mail volumes declined.

The NDDDS states that each dog has the capacity and is expected to screen 3,000 non-letter mail articles per dog and day (DAWE, 2020b). From January to December 2019, the SGF met the monthly utilisation standard in 9 out of 12 months and exceeded the standard by over 50% in 8 months (Figure 2). The MGF met and exceeded the standard by over 30% in 6 out of 12 months. The monthly utilisation standard of 3,000 non-letter mail articles per dog and day was not met at PGF between January and December 2019. No utilisation data was reported in the monthly performance reports for BGF.

Figure 2 Detector dog utilisation against the national standard (100% utilisation) for the Sydney, Melbourne and Perth mail gateway facilities, January to December 2019



Note: The standard (100%) was 3,000 non-letter items per dog and day. MGF: Melbourne Gateway Facility; PGF: Perth Gateway Facility; SGF: Sydney Gateway Facility.

Source: DAWE, 2020b

The PGF is significantly smaller than SGF and MGF. For example, in November 2019 SGF received 7.31 million non-letter class mail items, MGF 2.75 million and PGF 111,000. The Inspector-General also recognises that lower reported utilisation in Perth may result from using excess detector dog capacity in the mail pathway outside of the dogs' primary detection role in traveller clearance. However, given the very low volumes of mail and corresponding low dog utilisation, the department should consider whether the deployment of a detector dog to the PGF is an effective use of the detection resource.

Finding: Detector dog utilisation levels are higher in the mail pathway (where minimum standards set by the department are more regularly exceeded) than in the travellers pathway. However, there is still a significant opportunity to improve the consistency of utilisation of detector dogs within the mail pathway.

9.2 X-rays

2D X-ray utilisation

The department records how many travellers have bags screened by X-rays, and what the outcomes of these screenings were, but not the number of bags that are screened. The department measures are focused on an individual passenger's behaviour and individual's biosecurity outcomes rather than bag volumes. While the 2D X-rays have activity-based counters, the Inspector-General was informed that these are unreliable and unhelpful to management decision-making.

In the mail pathway, screening statistics are estimated based on mail volumes. However, to fully understand the relative importance of each screening activity, there must be consistency in data reporting. Screening by X-rays accounts for between 50% and 60% of non-letter class mail screened – approximately 40%–50% is screened by the department and approximately 10% is screened by ABF. In Brisbane, Perth and, to a lesser extent, Melbourne, the department screens all profiled mail cohorts, but ABF X-ray screening of non-profiled items accounts for a significant number of biosecurity detections. In Perth and Melbourne, detector dogs screen significantly more mail than X-ray units. The ABF statistics reported for SGF appear to relate only to referrals and not screened items as for the other gateway facilities.

Based on the available data, X-rays appear to be well utilised at SGF, with very high volumes of non-letter class mail being screened. Utilisation of X-rays at MGF, BGF and PGF is lower, and ABF screening of non-profiled items plays a significant role in biosecurity detections. This can be seen by comparing the ABF's contribution to detections to the department's X-ray screening at MGF and SGF (see Table 6).

This difference in detections in Table 6 in part reflects the gateway-specific cohort profiles. Mail cohorts are used to specify which groups of mail biosecurity officers are required to screen. The Inspector-General was advised that in 2021 national profiles began to be used instead of gateway-specific profiles. This permitted MGF, BGF and PGF to expand the mail cohorts and hence the volume of mail to be screened. This is a positive development.

As seen in Table 6, there is inconsistency in the capture of data relating to 'detection method' in the Mail and Passenger System (MAPS). SGF has very high numbers of manual detections relative to MGF. Given mail items are identified for inspection based on screening by biosecurity officers using X-rays and/or detector dogs and the ABF (using X-rays), the department must clarify what data officers are required to record against 'detection method' in MAPS.

Table 6 Number of detected noncompliant goods at Melbourne Gateway Facility and Sydney Gateway Facility by each detection method, 2018–2021

Year	Facility	ABF X-ray screening	DAWE X-ray screening	Detector dogs	Manual inspection	Leakage survey
2018	Melbourne	4,021	2,259	7,385	236	183
	Sydney	3,192	14,713	7,493	32,720	398
2019	Melbourne	3,797	4,000	19,982	729	200
	Sydney	2,226	12,478	5,016	26,369	369
2020	Melbourne	3,334	4,556	13,063	833	150
	Sydney	2,785	16,772	8,194	31,702	391
2021	Melbourne	1,951	3,485	2,400	1,374	88
	Sydney	1,862	24,813	9,548	6,002	395

Note: ABF: Australian Border Force; DAWE: Department of Agriculture, Water and the Environment.

Source: Data supplied by the department for this review

In response to a draft of this report the department advised that it is revising the relevant work instruction to include a definition for each detection method and when this may occur in the screening process.

3D X-ray deployment

In December 2019, the department received funding for an African swine fever (ASF) response that included 2 3D X-ray machines. This funding was used to purchase the machines for the Modern Seamless Border Clearance (MSBC) proof of concept (POC) work (see chapter 13). The machines were deployed for standard operational use at SGF and MGF. The MGF machine is located on the Express Mail Service (EMS) screening line. It is installed inline but after the location of the ABF 2D X-ray in the conveyor system. The SGF machine is located on a standalone conveyor line. At the time of writing, just over 2 years after the deployment of the 3D X-ray machines as operational units, ABF continues to screen using 2D X-rays before the mail items pass through the department's 3D X-ray units.

One of the touted benefits of the 3D X-ray is its ability to screen between 1,800 and 2,000 mail items per hour. This is a significant improvement in screening volume (efficiency) over the existing 2D X-ray units, which have throughput capacity of 800 items per hour. If the department's 3D X-ray machines are operating as automated screening machines, the throughput of mail would be significantly limited by the use of the ABF 2D X-ray before the 3D X-ray on the same mail conveyor belt. If the 3D X-ray machines are not automated, the throughput of the 3D X-ray machines depends on the speed of image analysis by a biosecurity officer. This means the impact of 3D X-ray on total throughput is marginal. If throughput cannot be maximised because of the lack of automation, there are serious questions about the value proposition and return on investment (ROI) of deploying 3D X-rays.

As part of the 2021–22 Budget, the department received $14 million for the installation of 3 additional 3D X-ray units at international mail gateways for standard operational use. It is important to note that these are not POC or trial units but replacements for the department's existing 2D X-ray units as operational machines.

In commencing installation work for these 3D X-ray units, the department's Secretary was advised that:

> *Challenges include the capacity of the facilities to accommodate these large units within the available footprints and ABFs current preference for 2D screening in the mail pathway. BOD [Biosecurity Operations Division] is investigating options within these facilities but also across other sites including the Brisbane and Perth Gateway Facilities.*
>
> *It is acknowledged that utilisation of RTT [Real Time Tomography] units by both border agencies is required in order to fully realise the benefits of 3D technology. ABF have agreed to a joint trial that focusses on the use of automated risk detection algorithms for customs risk materials such as bladed weapons, firearms and narcotics. The timing of this trial is contingent on the development and delivery of customs risk material algorithms by Rapiscan Systems and therefore is likely to commence in early 2022 to coincide with the expected algorithm releases. (DAWE, 2021f)*

ABF's agreement to a joint trial is a positive step forward, but this is a long way from resolving the current operational limitations resulting from 2 Commonwealth agencies using different X-ray technologies to screen the same mail items.

More than 2 years after the operational deployment of 2 ASF-funded 3D X-ray units and the imminent deployment of 3 more, there are fundamental questions as to the efficiency and effectiveness of the units (see chapter 14) and their suitability as a detection tool within the current operating infrastructure. The department has not completed an ROI analysis for 3D X-ray technology (see chapter 14.5) and this review raises serious questions about the reported benefits (see chapter 14.6) and time frames for essential deliverables (see chapter 13.9).

Closer cooperation between senior managers from the department, ABF and Australia Post is necessary to ensure that the biosecurity risk posed by biosecurity risk materials coming through gateway facilities is mitigated effectively.

Finding: If a rigorous return on investment analysis, including a comparative analysis of detection technologies and assessment of constrained and remedied operational scenarios, had been conducted during 2020–2021 it would have beneficially informed further expenditure on 3D X-rays intended for operational deployment. A rigorous process analysis involving Australia Post, ABF and the department is likely to lead to supported process engineering changes, significant processing efficiency gains and more rapid advances in detection.

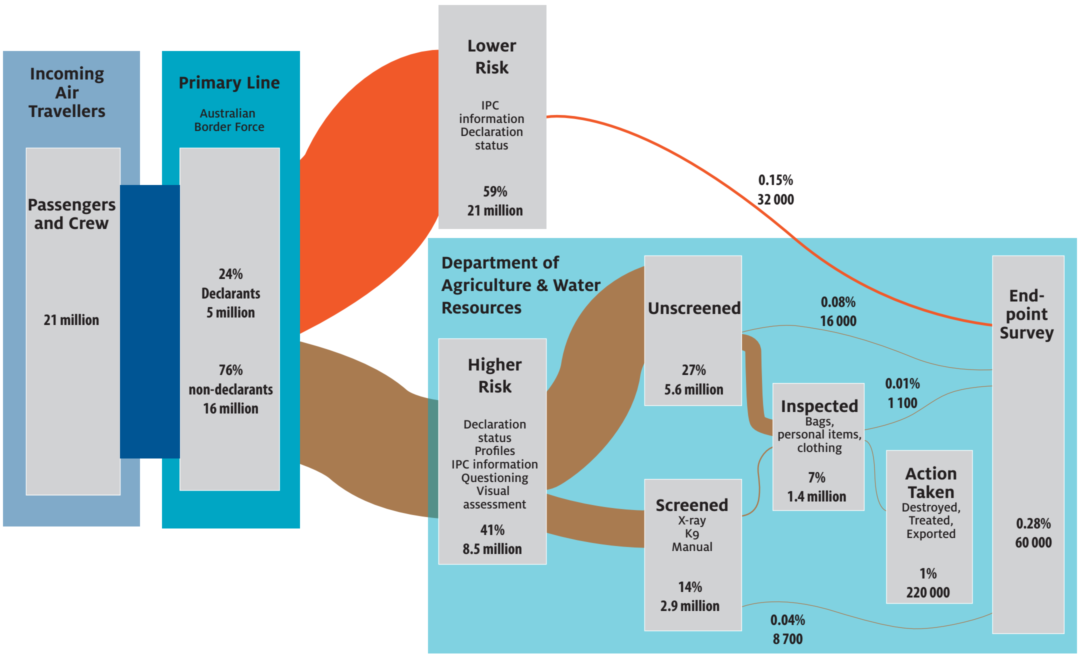
10. Current technology detection performance

A pathway perspective is used when considering performance because detection technologies are not standalone tools; they operate in the context of an integrated at-border biosecurity operation, where individual components support the broader objective of reducing the amount of biosecurity risk material that enters Australia.

10.1 Travellers

For context, Figure 3 provides the relative flow of travellers through the higher-level intervention points of the biosecurity system.

Figure 3 Air traveller biosecurity risk management, 2017–18

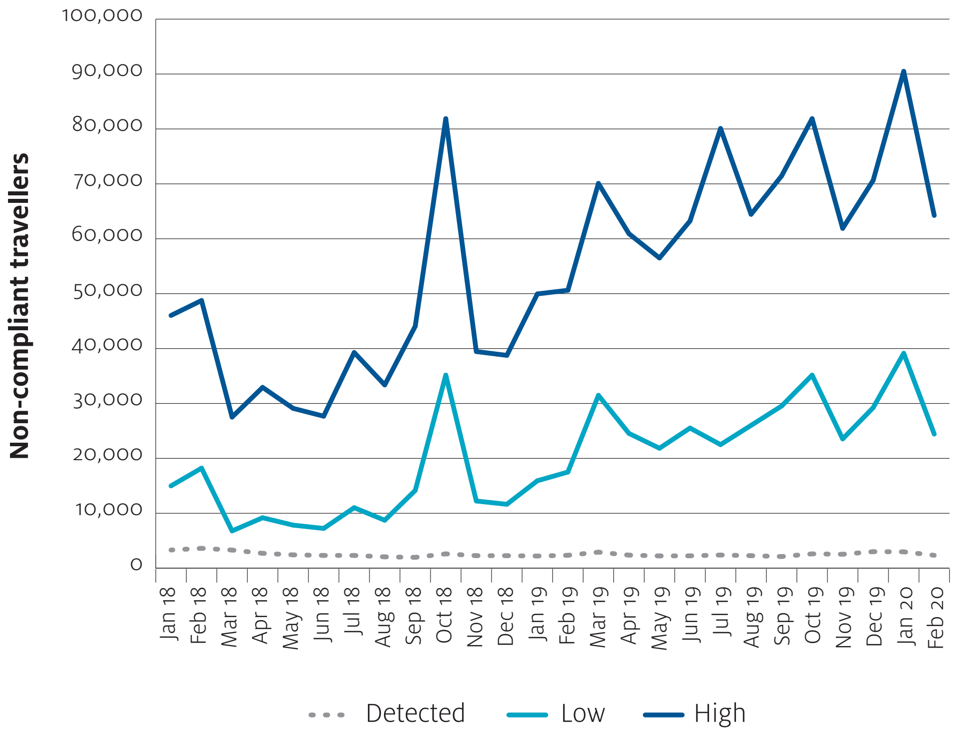


Notes: IPC: incoming passenger card; K9: canine/dogs.

Source: IGB, 2019a (figure adapted from IGB, 2019a review)

The department captures data on the number of travellers screened through each detection method and the outcomes of this screening (in terms of risk capture). This information is essential to understand the performance of the detection tool compared with others – including what it successfully detects and what is undetected. Measuring performance is complicated because the travellers to be screened are either declarants or selected based on broad profile cohorts, and they are then further assessed by risk assessment officers or a biosecurity marshal when they enter the secondary examination area in the airport arrivals hall. As a result, the relative effectiveness of any detection tool is highly dependent on multiple decisions made before the traveller undergoes baggage screening.

Figure 4 Upper and lower bounds of the estimated range of undetected noncompliant travellers (95% confidence interval based on leakage surveys) and number of detected noncompliant travellers, January 2018 to February 2020



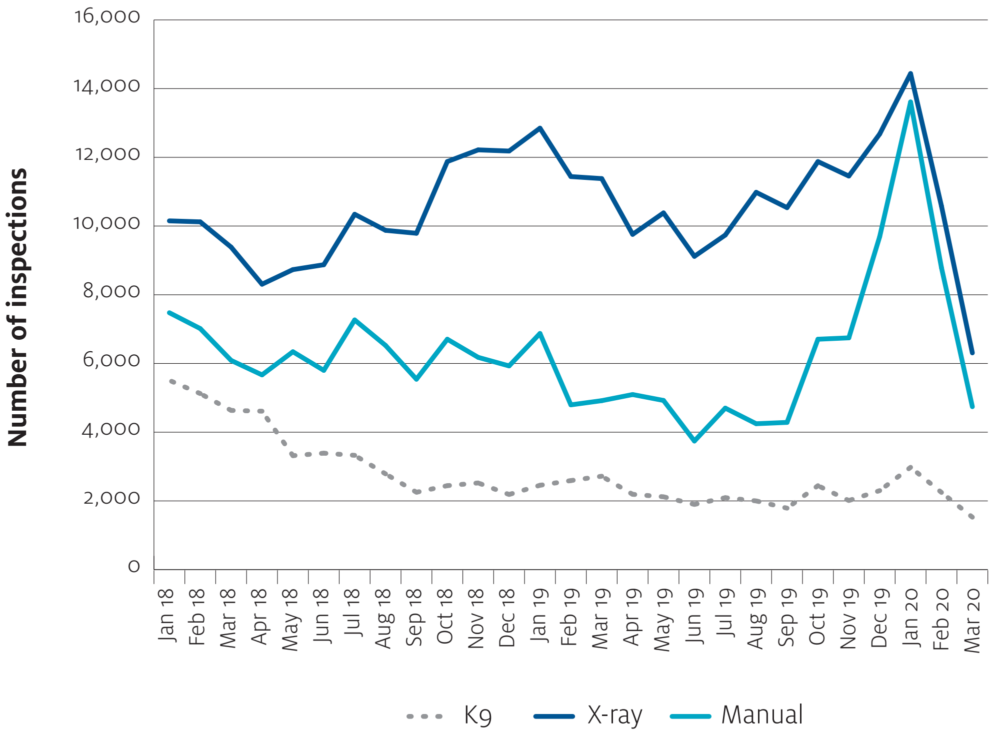
Source: DAWE, 2020a

What is evident from Figure 4 is the relatively low number of (actual) detections and a large range of undetected noncompliant travellers (lower and upper bounds estimated based on leakage surveys). The number of detected noncompliant travellers was reasonably consistent over the 25 months before the COVID-19 border closures. It is notable that the gap between detected and undetected noncompliant travellers increased during 2019. Possible explanations for this scenario include:

- leakage surveys being focused on higher risk cohorts rather than randomised, thereby driving up the non-detected estimate
- screening and inspection processes being ineffective at detecting biosecurity risk
- profiling risk cohorts being too broad and limitations on the number of flagged matches, resulting in higher risk non-declarants exiting through the 'green' channel
- saturation of detection resources – approaching risk level to Australia has been increasing, possibly as a function of passenger growth, while screening and inspection effort has been static or declining (noting detector dog and manual inspection numbers declined during 2018 and 2019)
- due to the ASF response, an increase in the number of travellers flagged for screening between November 2019 and March 2020 (when borders closed) through biosecurity profiles (see Figure 5).

Figure 5 provides a national view of the travellers who underwent noncompliance inspection after screening, for each screening method. It is noted that X-rays and manual screening resulted in a higher number of referrals for inspection than detector dogs. However, noncompliance from those referrals shows that the number of positive detections was significantly greater for detector dogs, followed by X-rays and manual screening (see Source: DAWE, 2020a Figure 6). This suggests that detector dogs are a more effective screening tool for identifying biosecurity risk material than X-ray and manual inspection.

Figure 5 Noncompliance inspection of travellers using detector dog (K9) and X-ray and manual inspection methods, January 2018 to March 2020

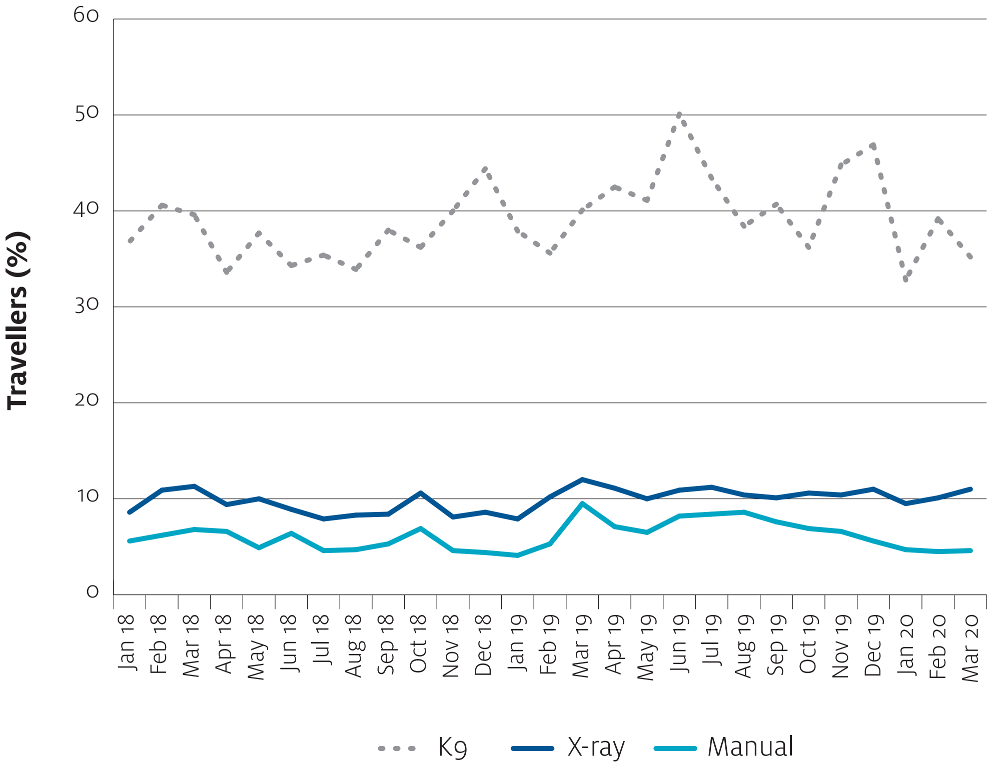


Source: DAWE, 2020a

It is noted that screening by detector dogs was trending downwards from January 2018, with 40%–50% less detector screening by late 2019. As discussed in chapter 9.2, detector dog utilisation in the traveller pathway was well below the required standard of 75%.

Figure 6 also highlight a significant risk that the department's risk-return operating model is being undermined by a focus on biosecurity activity and relative changes in that activity rather than on changes in the estimated approaching biosecurity risk. This is exacerbated by the deployment of profiles based on the number of highest risk travellers arriving on each flight rather than the number of highest risk travellers arriving at each airport. This is required due to ABF caps on the number of travellers that can be profiled for screening per flight. Airport-based profiles show large concentrations of high-risk travellers arriving at the same time – far exceeding individual flight caps but also exceeding the resources available to screen all high-risk travellers. So, instead, flight-based profiles are deployed so that travellers are screened in order of the approach rate to Australia of undeclared high-risk goods on each flight. The department is working with CEBRA to further refine profiling so that they are airport-based and incorporate resource limitations into the model.

Figure 6 Percentage of inspected travellers found noncompliant using detector dog (K9) and X-ray and manual inspection methods, January 2018 to March 2020



Source: DAWE, 2020a

In December 2020, the department ceased its monthly key performance indicator (KPI) reporting that included undetected traveller estimates and replaced it with activity-focused self-service data dashboards. The department advised that a new traveller pathway assurance dashboard is currently being scoped for development. To avoid the further entrenching of a resource-return approach, rather than a risk-return model, in the department's management of biosecurity risk, it is critical that this performance data dashboard, including estimates of undetected biosecurity risk, is quickly and successfully delivered.

Finding: The data indicates that the biosecurity risk was increasing (Figure 4) but the department's inspection effort using detector dogs, X-rays and manual inspection (Source: DAWE, 2020a Figure 6) was generally declining. The Inspector-General is not confident that the department was adequately applying an evidence-based and risk-return approach in the traveller pathway before the COVID-19 disruption.

Recommendation 6

Before traveller numbers resume to pre-COVID levels, the department should undertake a formal operational test of its traveller screening, detection, and leakage survey functions to ensure their efficacy.

Recommendation 7

The department's traveller pathway assurance dashboard should include focus on understanding and evaluating the relative success of the department's risk-return measures additional to the efficiency of its resource deployment.

Leakage surveys

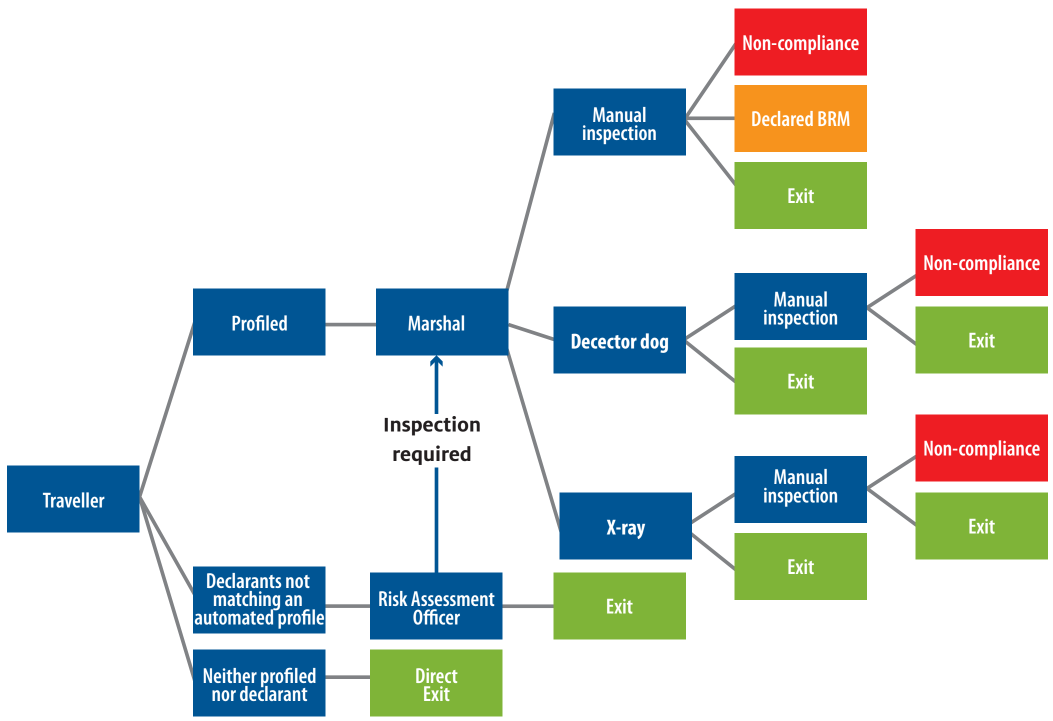
According to the estimates based on leakage surveys (Figure 4), the estimated number of undetected noncompliant travellers is at least twice the number of detected noncompliant travellers.

The majority of the 'leakage' of these undetected non-compliant travellers was through the direct exit stream (not profiled and nothing declared – see Figure 7) and account for up to 80% of the estimated undetected biosecurity risk travellers. Travellers cleared through 'Risk Assessment Officer/Assess and Release' officers and detector dog screening account for up to 15% of undetected travellers, 'Bench Assess and Release' and X-ray screening accounts for 4% and 3% of travellers respectively, while manual inspection results in less than 1% leakage of undetected non-compliant travellers.[1]

The proportion of detected to undetected biosecurity risk travellers suggests that the department's current profiling approach as a first-line screening tool is not performing at the level needed. This is a significant issue as risk-profiling is the primary determinant of the number of travellers that are screened by detector dogs and X-ray units and biosecurity officers. This may be due to current system limits to the total number of travellers matching biosecurity profiles that can be referred for further screening. This is being addressed in the traveller modernisation work to develop a biosecurity-specific risk engine for direct deployment by the department.

The department advised the Inspector-General that it is working to improve data collection and the profiling capability as part of the TAMS project (see chapter 5.2) and has recently received a CEBRA review, as part of an 'Advanced Profiling' project, which has recommended several changes to the profiling methodology.

Figure 7 Traveller biosecurity clearance process



Note: BRM: biosecurity risk material.

Source: Prepared as part of this review

1 Note: figures do not add up to 100% as the percentage varies month to month and the figures provided are indicative of the levels of each clearance process.

Leakage survey data collection is a critical biosecurity assurance function within a risk-return concept of operations. It underpins the department's assessment of approaching risk material and effectiveness of measures to intercept it, which in turn impacts profile development and resource deployment.

Ensuring high-quality leakage data collection based on the required sample size and randomised selection of bags and mail items is a critical operational management role.

Finding: The evidence available to the Inspector-General indicates that the current operating model within the traveller pathway, including the deployment of detector dog and X-ray detection technologies, is not achieving an optimal biosecurity outcome.

Recommendation 8
The department should seek to deploy its detection tools more actively and flexibly in the screening of travellers until data and systems enable a high level of effectiveness of cohort profiling.

10.2 Mail

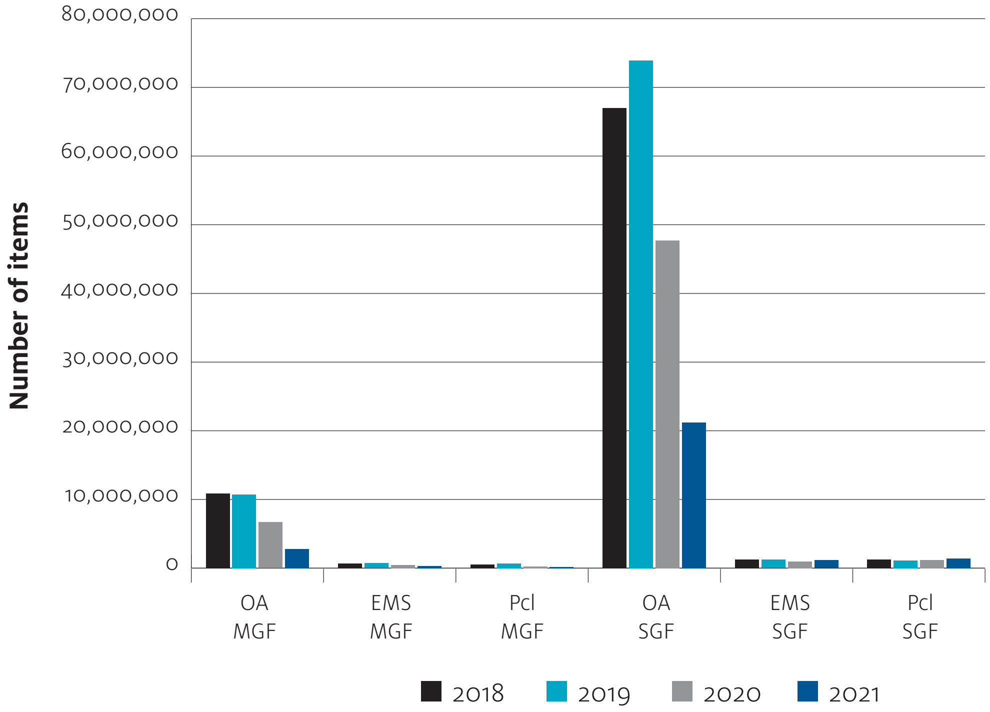
Mail volumes

The department routinely screens 3 of the 4 classes of international mail – Express Mail Service (EMS), Other Articles (OAs) and Parcels (Pcl). The letter class stream – contains very little biosecurity risk material relative to total numbers of risk items, and the department has not routinely screened letter class mail since October 2012 based on biosecurity risk-return.

The largest number of mail items arriving in Australia is OAs (Figure 8 and Figure 9), with the majority cleared through the Sydney Gateway Facility (SGF). The Melbourne Gateway Facility (MGF) is the second largest facility and, like Sydney, OAs make up most of the arriving mail. Brisbane and Perth receive significantly smaller quantities volumes of mail.

The COVID-19 pandemic had a large impact on mail quantities arriving in Australia, largely for processing at the SGF and MGF (Figure 8).

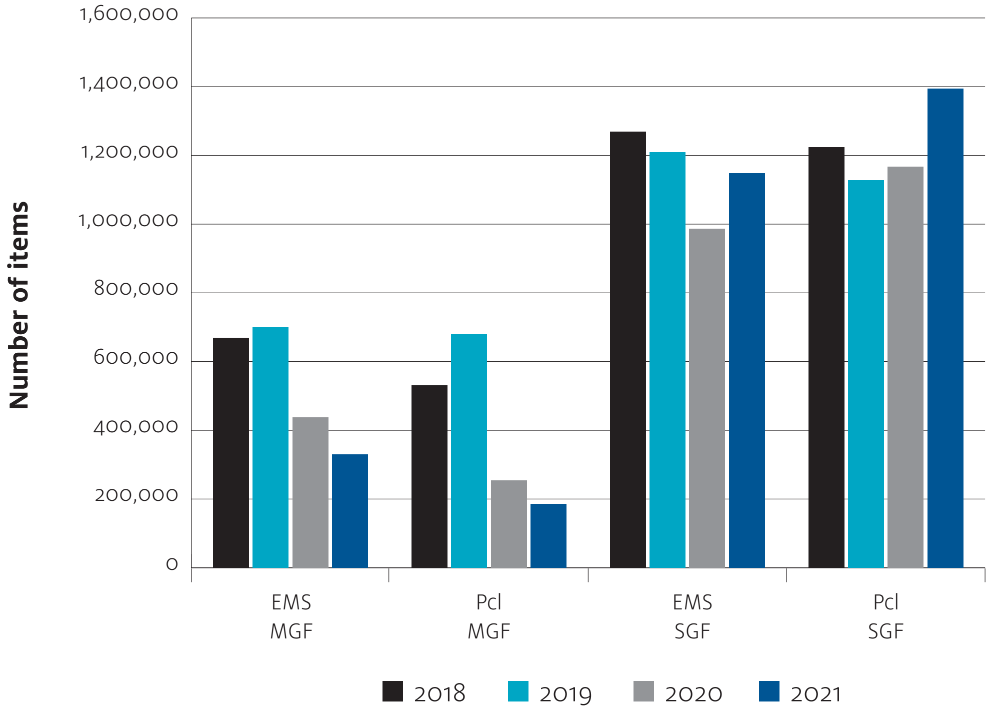
Figure 8 Mail quantities at Melbourne Gateway Facility and Sydney Gateway Facility and mail type, 2018–2021



Note: EMS: Express Mail Service; MGF: Melbourne Gateway Facility; OA: Other Articles; Pcl: Parcels; SGF: Sydney Gateway Facility.

Source: Data supplied by the department for this review

Figure 9 Quantities of 2 mail types at Melbourne Gateway Facility and Sydney Gateway Facility, 2018–2021



Note: EMS: Express Mail Service; MGF: Melbourne Gateway Facility; Pcl: Parcels; SGF: Sydney Gateway Facility.

Source: Data supplied by the department for this review

Mail profiling

The department develops national mail profiles to target high-risk biosecurity material in all non-letter class mail. Profiles are calculated using data recorded by biosecurity officers in MAPS (detection and leakage) and volume data provided by Australia Post for each arriving cohort of mail. The risk profiles are used to select various classes of mail for screening by X-ray, detector dogs or manual inspection for biosecurity risk material. Letters receive the least amount of screening and inspections because they are considered the lowest risk biosecurity material (IGB, 2019a).

Based on interviews with departmental staff in the mail policy and operating areas, COVID-19 had a significant impact on the reported sources of mail because mail from many countries was consolidated offshore in international hubs during 2019 and 2020. This impacted the department's risk profiles and was a contributing factor in moving from port-specific profiles to national profiles at that time.

Performance framework

For the last decade, the department has used a CEBRA-developed performance model for the mail pathway. The model involves a series of KPIs:

- Before Intervention Compliance (BIC) measures how effective the department is at promoting compliance (percentage of international mail articles that were compliant before intervention).
- Post Intervention Compliance (PIC) measures how effective the department is at promoting and enforcing compliance (percentage of international mail articles that were compliant after intervention).
- Non-Compliance Effectiveness (NCE%) measures how effective the department is at detecting biosecurity noncompliance. In mail, it is expressed as the percentage of noncompliant mail articles intercepted by the department at the border. The NCE% is estimated using data from leakage surveys.

The department categorises biosecurity risk goods into 2 categories – 'high risk' and 'risk' goods. Goods are classified as either 'high risk' or 'risk' based on advice from the department's scientific and technical areas. Consistent with the department's risk-return operating model, it uses statistical profiles and the deployment of its detection technologies to actively target high-risk goods. Where the department identifies 'risk' goods as a by-product of this operating model, they are managed appropriately (DAWE, 2019).

Before intervention compliance

For the quarter November 2019 to January 2020, before intervention compliance (BIC) for high-risk biosecurity goods and all risk (high-risk and risk) goods was 99.53%. This means that the pathway has a high level of compliance. However, as the number of non-letter class mail items is large – 88 million in 2019 – 0.5% equates to approximately 440,000 biosecurity risk items.

Noncompliance effectiveness

Within a risk-return operating model, understanding the NCE% assists the department in deciding the number and type of resources, including X-rays and detector dogs, to be applied within each gateway facility and across mail classes. This review assessed management reports from January 2018 to June 2021.

The NCE% varies significantly between gateways and mail classes. As was seen in Figure 8, the department's ability to screen mail is impacted by its volume, hence OA mail tends to have a lower NCE%. This is also seen in the difference between NCE% for the same class of mail in different ports. Sydney has a lower NCE% in OA and Pcl than Melbourne but a higher NCE% for EMS. This may reflect SGF's greater focus on EMS or a lower number of leakage surveys. Between January 2018 and June 2020, SGF consistently had smaller numbers of annual detections from leakage surveys compared with MGF despite having almost double the volume of EMS items.

There are variations in the NCE% between SGF and MGF (see Table 7 and Appendix A). The NCE% of each mail class is expressed as the percentage of noncompliant mail articles detected by the department and calculated using data from leakage surveys. The differences between gateway facilities may relate to the quality of the leakage surveys or the number of mail items screened relative to the total items per mail stream or both.

Table 7 Number of mail items and noncompliance effectiveness (NCE%) for each gateway facility and mail class, January 2018 to June 2020

Gateway facility	Measure	Other Articles	Parcels	Express Mail Service
Sydney	Total number of items	166,656,869	2,699,716	2,898,849
	Total number screened	39,678,232	560,057	1,099,344
	Mean NCE%	18.47	48.53	72.47
Melbourne	Total number of items	26,709,382	1,287,425	1,586,657
	Total number screened	14,791,561	1,146,037	1,023,574
	Mean NCE%	54.28	70.17	67.90

Source: DAWE, 2020b

If the department were using its performance reporting, specifically NCE% data, effectively for its risk-return decision-making and detection resource allocation in the mail pathway, the OA stream would be the focus based on volume unscreened and low NCE%. The EMS stream would be the lowest priority, as it has consistent high numbers of screening and high NCE%. As will be discussed further in chapter 13, the POC for 3D X-rays and deployment into standard operational use occurred for EMS.

Finding: It is essential that data to support the calculation and analysis of noncompliance effectiveness is collected so that the department's performance in managing the preventative biosecurity system across all import pathways is understood. Endpoint or leakage surveys (also known as CCV in cargo) is an essential element of this, and the department should take greater efforts to optimise the quality and quantity of this data collection. The department should avoid measuring its effectiveness in managing the preventative biosecurity system based solely on activity performance (a resource-return approach).

Recommendation 9

The department should strengthen its use of noncompliance effectiveness (NCE%) reporting as the key measure of risk-return effectiveness in designing and managing the preventative biosecurity system. While activity performance (resource-return) has its place, it is not an effective measure in understanding the department's impact in mitigating the biosecurity risk.

10.3 Post COVID-19 detector dog operations

With the rapid increase in international flights post COVID-19, the department has advised that it intends to undertake a review before reinstating detector dogs in smaller regions and airports. This review is intended to ensure adequate demand based on actual workloads and to address previous challenges of availability of detector dog handlers, wellbeing of detector dogs in hot weather conditions and suitability of kennelling facilities (DAWE, 2021c).

During interviews with the department the Inspector-General was informed that best-practice management of animal wellbeing requires that a minimum of 2 dogs be kennelled in a region. Prior to COVID-19 redeployments, single dogs were kennelled in Adelaide and Norfolk Island, and single dogs in Cairns and Darwin were co-kennelled with other dogs. All these locations reported ongoing issues with achieving appropriate levels of utilisation due to limited deployment opportunities.

Detector dogs can be a very effective detection tool when deployed appropriately in a biosecurity import pathway, but this comes with the associated development costs and ongoing overheads – handlers, kennelling and transport. The Inspector-General has not seen any biosecurity risk-based evidence that would support ‘a dog in every airport’ approach. Deployments of detector dogs must be based on the dog’s effectiveness as a detection asset, which will involve ensuring that detector dog wellbeing is managed. Poorly justified deployments reduce overall national biosecurity effectiveness, as those detection assets could be deployed in alternative import pathways where their contribution to reducing Australia’s overall level of biosecurity risk would be significantly greater.

In departmental documents and discussions with staff there was reference to the deterrent and promotional compliance effects of detector dogs in the traveller pathway. The Inspector-General notes that since 2013 the department has deployed detector dogs through screening channels. This means that travellers have limited visibility of detector dogs. There is no research available on whether the presence of detector dogs influences traveller compliance behaviour. Given this, the Inspector-General considers that deterrent and promotional effects should not be a factor in the department’s decisions on deployment of detector dogs.

Finding: A detector dog is an effective mass screening tool and should be deployed to maximise the detection of arriving biosecurity risk material and in a manner that provides for the maintenance of appropriate detector dog wellbeing. The assumption of a ‘deterrent effect’ from detector dog deployment lacks an evidence base and until that is available should not be a consideration in deployment strategies.

The department considers the sea traveller pathway to be of low risk. Before COVID-19, the department did not use detector dogs or X-rays to screen sea travellers. The department would normally perform manual screening of baggage as travellers depart the vessel. Limited data is available on the goods entering Australia through this pathway because biosecurity officers have recording limits for entering information in the department’s electronic data collection tool, the Mail and Passenger System (MAPS), on products seized at the time of disposal.

The Inspector-General has previously noted that this pathway presents an ASF risk because of ASF outbreaks in an Indonesian province and the large number of Australians who travel on cruises to Indonesia. The Inspector-General previously recommended that, to reassess the risk, the department should screen cruise vessel travellers who end their voyage in Australia and ensure that an evidence-based approach is being applied (IGB, 2019a).

The first post-COVID-19 cruise vessel returned to Australia in mid-April 2022. Sea traveller numbers are expected to increase quickly during the 2022–2023 season commencing around October 2022. In response to the Inspector-General's ASF recommendation, the department advised that it intends to conduct a targeted screening of sea travellers later in 2022 using detector dogs, with a particular focus on detection of meat and other animal products, (including ASF risk material (IGB,2020. It also advised that the Travellers Maritime Intervention Strategy is currently in development and that this will inform future deployment of detector dogs in the sea traveller pathway.

11. Staff capability

11.1 Staffing numbers

COVID-19 had a significant impact on the deployment of detector dog handlers, with most detector dog assets being redeployed away from airports to mail centres. Table 8 provides a breakdown of where biosecurity officers undertaking detector dog handling roles and staff trained in 2D X-ray and 3D Xray screening are geographically located (DAWE, 2021g). This information is current as of 30 August 2021 and includes the:

- number of biosecurity officers accredited as detector dog handlers
- number of staff in mail who undertake 2D and 3D X-ray screening
- number of staff in travellers who undertake 2D X-ray screening
- number of staff in travellers who undertake 3D X-ray screening (applies only for Melbourne; the Real Time Tomography (RTT) is currently decommissioned).

Table 8 Officer deployment by detection technology, August 2021

	No of biosecurity officers by location					
	Qld	NSW	Vic	SA	WA	NT
International airports						
Detector dog handlers	8	–	–	–	–	–
2D X-ray	49^	56	39	13	33	16
3D-X-ray	–	–	59	–	–	–
International mail facilities						
Detector dog handlers	2	19	10	0	3	0
2D X-ray	6	38	19	–	11#	–
3D X-ray	–	13	17	–	–	–

Note: Due to COVID, detector dogs only operated at Brisbane international airport. All other detectors dogs were redeployed to mail gateway facilities.

Total number 11 staff, however they are part of an integrated workforce and also work in cargo. On average daily numbers at the Perth mail facility is approximately 6 depending on workload demand.

^ Total number of 49 staff which includes 30 in Brisbane, 11 in Gold Coast and 8 in Cairns

Source: DAWE, 2021g

11.2 2D X-ray training

The department has recently developed a new X-ray training program framework for 2D X-ray operators that involves 2 courses:

- X-ray safety and awareness
- biosecurity X-ray screening.

The Inspector-General notes that these courses include instruction on relevant guidelines and work instructions, with progressive online knowledge assessment in the department's learning management system 'LEARNHUB'. Also, supervised assessment activity by a technical training officer involves the actual operation of the X-ray unit from both functional and image analysis perspectives.

This new training requires officers to complete a Centre for Adaptive Security Research and Applications (CASRA) 40-image online assessment task and achieve an 80% pass mark. This is critical to ensuring officers have the appropriate capability to effectively identify biosecurity risk on-screen. The X-ray image identification research trials, conducted by the department as part of the simulated trials comparing 2D and 3D technologies (see chapter 13.9), showed that an individual officer's ability to identify biosecurity risk material in an X-ray image can vary by as much as 20% (Clarke-Errey and Finch, 2019).

Finding: Improved X-ray training is an important component of maintaining and lifting the effectiveness of the department's 2D X-ray assets. To ensure continued competency in X-ray image analysis, the department should require all officers assigned to traveller and mail pathways to undergo the CASRA training at a minimum and for existing officers to undergo a 12-month reaccreditation in image analysis.

To support ongoing skill improvement in image analysis, the department should undertake regular image capture of actual complex mail and baggage images for use in X-ray image training of officers. Adaptive computer-based training (CBT) could be used to incorporate superimposed objects and images of different complexity into actual scans, and officers could then be required to record a potential risk biosecurity item. This could also provide additional improvements and assurance in officers' image analysis capabilities. One CBT study showed user improvements in positive identifications by screeners of 8% on average and a reduction in the number of false alarms by 6% (Bracceschi, 2021).

11.3 Detector dog handlers

The detector dog handler course was brought into the department in 2015. It continues to be run by the department. Handlers are recruited by and report to their respective regional management groups. Handlers undergo a 12-week handler training program. This includes 2 weeks on the job familiarisation, 4 weeks intensive training at the national training centre, 5 weeks in the field development and 1 week of advanced technical delivery. The department has a detailed selection schema identifying suitable individuals to undertake dog handler training (Smith, 2022) – summarised here:

1. Detector dog handler role and required skills examples are used to identify potential detector dog handlers.
2. Suitability interview questions, practical and theoretical assessment criteria are requested from the National Technical Manager.
3. An assessment of suitability is conducted before nominating applicants to participate in the detector dog handler training.

4. A suitability interview is conducted.
5. A practical and theoretical assessment is conducted to evaluate the ability of a person seeking employment as a detector dog handler. A minimum of 6 practical assessment exercises must be performed.
6. The applicant is provided with one additional opportunity to repeat a practical exercise after being provided feedback, to test their learning and physical capability.
7. A rating scale of A–E is used to grade the applicant's performance in:
    a. the suitability interviews
    b. the practical assessment.
8. A medical and fitness assessment is conducted to ensure suitability of successful applicant for the role.

New handlers are paired with experienced detector dogs and, similarly, new dogs are paired with experienced handlers. The performance of the handler and the dogs is regularly monitored by 7 technical supervisors who are also functionally aligned to their respective regional management groups. Handlers and dogs undergo formal performance assessment twice a year to ensure continued effectiveness.

Handlers are authorised biosecurity officers under the *Biosecurity Act 2015* and are recruited through internal and external processes. There are longer lead times for external recruitment because officers need to also undertake base-level biosecurity officer training. The Inspector-General was advised that the current strategy in Victoria where recruitment is taking place for handlers and biosecurity officers is to seek internal candidates for handler vacancies and backfill through recruitment of external applicants for biosecurity officer positions.

Given the lead times involved in training dog handlers, availability of insufficient handlers will mean that not all dogs can be deployed. This means a valuable detection asset will be idle and biosecurity risk material will potentially be undetected. It seems reasonable to expect that there would be an appropriately sized cohort of biosecurity officers trained as handlers available to ensure optimal utilisation of detector dogs. However, it should not be a complex cost-effectiveness optimisation decision to ensure that detection capability is cost-efficiently maintained at a high degree of operational readiness.

Finding: A sufficient cohort of detector dog handlers is necessary to manage fluctuations in officer availability. This will ensure that detector dog assets are being continuously deployed at a high level of efficiency.

11.4 Technical officers

The departments 7 technical officers nationally who are responsible for ensuring detector dogs are effectively deployed and proficiency is maintained in accordance with the National Detector Dog Deployment Standards guidelines. These officers are part of the operational programs (mail and travellers) and report on technical issues to Detector Dog Operations.

Key functions performed by technical officers related to capability are to:

- provide feedback, technical advice and develop technical and operational capability of detector dog handlers
- perform business assurance assessments

- manage and report team development and proficiency, monitor and provide business assurance documentation to the National Technical Manager and Assistant National Technical Manager
- liaise with the National Technical Manager and Assistant National Technical Manager to resolve technical performance issues
- assign, coordinate and oversee technical training of detector dog operations staff
- deliver specific training to identify/improve individual detector dog team performance
- implement and review detector dog team proficiency maintenance training
- analyse and discuss detector dog operations utilisation data with management.

Finding: The department appears to be well short of optimal utilisation of detector dogs (scale, deployment and handler availability). With increasing numbers of travellers and mail post COVID-19, the department must quickly bring this important detection capability up to an appropriate standard of operational deployment.

12. Improving existing detection capabilities

12.1 Detector dogs

Insights into odour identification

In recent years, the department has undertaken several rigorous trials in conjunction with university research partners aimed at exploring detector dog target odour capabilities. This work has involved improving understanding of detection capabilities relating to common biosecurity risk goods, insects and even the COVID-19 virus.

Brown marmorated stink bugs

In 2018, the department commissioned a research study on the efficacy of detector dogs in detecting brown marmorated stink bugs (BMSB) following unprecedented detections of BMSB in cargo, particularly from Europe, in preceding years. Due to the small size of BMSB, the insect can access areas of cargo that are not readily visible or accessible to a biosecurity officer. This is particularly the case in break-bulk cargo such as machinery and vehicles.

The department undertook a POC study to assess whether detector dogs could be trained to detect BMSB. A major hurdle was access to BMSB odour for training purposes due to the exotic nature of the BMSB. As part of the project, the University of New England was able to develop a solvent extract to replicate BMSB odour for dogs to be trained on. During 2 separate field trials using the solvent extract, it was confirmed that it was possible to establish scent association for 6 detector dogs. Initial imprinting of BMSB odour for an additional 14 detector dogs was also undertaken and operational-based training was delivered to 6 detector dog handlers (Smith, 2022).

In response to the increasing threat posed by BMSB and the success of the POC study, a pilot program to test capacity and capability of dogs to detect BSMB was launched at the Port of Brisbane in January 2019. The deployment focused primarily on heightened surveillance screening of cars, machinery and break-bulk cargo discharged from roll-on roll-off vessels.

The pilot proved that dogs could be practically deployed in the wharf environment and could provide effective screening with efficiencies in speed upwards of 5 times that of traditional inspection methods. This meant that significantly more discharged items were able to be verified BMSB-free before leaving the wharf environment than would otherwise have been possible (see Table 9) (Smith, 2022).

Table 9 Comparison of detector dog versus manual inspection of imported cars for brown marmorated stink bug

Inspection task	Number of cars	Two-dog teams – inclusive of set-up/ pack-up (hours)	Visual inspection (hours)
Full deck of cars	300	3.6	25
Full vessel of cars (10 decks)	3,000	35.8	250

Source: Smith, 2022

Khapra beetle

In mid-2020, the department explored the possibility of deploying detector dogs to detect khapra beetle – Australia's No. 2 priority plant pest. It concluded that the training of detector dogs to identify insects and other new scent targets was well-established and could be developed for khapra beetle by the National Detector Dog Training team.

However, the availability of a suitable khapra beetle odour with which to establish and maintain the dogs' capability posed a significant challenge. It proved difficult to access the odour samples for live khapra beetle for detector dog training and capability maintenance. Without access to live khapra beetles, training would be reliant on manufacture of a replicated odour which would require a minimum 6-month lead time to develop, test and deliver. Development of the odour samples would follow the solvent extract approach taken with BMSB or could potentially utilise other technology such as synthetic odour development or 'soak' type materials that absorb odour direct from source material (DAWE, 2020c).

Further, it was assessed that the effectiveness of the dogs in screening sea containers for khapra beetle insects would be adversely impacted by the high likelihood that the dogs would also encounter other related target items (not khapra beetle). For example, the existing dog fleet would respond to any consignment containing seeds for sowing, which already formed part of a known import, regardless of the presence, or not, of khapra beetle. In this scenario, the handler would be unable to tell why the dog had reacted. It was proposed that dogs specifically trained to detect insects, but not other target odours, would be one way to address this issue.

The department estimated that the development of a pilot khapra beetle detection capability would cost $270,000 and 0.5 full time equivalents (FTE). Ongoing deployment costs would be $130,000 per annum for sampling and screening facilities and odour production and 3 FTE. These costs do not include the kennelling, transport and maintenance of the dogs or sample acquisition. Based on the available information, the Inspector-General estimates the cost of deploying 2 dog teams for khapra beetle detection using a sampling methodology in the vicinity of $800,000 to $900,000 per annum (Assumptions: 6FTE @ $100,000; $100,000 for kennelling, transport and maintenance; $130,000 for sampling and odour identification). A fully functioning capability could screen approximately 60,000 containers per year (Assumptions: 40 containers per hour for 5 hours per day for 150 days per year = 30,000 containers x 2 dog teams).

Remote air sampling

The department also considered 'remote air sampling' of containers, involving air being drawn through a specialised filter directly from a sealed container. The filter captures the odour molecules from the air inside the container and is later presented in batches for detector dogs to screen. Any containers identified by the dog would be flagged for further inspection, with non-indicated containers being released. It was estimated that a

2-dog team could screen samples from approximately 40 containers per hour using this method, offering significant time and cost savings when compared with manual unpack or 'tailgate' inspections (opening the container doors and doing a visual inspection of the goods). The department did not provide data on the number of hours that a dog could maintain this rate of detection.

COVID-19 detection search

In April 2020, the department partnered with ABF and the University of Adelaide to monitor international research and progress trials on the usage of detector dogs to identify COVID-19 positive travellers. While the ABF led the research trials, the department committed an experienced Adelaide-based detector dog handler and dog transport vehicle to assist in the training and deployment of the detection dogs during the project.

The research assessed the dogs' ability to differentiate between sweat samples (on gauze swabs) collected from patients that returned COVID-19 positive results and those that returned COVID-19 negative results.

The project was successful in demonstrating that detector dogs could be trained to identify COVID-19 positive travellers during the infectious phase of the virus cycle.

International research into COVID-19 detector dogs have shown consistent results with Australian trials. To date, most countries involved in similar trials have chosen to discontinue this research. The department ceased involvement in December 2021.

Odour generalisation

The department conducted several experiments, in collaboration with the University of New England, to provide greater insights into the ability of biosecurity detector dogs to generalise odours. Olfactory generalisation enables dogs to identify variations of a target odour and respond to similar odours in the same way as they would respond to the originally trained odour. This has important implications for how they are trained:

- Novice dogs presented with a range of novel citrus fruits demonstrated an ability to generalise at an early stage in their training. Chemical odour analyses showed that these citrus fruits emitted several volatile components in common.
- Experienced dogs, for which chicken eggs are a common target odour, were presented with a range of eggs from other novel species and showed a surprising lack of recognition to backyard chicken eggs. Chemical odour analyses found that store-bought chicken eggs emitted several unique volatiles not detected in backyard chicken eggs, as well as having others in common. Therefore, dogs may require specific training with untreated, non-commercial eggs of different types to ensure they can reliably detect eggs from the range of species that are illegally smuggled across our borders.
- Chemical odour analyses of 7 divergent insect species revealed some similarity amongst the volatile components, with one component (acetic acid) present in all 7 tested species. Therefore, it may be possible for dogs to generalise across the odours of different species of insects, and appropriate control odour samples are needed if discrimination for a specific species is desired. Results also suggest that olfactory discrimination would be readily achieved due to the large number of unique volatile components of different insect species.

Performance effectiveness

The department provided strong evidence of its efforts to further improve the detection efficiency and effectiveness of its dog fleet. Jointly with the University of New England, the department explored factors relating to dog selection, training and deployment. The aim of the research was to 'enhance selection techniques by identifying and assessing factors that influence a dog's ability to be trained to be a successful biosecurity detector dog' (Brown et al., 2021).

Improved dog selection would provide benefits to the department and ABF by reducing the resources committed to dogs that ultimately do not meet performance requirements and are subsequently returned to the ABF. The report concluded:

> *The department's current detector dog selection criteria provides a reliable indication of success in terms of completing the initial training course, but does not appear to be a good indicator of longer term success in the operational environment. Adapting the current dog selection testing protocol to incorporate additional traits associated with longer term operational performance may be warranted. Further research is needed to identify specific traits associated with biosecurity detector dog performance, and to develop a simple standardised behaviour test that can accurately identify these traits. Determining the heritability of desirable traits within the breeding colony from which these dogs are selected would also be of benefit. (Brown et al., 2021)*

Finding: The rigorous technical and experimental analysis that the department has undertaken in recent years to improve the performance and capability of detector dogs is applauded. This research has shown that detector dogs are a highly adaptable detection tool in the management of a range of biosecurity risks and can be specifically and generally trained for either targeted or flexible deployment across multiple import pathways.

Implementation of development activities

The Inspector-General notes that the department received $84.1 million in the 2021–22 Budget to target development of improved measures for 'hitchhiker pests', including khapra beetle, in sea containers and other cargo (DAWE, 2021h). During departmental interviews, the Inspector-General was advised that the operational deployment of detector dogs to conduct internal and external marine container screening had not been considered, despite the success of the various trials over the preceding 4 years.

The department has shown strong interest in recent years in technology-based research and development (R&D) but has not effectively invested in the optimal deployment of its existing detector dog capabilities against many of the operating challenges for which it is seeking experimental technological solutions. There is a need for a detection deployment strategy focused on ensuring best possible biosecurity controls now, rather than experimental capability with a possible payoff in 5 to 10 years.

Similarly, in a recent announcement, $2.041 million was committed over 4 years for 4 detector dogs to conduct surveillance as part of the Northern Australia Quarantine Strategy (NAQS) program. In response to a question from the Inspector-General about how these dogs would be deployed, the department advised that:

> *planning and implementation for the capability of the additional four detector dogs is being conducted collaboratively with NAQS Torres Strait and Field Operations. NAQS provided the following initial information:*
>
> - *Detector dogs to be located in northern Australia.*
> - *There has been some initial work on a proposal for a dog to be located on Thursday Island.*
> - *There is a focus on training rangers for preparedness and response as well as connecting rangers to industry.*
> - *BOD to consider how this will include detector dogs.*

The department advised that in late 2021 it created a new section to manage, assess and advise on different technologies. The new section will support prioritisation and consider trials and/or implementation of fit for-purpose technological solutions within biosecurity operations across all pathways. It will need to apply rigorous assessments of the likelihood of new technology contributing effectively to the department's risk-return approach to biosecurity risk mitigation, with a favourable return on investment.

Finding: The department has conducted excellent work on exploring and enhancing the detection capabilities of detector dogs but is yet to effectively leverage this good work. There appears to be no clear direction or process as to how this work is translated into an integrated operational risk management capability.

Recommendation 10
The department should establish clearer processes for the consideration and integration of new or enhanced detector dog detection capabilities into operational biosecurity risk management.

12.2 2D X-ray projects

The department has undertaken a number of activities to better support the use of its fleet of 29 2D X-ray in airports. These activities have included:

- updated instructional material on the management and use of 2D X-ray equipment
- development of a new competency-based learning program (see chapter 11.2)
- introduction of trays to improve useability and safety
- digital signage to assist travellers in understanding how to safely load a bag onto the X-ray conveyor
- operational checklists and equipment labelling
- hardware and software upgrades
- research on automated detection algorithms.

These activities are important to the department's detection capability, as current evidence suggests that the 29 2D X-rays deployed nationally will continue to play a key role in the department's suite of detection tools over the medium term and possibly longer term.

Other operational improvements

It was identified that there were many instances of baggage being jammed in or around X-ray units, causing both a safety and a financial impact to the department. Given this, the department commenced a trial of baggage trays at Melbourne airport. The trays proved to be effective at preventing these problems and have been rolled out nationally in the traveller pathway. A new guideline and work instruction was published in late 2021.

For a pilot program undertaken in Sydney and Melbourne airports, monitors were mounted on top of the X-ray units to display an animation that instructed travellers how to correctly load baggage onto the conveyor belt and provided safety information. The animation can also be incorporated with other messages, such as information on specific biosecurity risks, such as ASF. The digital signage is being installed on every X-ray unit in the traveller pathway.

The department is working with the DoHA to develop an asset label and X-ray operation checklist. Key information about the unit is displayed, which will assist with officers to identify who to call if a fault or incident occurs.

X-ray hardware and software upgrades

The department is undertaking a trial with Smiths Detection on a new 2D X-ray interface that could provide:

- improved reporting capability related to total bags, operator decision-making on bags, and X-ray utilisation
- an enhanced training platform to make it easier to both test and train new starters and verify existing officers. It will also be able to provide the flexibility to conduct online training and remote learning
- an easier to use touchscreen and physical mouse interface and a performance dashboard that can provide key feedback to management.

At the time of writing, these enhancements were still being tested and evaluated for cost benefit. Moving to bag-level X-ray screening requires an operational change in addition to technology change.

12.3 2D algorithm project

As part of the ASF response activities, the department commenced a trial to assess whether biosecurity algorithms can be developed and deployed to enable automated detection using a dual view 2D X-ray unit. The department contracted a company that has been developing biosecurity algorithms on behalf of US Homeland Security and US Customs and Border Protection to assist with this project.

The project's aims are to determine:

- whether biosecurity algorithms are able to be deployed onto a conventional 2D X-ray dual-view unit to automatically detect biosecurity risk material
- the capability of the Rapiscan 927DX unit compared with the department's existing Smiths 100100v X-ray units.

Work on this project is at an early R&D stage (DAWE, 2021i).

> **Finding:** 2D X-rays will continue to be required for the foreseeable future as an integral part of the department's detection capability. Continued enhancements in processing, image analysis and technology are important in ensuring the optimal effectiveness of this relatively low-cost detection capability.

13. Modern Seamless Border Clearance project

13.1 MSBC intent

The department's exploration and deployment of 3D X-rays under the Modern Seamless Border Clearance (MSBC) project is the most significant development and investment in detection technology since the 2001 Increased Quarantine Initiative (IQI) 2D X-ray deployment.

The MSBC project has as its objective 'To collaborate with other border agencies in trialling new and innovative technologies to achieve a more seamless border experience for international passengers and imported mail and air cargo in the medium to long term' (DAWE, 2019).

The key outcomes of this trial of new X-ray technologies for the department will be to determine:

- if the new X-ray technologies can be more effective than current X-ray units in assisting biosecurity officers to identify biosecurity risk material
- if the new X-ray technologies can allow baggage, mail or cargo with no biosecurity risk material to be processed faster
- if additional information from the new 3D X-ray units can allow the development of computer algorithms to automatically analyse X-ray images and alert biosecurity officers that there are suspicious items that require further investigation (DAWR, 2018b).

The first phase of the MSBC project was the Emerging Innovation X-ray Trial (EXIT), which had 4 deliverables:

1. Trial real-time 3D X-ray units and evaluate the units as an alternative to the department's current fleet of 2D X-rays.
2. Develop a POC auto-detection computer algorithm supported by a comprehensive image library of biosecurity risk materials. This includes testing the learning capabilities of the algorithm and an extensive operational deployment.
3. Analyse new processes for deploying X-ray technologies to maximise potential benefits to the department's strategic objectives.
4. Analyse where the department's future use of new technologies and processes has potential to provide even greater benefits to the department and to other agencies by working in partnership.

A detailed communications plan for the Emerging Innovation X-ray Trial 2018–19 was developed (DAWR, 2018a).

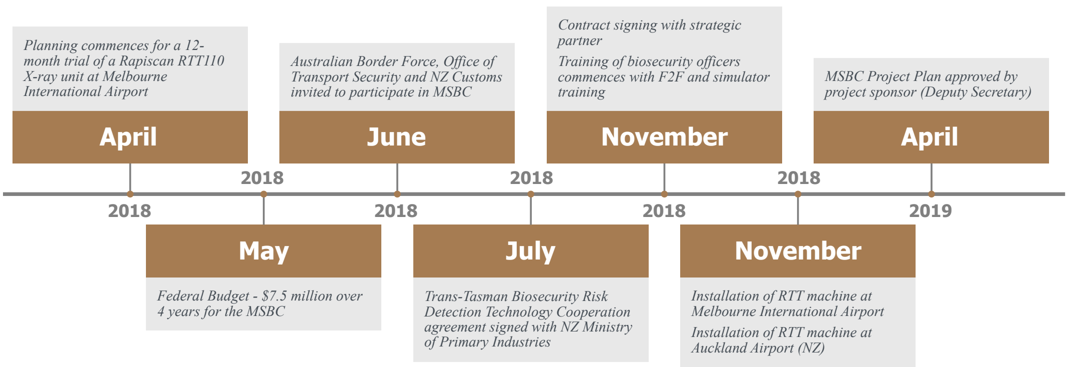
Since 2019, 3D X-rays have come to dominate the department's thinking on at-border detection mthods, and it has received significant funding for them. As will be discussed below, what was planned as a medium to longer term potential capability quickly came to be seen as a currently deployable capability, but for which the evidence was thin, and the requisite technology enablers remain in the R&D phase.

13.2 MSBC project planning

The MSBC project plan was approved by the department (via Senior Responsible Officer and Project Sponsor) in April 2019 – some 12 months after planning for the 3D X-ray project commenced, 10 months after funding commenced and 6 months after the first POC X-ray was installed at Melbourne airport (Figure 10). The MSBC project plan was a comprehensive document and clearly articulated the objectives, outcomes and benefits that each component and project phase would deliver over the 4-year life of the project.

The department advised that subsequent versions of the MSBC project plan should have been developed and endorsed but that this did not occur due to an (apparent) lack of project management resources and the fact that 3 funding streams and 3 POC projects were running concurrently. The department decided that project delivery was to take precedent over project management. In place of formal project planning, the department used other project communication and monitoring tools, including 'projects on a page' reporting and regularly updated communication materials, to keep the department's executive and key stakeholders informed.

Figure 10 Preparatory timeline of Modern Seamless Border Clearance program



Note: F2F: face to face; MSBC: Modern Seamless Border Clearance; RTT: Real Time Tomography.

Source: Prepared as part of this review

Based on other documentation provided by the department, project management for the multiple sub-projects within the MSBC project of work was apparently 'outsourced' to the vendor. The vendor provided proposals with timelines, which became the de facto project plans; and milestone and end-of-stage reporting, which became de facto project-tracking and stage-gate reporting. This is an extraordinary attitude towards project governance.

The Inspector-General was advised that the final MSBC project closure report is in draft form and will be completed by 30 June 2022. The department advised that the 3 funding streams (MSBC, Biosecurity Innovation Fund and ASF measures), which incorporate interrelated and interdependent 3D X-ray project activities, make the closure report complex, as some project phases are complete, some have been delayed and some have changed or evolved over time – for example, the delivery of current detection capability or commencement of new X-ray R&D (for example, seed detection) that is additional to the 3D X-ray R&D.

> **Finding:** Formal project management activities, such as a project plan, were an afterthought in the MSBC project and reflected a continuing low level of project management maturity at that time.

13.3 MSBC project timetable

The MSBC program of work was divided into 6 phases over 4 years, with each phase consisting of several projects (see Table 10). The department successfully completed most of the project activities within the project schedule for phases 1, 2 and 3. Phases 4, 5 and 6 are progressing but are several years behind planned delivery.

It is noted that the delays in the MSBC program were impacted by matters both within and outside of the department's control, including:

- new funding to implement ASF initiatives, including operational 3D X-ray screening in mail
- the addition of several new MSBC projects, including the wildlife algorithm and an X-ray capability for the detection of seeds in mail
- COVID-19 related operational impacts, including the near closure of most airports.

Table 10 Modern Seamless Border Clearance project plan

Phase 1 – Emerging X-Ray Innovation Trial	
2018–19	
Complete	Operational trial and evaluation of a Rapiscan Real Time Tomography RTT®110 x–ray unit at Melbourne International Airport to test the technology's effectiveness in the traveller pathway.
Complete	Training of staff (face-to-face and simulator) delivered to biosecurity officers and nominated Australian Border Force officers at Melbourne International Airport.
Complete	Proof of concept to test whether an algorithm can be developed to automatically detect biosecurity risk material (fruit).
Complete	Partnership with New Zealand Ministry for Primary Industries, which has installed an identical RTT®110 unit at Auckland International Airport and will contribute equally to the algorithm development.
Complete	Cooperation with Australian Border Force to test the concept of shared technology infrastructure.
Go	Go/no-go decision to extend trial or investigate alternate technologies.
2019–20	
Complete	Evaluation of initial 12-month operational trial of Rapiscan Real Time Tomography RTT®110 x–ray unit.
Complete	Algorithm proof of concept – biosecurity risk material including meat, fish and vegetables.
Complete	Evaluation of algorithm for biosecurity purposes.
Go	Go/no-go decision to proceed into phase 2.

Phase 2 – 2019–20, 2020–21	
Complete	Proof of concept to test inline screening and automatic detection of biosecurity risk material at an international mail gateway.
Complete	Cooperation with Australian Border Force to test the concept of shared technology infrastructure.
Complete	Training of staff (face-to-face and simulator) delivered to biosecurity officers and nominated Australian Border Force officers at international mail gateway.
Complete	Evaluation of inline screening and automatic detection of biosecurity risk material at an international mail gateway; and decision to extend trial or investigate alternatives.
Phase 3 – 2019–20, 2020–21 and 2021–22	
Complete	Evaluation of autodetection algorithm successes and capabilities for biosecurity purposes.
Go	If proof of concept trials are deemed successful, further development of biosecurity algorithm to incorporate additional risk materials.
Phase 4 – 2020–21	
In progress	Proof of concept to test inline screening and automatic detection of biosecurity risk material at an international airport.
In progress	Cooperation with Australian Border Force.
Not started	Evaluation of proof of concept.
Phase 5 – 2020–21	
Not started	Proof of concept to test algorithm compatibility with alternate 3D X-ray units.
Not started	Cooperation with Australian Border Force to continue exploration of shared infrastructure and test algorithm compatibility on alternate 3D X-ray units.
Phase 6 – 2021–22	
In progress	Proof of concept to test offshore screening for biosecurity risk material.
In progress	Partnership with New Zealand Ministry for Primary Industries to explore opportunities and limitations of offshore screening for biosecurity risk material.

13.4 Resourcing

The department has received 3 funding allocations for 3D X-ray technology and has internally funded project elements through the Biosecurity Innovation Program. In July 2018, the department received $7.5 million to conduct the 4-year MSBC POC. In December 2019, the department received $6 million over 2 years in response to ASF, for the operational deployment of 2 3D X-rays, one each in SGF and MGF and algorithm development trials for 2D X-rays. In July 2021, a further $19.5 million was received for a trial of pre-border biosecurity screening on travellers and cargo.

In total, the department has received $18 million to conduct trials and POCs of 3D X-ray technology and $15 million for the purchase and installation of 5 operational 3D X-ray units:

- $7.5 million over 4 years – MSBC POC funding, July 2018
- $6.0 million over 2 years – ASF response funding: 3D X-rays in SGF and MGF, December 2019
- $19.5 million over 2 years – biosecurity trial pre-border biosecurity screening technology on travellers and air cargo, July 2021.

In addition, the various 3D X-ray activities have clearly received a considerable amount of management attention. It is arguable, on the evidence available to the Inspector-General, that optimising the performance of the department's detector dog fleet and 2D X-ray fleet has not received anywhere near the same level of attention. This has present-day and near-term implications for biosecurity risk mitigation in mail and traveller pathways and potentially other areas.

13.5 Project management office

The department has received significant funding for biosecurity detection technology over recent years to delivery enhanced biosecurity outcomes. In the past, projects such as the Biosecurity Integrated Information Systems and Analytics (BIISA) program under the Agricultural Competitiveness White Paper – Biosecurity Surveillance and Analysis initiative have only partially delivered the intended outputs and outcomes (IGB, 2021). It is critical that rigorous analysis of project outputs and outcomes is undertaken. Also, these must be assessed by the relevant management committees to ensure appropriate decisions are made – projects actually delivering against expected benefits – providing justification for the continued expenditure of funds.

Given the level of funding the department has received for biosecurity operations over the last 3 years, including in detector dogs and X-rays, the department identified the need for a significant uplift in project management capacity and capability. This has been noted in relation to the MSBC program of work and has been a theme of previous Inspector-General reviews (IGB, 2021; IGB, 2019c).

A separate Biosecurity Operations Division Portfolio Management Office (BOD PMO) was established in June 2021 to provide oversight, management and coordination of the programs and projects within the Border Operations Division. The BOD PMO aims to provide the department with a greater likelihood of success in the achievement of outcomes and benefits. This is strongly supported by the Inspector-General.

The BOD PMO activities include:

- Information Hub – gathering information from programs and projects, undertaking analysis of progress, exception handling
- Centre of Excellence – supporting programs and projects in getting established so they can run effectively
- Reform Control – monitoring program and project management to ensure agreed processes are being followed
- Delivery Support – ensuring programs and projects have the right resources at the right time to run successfully
- Reform Planning – biannual planning of programs and projects to ensure alignment with the future operating model
  - Reform Assurance & Continuous Improvement – coaching and support, reviews and 'lessons learned' activities.

The Inspector-General was advised that the BOD PMO works closely with the department's Enterprise Project Management Office, which has a PMO role across the department.

The BOD PMO's focus on improving the identification, tracking and evaluation of benefits is also a positive development. It is anticipated that this work will provide a greater level of certainty around program and project performance, including go/no-go gateway decision-making and ROI assessments. The BOD PMO should take an active and disciplined role in ensuring the quality of the program and project reporting.

Finding: The BOD PMO is a good initiative. It will be important for it to bring a consistent discipline across programs and projects – particularly those that have already been running for several years, such as the MSBC.

13.6 MSBC Power and Potential Report

During mid-2020, the department contracted the production of the report *MSBC – the power and potential of 3D X-ray technology and automated detection algorithms* (the Power and Potential Report) to 'show the journey of the X-ray trials, the successes to date and the potential future use of the technology' (DAWE, 2020d).

The Power and Potential Report states that the phase 1 trial was a success:

> *These trials have proven that 3D X-ray technology has the power and potential to enable a seamless border experience and ensure Australia's biosecurity system can address ever-evolving risks to maintain Australia's standing as one the few countries free from the world's most destructive pests and diseases. (DAWE, 2020d)*

In response to requests from the Inspector-General for the department's detailed analysis of the POC results, the department referred the Inspector-General to the Power and Potential Report. The analysis contained in the report is limited, consisting of headline figures. The report appears to be a marketing document rather than a serious analysis. It overstates what the trials 'proved' and, in particular, that a 'seamless border experience' was operationally feasible within the foreseeable future. The Inspector-General is concerned that the department did not undertake a serious and detailed analysis of the POC trial results to properly assess the performance of 3D X-rays.

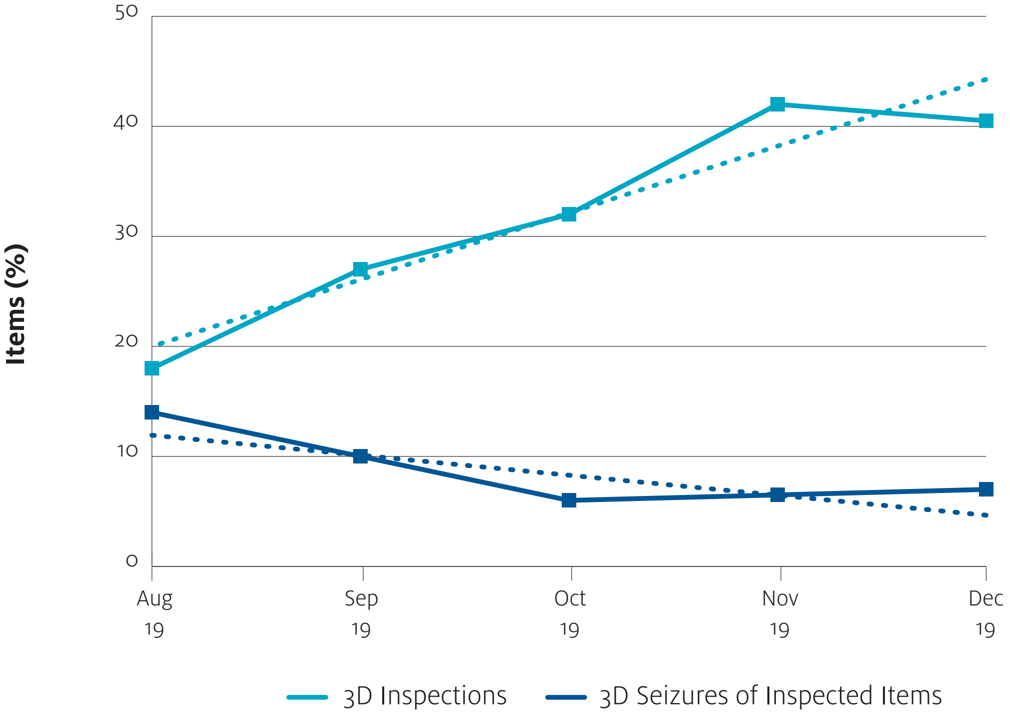
While certain results from the trials appeared promising, the context of the POCs were not analogous with how the technology would be used in a seamless border operational deployment; the development processes, particularly for algorithms was very early stage R&D with no guarantee of operational deployment; issues of operational integration were not considered; infrastructure requirements were not addressed; and 'return on investment' was noted as needing to be considered, although the department has not yet undertaken any ROI analysis.

As will be discussed further in chapter 14, the analysis in the Power and Potential Report is incomplete and selectively presents data to provide an unequivocally positive assessment of 3D X-ray technology. For example, Figure 11 is taken from the report and shows 3D X-ray inspections and seizures in the mail pathway between August and December 2019. In relation to this graph, the report identifies the benefits as:

1. Fewer inspections have reduced the time biosecurity officers need to spend manually inspecting bags [sic – mail items].
2. At the same time, the seizure rate among items inspected increased from 18% to 41%, representing greater efficiency, as there are more seizures from fewer inspections.

The Inspector-General is concerned that the trial was conducted between August 2019 and March 2020, but only August to December figures were presented. Figure 11 – from the department's MSBC report – shows that between January and December 2019 seizures went up while inspections went down, which would appear very positive. However, Figure 12 includes more data (August 2019 to April 2020) and presents a very different picture and interpretation. The department advised that it excluded this data because it was 'significantly impacted by several factors', including redeployment of the X-ray unit in January 2020 and COVID-19 related logistics issues. The Inspector-General accepts that the redeployment of the X-ray in 2020 clearly impacted results. However, on review of Express Mail Service (EMS) volume data for SGF and MGF between January and April 2020, EMS volumes continued to increase through to March 2020 before dropping precipitously in April 2020. As such, the Inspector-General does not accept this explanation for the report's failure to include data for the full trial period. For completeness of analysis, presentation of results with appropriate caveats is preferrable to omission of data.

Figure 11 Percentage of inspected and seized items using 3D technology in the mail pathway, August to December 2019



Source: DAWE, 2020d (figure adapted from Department supplied document)

When comparing the performance of 3D X-ray with 2D X-ray and detector dogs, the department chose to report the results of the simulated trial involving the screening of 40 constructed bags (see chapter 13.9). This data was highly favourable to 3D X-ray performance. The report did not include comparative POC performance results from the operational trials, which showed better performance by 2D X-ray and detector dogs over the trial period (Figure 12).

On the benefits of reduced officer screening, the Power and Potential Report (DAWE, 2020d) concluded that 3D X-ray was superior to 2D X-ray and detector dogs, with the latter requiring 'an additional 40% inspection effort using the 2D technology' (DAWE, 2020d).

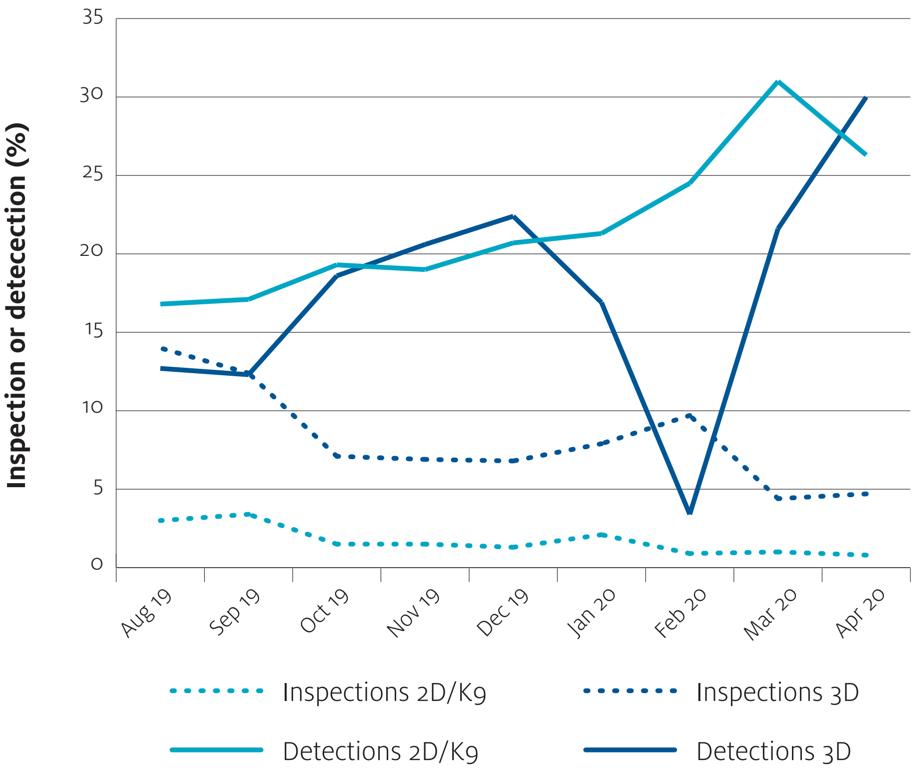
Based on the MSBC trial data provided to the Inspector-General for this review, the ratio of detections per inspection reported did not match that presented in the Power and Potential report (DAWE, 2020d). The ratio of 2D X-ray and detector dogs was 5 inspections per detection, while for 3D X-ray it was 6.1 inspections per detection. Rather than 3D X-ray delivering a 40% benefit, 2D X-ray and detector dogs delivered an 18% better outcome over the trial period. Issues of POC data collection and analysis are discussed in chapter 14.1.

The department's report also uses 'detections per screened items' as a measure to compare different cohorts of mail or traveller baggage. This comparison can be problematic, as the distribution of biosecurity risk material varies between cohorts and may have significant within-cohort variability. A comparison based on 'detections to screened volume' also removes the influence of the screening process on the detection outcome, which showed up to 20% variance between operators in the simulated 2D and

3D screening trials conducted by the University of Melbourne's Statistical Consulting Centre (see chapter 13.9) (Clarke-Errey and Finch, 2019).

Many activities of the MSBC project have included rigorous design and analysis. However, there are instances where the critical components of design, collection and analysis of results have been inadequate and incomplete and the reporting that was produced appears biased in its presentation (see chapter 14).

Figure 12 Percentage of inspections and detections in the mail pathway by detection technology, August 2019 to April 2020: 2D X-ray plus detector dog (2D/K9) and 3D X-ray (3D)



Note: Inspections are expressed as a percentage of the total number of items; detections are expressed as a percentage of the number of inspections.

Source: Data supplied by the department for this review

Finding: The proof of concept data and its interpretation in the Power and Potential Report has accuracy issues (validity of calculation methods), is superficial (headline figures only), selectively presents data (only positive findings presented) and involves overly optimistic extrapolations (fails to take into consideration complexity of the operating environment and variation in approach to biosecurity risk material).

13.7 Implications for future operating models

The Power and Potential Report devotes 15 pages to describing future operating models based on the 'success' of the phase 1 trials. The 'promises' made in this section are highly conceptual and do not reflect the realities of the operating environment. For example, approximately a third of all air traveller detections are made in hand luggage, which will not be subject to inline 3D X-ray screening under the proposed models (Table 11). The department has advised that it accepts that a range of identification and screening processes will still be required in the baggage hall.

There is also a suggestion that 3D X-rays will reduce the number of officers required. As seen during IQI, when the department conducted mass screening, and reflected in the estimates of undetected noncompliant goods in the traveller KPI reporting (see Figure 4), an increase in screening will result in an increase in the detection of biosecurity risk goods.

In 2009–10, when traveller screening was still undertaken on a 'mass screening' basis, the department made 481,767 seizures of all types of biosecurity risk goods in the traveller pathway (DAFF, 2010). In 2018–19, under the risk-return concept of operations, the department made 27,875 detections ('seizures') in the traveller pathway, but the estimated number of noncompliant travellers entering Australia and carrying biosecurity risk goods was between 229,769 and 628,109 (with a 95% confidence interval). Note that the department made a number of policy changes in relation to categories of biosecurity risk goods between 2009–10 and 2018–19 that would have resulted in a reduction in the total number of biosecurity risk goods, hence the lower estimate may be below that of the 2009–10 seizures.

Far from reducing the number of inspections required (and the associated biosecurity officers, inspection benches and queuing areas), successful mass inline screening of hold baggage will require an increase in officers to deal with the significant increase in the amount of actual and suspected biosecurity risk material.

Furthermore, prior to the delivery of the Biosecurity Algorithm, baggage image analysis will need to be conducted by biosecurity officers – notionally in remote screening centres. However, airports will be unwilling to compromise contractual baggage handling performance standards that require, for example, the first bag to be loaded on the conveyor belt within 10 minutes of the aircraft hold opening and the last bag within 40 minutes. Within this 30-minute screening window, officers will be required to analyse between 500 and 1,000 bags per flight. To do this effectively, assuming 20 seconds per bag, between 6 to 12 officers per 3D X-ray will be required. In 2019 there were on average 290 international inbound flight arrivals per day (BITRE, 2022). The Inspector-General has not seen evidence-based assessments, based on these types of processing requirements, of how 3D X-rays will result in reductions in staff and cost savings. Potential scenarios include high-cost technology being under-utilised due to inadequate staff resourcing (the resource-return model), which is a factor of current deployment of detector dogs and 2D X-rays.

Table 11 Detections of biosecurity risk material in the air travellers pathway, 2017–2020

	Carry-on baggage	In-cabin baggage	In-hold baggage
2017	2%	35%	63%
2018	2%	36%	62%
2019	2%	33%	65%
2020	2%	29%	69%

Source: Data supplied by the department for this review

Finding: The assumptions underpinning investment decision-making in relation to 3D X-ray appear to be based on weak and incomplete analysis. The concepts of operations being proposed provide an inaccurate picture of the impacts on operations resulting from a change to mass screening and the likely impacts on resourcing. The department needs to undertake robust and rigorous analysis as a matter of priority.

13.8 Potential 3D X-ray pathway coverage

Discussions with an airport corporation during this review identified that between 70 and 10 3D X-ray machines would be required to provide coverage of all aircraft hold baggage arriving at that airport. Based on this information, the Inspector-General asked the department how many 3D X-rays would be required to provide national coverage for hold baggage, as proposed in the Power and Potential Report. The department advised the Inspector-General that:

> *Site analysis of baggage carousel infrastructure across all Australian international airports to inform a response to this question has not been possible in the required timeframes. The department is progressing a POC at two partner airports (names redacted) with the aim of evaluating the effectiveness of the RTT [Real Time Tomography] technology for inline screening of biosecurity risks. For example, in the proposed design for the [airport 1] installation, one X-ray can cater for x2 inbound lines. The results from the POC will inform decisions about how the technology can be incorporated into the department's traveller pathway operating model new developments such as WSA [Western Sydney Airport] that has potential to screen 100% of checked bags with one RTT due to modern conveyor sortation systems. For older airports, the results of the trial will help inform future upgrade opportunities. The results of the trials will inform how widely this in-line screening concept can be rolled out.*

The airport trials to test 3D X-ray detection integrated into baggage conveyors systems are still in an early planning phase, with the activity to continue over several years. The department advised that the future operating model may not involve 100% coverage of arriving hold baggage, instead focusing on specific profiled flights, the baggage from which could be directed to inline screening. This indicates that traveller screening will remain reliant, and potentially increasingly reliant, on pre-arrival traveller profiling. It also points to continued significant leakage of biosecurity risk material through international airports.

Also, as part of this trial, significant investment is being made in a remote image analysis centre and research and development on baggage tagging and tracking, in addition to ongoing R&D on biosecurity algorithm development. As discussed in chapter 14.5, rigorous modelling of different operating scenarios to inform POC and operating strategies would be a more mature approach to business process and capability redesign than the department's current approach, which can appear like a 'build it and then assess feasibility' approach.

In mail gateway facilities, the department advised that there were 21 mail screening lines – 11 in Sydney, 6 in Melbourne, and 2 each in Brisbane and Perth. At the time of writing, 3 of the 21 lines had 3D X-rays and 2 more were scheduled to be installed by the end of the 2022–23 financial year. The department advised that there was insufficient space within the gateway facilities to install 3D X-rays on each conveyor line. The footprint of the 3D X-ray is roughly 5 times the size of the current 2D X-rays – a footprint of at least 10 sqm, depending on configuration, versus 2 sqm. Clearly, such a scenario is not practical.

There may be merit in considering use of 3D X-rays to (semi) automatically conduct initial screening of the high-volume Other Articles (OA) cohort, which is currently poorly covered by existing screening methods. This screening may be able to be completed at another facility before the normal Australia Post sorting within the crowded gateway facility.

The department has not provided any evidence that it has estimated the potential cost of delivering the future-state designs outlined in the Power and Potential Report. The Inspector-General estimates that full implementation of the 'possible future' outlined in this report may cost between $250 million and $350 million over 10 years, plus several million dollars per year in maintenance costs. To date, the department has received $33 million for the installation of 5 operational units in mail gateways and the conduct of multiple POC trials.

The only apparent workable scenario from the information available from the department is that the 3D X-ray detection technology will be deployed to provide automatic or operator-enhanced detection of risk material (biosecurity and other risks) from selected, profiled incoming flights. Under this scenario, detector dogs and 2D X-ray machines (potentially enhanced using biosecurity algorithms) will remain the core frontline detection for the traveller and mail pathways beyond 2030.

Finding: The department is conducting high-cost proof of concept trials with long lead times in the traveller pathway without commissioning detailed and rigorous analysis by appropriately skilled data analysts and modellers of its previous trials or undertaking operational modelling as to the feasibility, infrastructure impacts and costings of the proposed future operating concept, and alternative models based on, or incorporating, 2D X-rays and detector dogs.

13.9 Comparison of 2D and 3D X-rays in simulation trials

The department conducted 3 simulation trials during 2019 and 2020 to assess the effectiveness of 2D and 3D X-ray technologies on the screening of travellers' baggage and one trial for international mail. The simulations were conducted in collaboration with the University of Melbourne's Statistical Consulting Centre.

Trial 1

The simulation trial comprised the same technicians inspecting the same set of 40 'constructed' bags on both 2D and 3D technologies in 2 separate sessions. The process of determining who used which technology first was arbitrary but did strive to achieve balance and was not related to any known characteristics of the technicians. No feedback on performance was given to technicians between sessions (Clarke-Errey and Finch, 2019).

The finding was that:

> *the trial demonstrates superior performance by the 3D technology, in both identifying risk items and accurately determining their absence. For bags containing risk items, the odds of identification of risk were estimated to be 2.11 times higher using 3D compared to 2D. For bags containing no risk items, the odds of successful identification of lack of risk were 2.96 times higher for 3D than for 2D.*

Trial 2

The design involved 15 technicians evaluating the same 40 constructed bags using both technologies, all of whom were involved in the first trial (though one had to be excluded from analysis in the first trial due to incomplete data) (Clarke-Errey and Finch, 2020a).

The finding was that:

> *For bags containing risk items, the odds of identification of risk were estimated to be 2.6 times higher using 3D compared to 2D; slightly higher than the first trial. For bags containing no risk items, the odds of successful identification of lack of risk were very similar – 1.1 times higher for 3D than for 2D. The results for bags with no risk items contrast with the original trial where superiority of 3D was found; here the performance is more similar on these bags.*

Trial 3

The design involved 6 technicians evaluating the same 50 constructed bags using both technologies, with the primary goal being to identify each of the individual risk and non-risk items correctly within the bags (Clarke-Errey and Finch, 2020b).

The finding was that:

> *Overall, this third trial demonstrates superior performance by the 3D technology, in identifying risk items and non-risk items. For risk items, the odds of identification of risk were estimated to be 1.9 times higher using 3D compared to 2D, consistent with the first two trials. For non-risk items, the odds of successful identification were 1.5 times higher for 3D than 2D.*

Trial 4

The design involved 6 technicians evaluating the same 80 constructed boxes or plastic bags using both technologies, with the primary goal being to correctly inspect or release these mail packages according to their contents. The small number of technicians was because of staffing reductions due to the COVID-19 pandemic – this and has likely impacted the precision of the results for this trial (Clarke-Errey and Finch, 2020c).

The finding was that:

> *The 3D technology was observed to perform better at correctly identifying which mail packages should be inspected, while the 2D technology was observed to perform better at correctly identifying which mail packages should be released. For both technologies, the detection rate of true positives was over 98%. The performance of the technicians was found to be consistent, and there did not appear to be learning occurring between sessions on the two technologies.*

Conclusions on the trials

These simulation trials indicated that officers may be able to better identify the presence or absence of biosecurity risk material using 3D X-rays than 2 D X-rays. However, the authors noted that, while the results provide some indication of potential improvements, it is necessary to take into consideration the nature and scope of the simulation trials relative to the actual biosecurity operating environment:

> *The same caveats provided in previous reports are relevant for the interpretation of this trial. In particular, as this trial was in a simulated setting, the results might not generalise to the operational environment and operational trials are still required to fully understand the technology performance. (Clarke-Errey and Finch, 2020c)*

The Inspector-General supports the analytical approach adopted in this aspect of the project, which involved the structured collection and expert analysis of data to inform the department's understanding of the relative merits of the 2 technologies.

However, the Inspector-General also notes that trials 1 to 3 included 40 'constructed' bags, of which 31 contained biosecurity risk material, and that the sample sizes in trial 4 were too small to calculate statistically significant results. As such, while these results are indicative of potential performance, the extent to which these results are replicable in the more complex operational environment (as noted by the authors) required further assessment.

13.10 Algorithm development

In 2019 the department and the New Zealand Ministry for Primary Industries (MPI) established a joint program to assess the feasibility of algorithm-enabled automated detection using 3D X-ray technology for border clearance of inbound biosecurity risk goods.

For 3D (or 2D) X-rays to operate as unstaffed automated screening tools, such as airside inline screening of travellers' hold luggage, the algorithm must be capable of reliably detecting the range of biosecurity risk goods, including fruit, meat, fish, vegetables, plants, and seeds in all forms. Other goods, such as shoes, boots, camping equipment and live animals, may also need to be detected.

According to one supplier, more than one algorithm approach is required to meet the objectives of the program. Algorithm approaches include conventional segmentation-classification as well as artificial intelligence, including deep learning with convolutional neural networks (Rapiscan Systems, 2020). Algorithm development is a complex activity, as algorithms need to enable reliable detection across a non-uniform set of biosecurity risk commodities combined with a range of other commodities.

The Biosecurity Algorithm project is continuing to build on the work conducted in the program to date. Of particular note is the move towards real-time deep learning algorithms and the use of these directly at the scanning system without delay between item scanning and algorithm results. The department has contracted the University of Melbourne to conduct independent validation of the algorithm development process.

As the Biosecurity Algorithm (consisting of separate algorithms for meat, fruit, seafood, plant and vegetables) development continues, the department is also contributing to the development of a wildlife algorithm. This has involved the development of a reference catalogue of approximately 500 different specimens, as well as drawing on research for the biosecurity meat algorithm (Rapiscan Systems, 2021).

In October 2021, the department signed a 2-year contract for the ongoing development of the Biosecurity Algorithm (DAWE, 2021j). Under this contract, the department has set the following deliverables:

> *The Algorithm for the biosecurity algorithm program must meet the following Acceptance Criteria by the Milestone Date to be Accepted by the Commonwealth:*
>
> *(i) milestone 4 (by 30 June 2022): The detection accuracy must be:*
>
> *(A) fruit ~70%;*
>
> *(B) meat ~60%; Page*
>
> *(C) seafood ~60%;*
>
> *(D) plant and vegetable ~50%; and*
>
> *(E) false positives <12%.*
>
> *(ii) milestone 8 (30 June 2023): The detection accuracy must be:*
>
> *(A) fruit ~80%;*
>
> *(B) meat ~70%;*
>
> *(C) seafood ~70%;*
>
> *(D) plant and vegetable ~60%; and*
>
> *(E) false positives <12%.*

At the detection accuracies specified as deliverables in this contract, the Biosecurity Algorithm will not be deployable as a fully automated capability by 30 June 2023. At these performance rates it could be deployed as a decision support tool to aid officers when visually analysing X-ray images. The first of these partial deployments occurred in June 2022.

The Inspector-General is concerned that the language the department uses regarding the 3D X-ray Biosecurity Algorithm is too often imprecise. This risks creating a perception that the work undertaken over the last 3 years has produced an operational Biosecurity

Algorithm. For instance, a July 2021 brief seeking contractual approval for a further 2-year development program stated:

> *In partnership with [name redacted], the department has proven it is possible to detect biosecurity risk material; using computer algorithms. Biosecurity algorithms now exist for fruit, meat, seafood and plant materials. (DAWE, 2021k)*

Similarly, a May 2022 departmental announcement on the installation of a third 3D X-ray in a mail gateway facility stated:

> *Having a dimensional weigh scanner unit installed will enable the department to overlay the illegal wildlife trafficking algorithm on outbound parcels using the 3D x-ray. (DAWE, 2022b)*

At the time of writing the wildlife algorithm remains in development with no clear timeline for when it would be operationally deployable.

In June 2022, the department advised the Inspector-General that its definition of 'fully operational' meant 'the algorithms have been deployed in the operational environment and are being used to inform biosecurity risk decision making'.

This comment was provided in the context that:

> *The biosecurity algorithm will initially include product types that have been included in the priority data set. Over time with operational data collection the algorithms dataset will expand to include a wider range of biosecurity risks at the category and sub-category level.*
>
> *…*
>
> *Whilst the algorithms will be operationally deployed by 30 October 2022, operational data will be used in the ongoing development of the algorithm. This will result in increasing levels of effectiveness over time. At this stage, we are unable to predict the rate at which an increase in effectiveness will be achieved.)*

The Inspector-General does not accept that a biosecurity algorithm that does not meet the department's own acceptance threshold criteria; that identifies a partial set of biosecurity risk items, which is being deployed operationally to test the performance of the laboratory developed algorithms; and that includes an unspecified time frame of ongoing development can legitimately be termed 'fully operational'.

The Inspector-General is concerned that the continuing failure to properly articulate the development stages of the algorithm projects is misleading.

Finding: While progress is being made on the development of a Biosecurity Algorithm, there is currently no operationally functional Biosecurity Algorithm. At the time of writing, several component algorithms are progressing to decision support status, but there is no timeline for when, or the likelihood that, the Biosecurity Algorithm will be available for operational deployment. Given the centrality and criticality of Biosecurity Algorithm to the 3D X-ray strategy, the department needs to carefully monitor progress and align to the staged achievements of its other procurement and infrastructure projects. Delivery of Biosecurity Algorithm, in full or in part, should be factored into the Operations Research analysis referred to in Recommendation 1 of this report.

13.11 Seed detection

Seed detection is an integral component of biosecurity risk material screening for mail centres. In July and August 2021, seed detections at SGF made up between 13% and 17% of all detections. Roughly half of those detections were made with X-ray machines. The remainder was detected by detector dog, by manual inspection and through leakage survey activities. Importantly, the level of detection within the leakage survey was 41%

in July and 24% in August, indicating a larger proportion of seeds were going undetected than were being detected.

Regarding the detection of small seeds, the department has advised that current high-energy 2D or 3D X-ray technology deployed in mail centres is only partially effective. High-energy X-ray is unsuitable for the detection of smaller items that have a less dense molecular structure because the X-ray beams are likely to penetrate through the item, resulting in no image being produced:

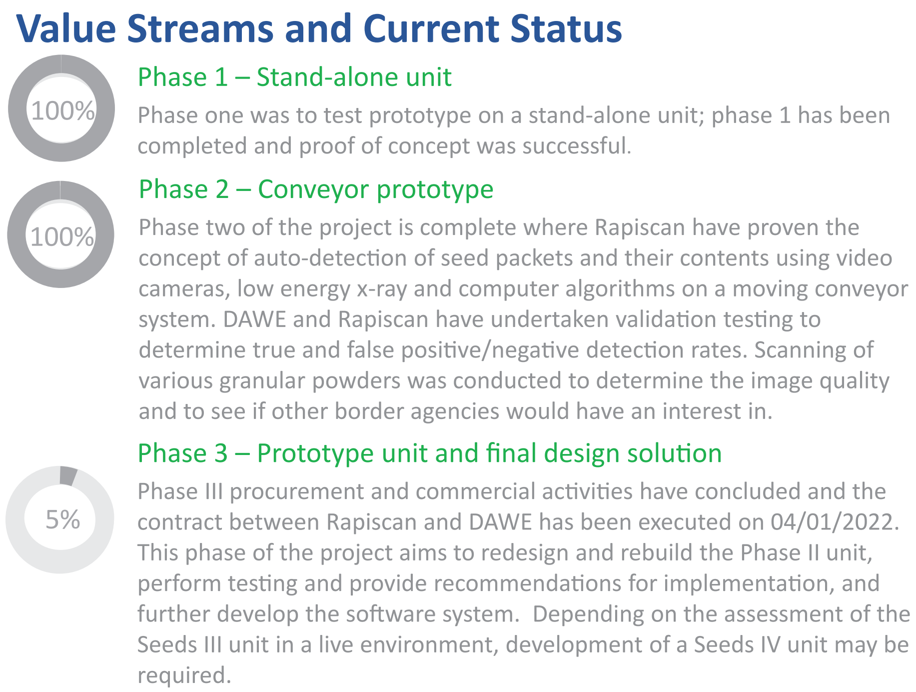
> *X-ray contrast increases rapidly as energy decreases, but at the same time the penetrative power of the X-ray beam decreases rapidly with decreasing X-ray energy. In the case of imaging seed packets, it is beneficial to use low energy X-rays (typically below 80keV X-ray energy) to achieve good contrast for even small seeds. A high-resolution imaging system is required to see small seeds on the order of 0.1mm in diameter (Rapiscan Systems, 2019).*

As a result, the department has been exploring alternative X-ray technologies using low-energy, high-resolution X-rays combined with computer algorithms to automatically detect the presence of seeds and their packets (Figure 13) (DAWE, n.d.a).

The concept plan for this work is that letters and small packets will be separated from larger packets and parcels for scanning by a dedicated high-resolution X-ray system equipped with automated seed detection algorithms. The automation systems required for separating small packets and letters from large packets and parcels in the general mail stream is the subject of a separate proposal, along with development of the underlying X-ray imaging technology and seed detection algorithm.

Figure 13 Seed detection project progress, January 2022

Source: DAWE, n.d.a



To date, approximately $1 million dollars has been spent on the first 3 phases of the prototype project. Phase III trials are due to conclude in June 2022. Phase IV, which will focus on operational deployment, will commence in mid-2022. No costs or time frames are currently available for operational POCs and subsequent deployment.

13.12 Wildlife algorithm

The initial phase of the Wildlife Tracking Project was internally funded ($261,800) through the department's Biosecurity Innovation Program in financial year 2020–21, with a further $1 million in funding from a collaborating partner. The proposal stated:

> *Over 12 months, the department proposes to develop an algorithm using 3D RTT to identify wildlife for both inbound biosecurity screening as well as outbound screening by entities such as Australia Post.*
>
> *The project will also involve a financial contribution to [name redacted] who are aiming to develop technology able to identify the origin of wildlife (captive bred or wild caught). This initiative will be progressed over three years and will leverage the first phase of the project led by the department. The ability to determine the origin of wildlife will enable entities to verify claims made on certification and also to better understand trends in illicit wildlife trade.*
>
> *If successful the outputs will enhance biosecurity by intercepting high risk animals at the border and will also contribute to our responsibility for implementing CITES both into and out of Australia. (DAWE, n.d.b)*

The follow-up project proposal for 2021–22, costed at $468,000, stated:

> *This project over 24 months will develop a 3D detection algorithm using computed tomography (CT) 3D X-ray to identify wildlife/animals, turtle/tortoise shell and ivory for both inbound biosecurity screening and outbound screening.*
>
> *If successful, the outputs will enhance biosecurity by intercepting incoming high-risk animals at the border. It will also contribute to satisfying our legislative responsibility for implementing CITES requirements, both into and out of Australia, and our responsibilities in administering the EPBC Act (DAWE, 2021l).*

The 2020 project did not deliver a wildlife detection algorithm, hence the requirement for additional funding. Optimistic predictions, under the heading of 'Problem / Opportunity Statement', were that 'Based on previous positive results with automated detection algorithms, it is expected this project will be successful' (DAWE, 2021l).

13.13 Centralised screening facility proof of concept

As part of its 3D X-ray program, the department is planning to establish a central screening facility for all biosecurity program scanning systems and locations. This may connect with scanners at one or several locations where the X-ray screening hardware is deployed. In 2021, significant work on building the infrastructure and ability was completed, and it is ready to be tested and trialled at a local operational level at the SGF.

Local inspection will also (still and where relevant) be provided at each operating facility to ensure real-time operation and redundancy in case there are network outages. The central screening facility will allow real-time, as well as retrospective, review of image data and dashboards in a central hub and will be rolled out as the department identifies readiness and willingness to adopt this advancement (Rapiscan Systems, 2021).

It is noteworthy that operational and national program areas for the traveller and mail pathways that are designing 'future' concepts of operations did not mention this development during discussions with the Inspector General, nor is it referenced in the future operating model documentation. The centralised screening monitoring / decision-making concept relies on auto-streaming or selection of bags or packages of interest, which is a separate project.

Finding: Consistent with what has been seen in many aspects of the 3D X-ray program, the department has not demonstrated any evidence-based assessment of the likely cost and resourcing implications of establishing a centralised screening centre or the implications if automated detection using a Biosecurity Algorithm is not practical or be significantly delayed.

13.14 Package tracking proof of concept

The package tracking integration POC involves taking 3D X-ray image data and biosecurity algorithm results and correlating these with video-based package tracking data. The intention is to be able to deliver this functionality at full mail centre scale to provide a robust means for high-throughput mail screening of small packets and larger parcels. The desired outcome is to have ability to screen multiple items across a conveyor belt simultaneously and therefore achieve the high throughput that is required in mail centre applications (where items are not generally passed along a conveyor belt in an orderly sequence).

The package tracking system associates with each package relevant camera image data, as well as X-ray image data and algorithm results with each package. This allows a video camera based image recall system to identify a packet using its ‘package biometric’ and recall its X-ray image data and biosecurity inspection results. This simplifies the quarantine inspection process, with the package tracking camera data being used to verify visually that the correct data has retrieved. The video data will also help drive automated ‘pick and remove’ robots to select specific risk packets from the stream of packets passing along a conveyor belt post-screening (Rapiscan Systems, 2021; DAWE, n.d.b).

13.15 Air cargo proof of concept

At the time of writing the department was progressing the installation of a 3D X-ray into a Conference of Asia Pacific Express Couriers (CAPEC) member facility in Sydney. This project was due to be rolled out as part of the MSBC in 2020–21 but was delayed into 2021–22. A total of $1.42 million was budgeted for this POC project (DAWE, 2020e).

It remains unclear to the Inspector-General which aspects of 3D X-ray screening capability this POC is testing that could not have been tested in the mail pathway using EMS or OAs. The department statements on this have mentioned issues such as ASF assurance, which is a pathway activity rather than a POC X-ray capability issue. Furthermore, in the 2.5 years during which ASF has been the subject of heighted attention, the department has not deployed detector dog resources or used or expanded its use of existing 2D X-rays in the express air cargo pathway to strengthen detection of ASF risk material.

Similar to comments made in chapter 13.7, it is imaginable (though probably not logistically practical) that all inbound express airfreight could be profiled for inspection and automatically screened using algorithm-equipped 3D X-ray machines. This could replace significant resources that are applied to import document processing with increased inspection resources for inspection of all packages identified as containing potential biosecurity risk material. All such concepts could be rigorously modelled at relatively low cost for logistical practicality, biosecurity effectiveness, cost implications and client impacts before any physical testing was conducted.

13.16 Trans-Tasman screening proof of concept

The Trans-Tasman screening program aims to demonstrate how biosecurity screening can be conducted while a flight is in transit, either to clear baggage or to mark baggage for biosecurity inspection on arrival. To conduct this program, either an outbound scanner in New Zealand and/or an inbound scanner in Australia will be used to screen baggage. Biosecurity algorithms will be used for X-ray scanning of all bags, and images will only be inspected if the biosecurity algorithm highlights a biosecurity risk item; identified bags will be marked for biosecurity inspection only if the inspector confirms the algorithm result.

For POC, bags marked for biosecurity inspection will be manually labelled with a Radio Frequency Identification (RFID) tag and travellers with labelled bags will be subject to a biosecurity inspection. The image data and inspection results on the specific bag will be recalled using the RFID tag for biosecurity officer review.

Where bags are scanned in New Zealand before a flight to Australia, the screening process involving expert officers can occur in New Zealand or Australia as required. When bags are scanned in Australia on arrival, local inspection at the arrival airport may be required due to technical difficulties getting high-speed transmission of large volumes of image data to a central control room for timely processing (see Rapiscan Systems, 2021).

Finding: Screening of outbound baggage is standard practice for many airports internationally. The ability to access image data and screen it before bags arrive in Australia may provide greater coverage at a lower cost than retrofitting 3D X-rays to inline conveyors within existing airports. As with all high-speed mass screening, the Biosecurity Algorithm required to identify biosecurity risk goods will be essential.

14. 3D X-ray performance

14.1 Value proposition

The value proposition, including opportunity cost, of 3D X-ray is based on its relative effectiveness and efficiency when compared with 2D X-rays and detector dogs, resulting from:

1. improved image analysis outcomes by biosecurity officers
2. speed of screening – allowing for a greater number of items to be screened
3. automation – the development of a Biosecurity Algorithm that enables the automated detection of biosecurity risk items.

Points 2 and 3 are critical and interdependent to the value proposition of 3D X-rays. Without them, the return on investment, both financial and to the preventative biosecurity system, will be negative.

The department has shown that 3D X-rays can effectively and repeatedly detect biosecurity risk material. However, as discussed in chapter 13.7, the Inspector-General has concerns about the data used and the rigor of the analysis of the outcomes of the POC and operationally deployed 3D X-rays. Central to this concern is the absence of a data collection strategy and evaluation metrics.

Unlike the simulated trials conducted by the Statistical Consulting Centre (see chapter 13.9), the traveller and mail operational environments are more complex and dynamic. Evaluation of the relative effectiveness of the detection tools in this environment requires specification of metrics, mapping of variables, and collection planning to ensure that the data is available to conduct the required analysis. The Inspector-General was not provided with evidence that there was considered or a structured approach to gathering the data that is required to conduct the detailed analysis.

During this review, the Inspector-General saw sufficient inconsistencies and gaps in data and analysis relating to the stated performance and to the short- to medium-term capability of 3D X-rays to have developed significant reservations about the evidence basis upon which some key decisions have been made. In a reply to the Inspector-General, the department provided comments by the University of Melbourne's Statistical Consulting Centre (SCC) on a draft of this report:

> *The SCC and DAWE have discussed running operational trials where the two x-ray technologies were compared directly (no K9) and where the populations contributing to the throughput for each technology were as similar as possible by matching flight codes and timing of the baggage arrival. We do not believe this has been done for these data.*

The department produced 34 positive media releases and other promotional communications (3 ministerial, 10 external and 21 internal) between November 2018 and April 2021 on the merits of the 3D X-rays (DAWE, 2020f). However, it did not undertake a detailed and rigorous analysis of the results of the POC.

The Power and Potential report contains the most detailed analysis of the phase 1 Modern Seamless Border Clearance (MSBC) POC, including a section entitled 'What the trials have achieved'. Over the 11 pages of headline numbers comparing 3D X-ray and 2D X-ray and detector dogs, there is not a single result presented where 2D X-ray and detector dogs outperformed 3D X-rays, although there was data which did show this.

As part of this review, the Inspector-General reviewed several data files from both the POCs and subsequent operational deployments of 3D X-rays and identified outcomes that raise questions about:

- the quality of data
- the absence of data necessary to conduct the required analysis to understand performance
- bias towards 3D X-ray in the metrics that have been reported.

As discussed in chapter 13.6, the results were not unequivocal when considering the ratio of 'inspections to detections', rather than 'throughput to detections' that was consistently reported. To have value for critical management decision-making, the latter statistic requires an understanding of the approach rate of biosecurity risk material in the goods being screened. However, data was not collected to enable analysis that differentiates the approach rate for goods screened by 3D X-ray compared with 2D X-ray and detector dogs. Therefore, the analysis of the relative effectiveness is questionable.

> **Finding:** The analysis of the proof of concept and operationally deployed 3D X-ray machines has lacked the necessary depth and rigour, with an apparent bias towards reporting results that support further investment in 3D X-ray technology.

On the basis of information provided by the department, the Inspector-General considers that the interdependencies of key deliverables of the MSBC program, in particular the Biosecurity Algorithm, has become disconnected from the deployment and installation components of the POCs. The department's X-ray technology provider has made progress on developing a Biosecurity Algorithm in the test laboratory environment. A further two years of R&D was approved as part of an October 2021 contract, which included:

> *The biosecurity algorithm program will continue to build on the work that has been conducted in the program to date. Of particular note is the move towards real-time deep learning algorithms and the use of these directly at the scanning system without delay between item scanning and algorithm results.*

The Biosecurity Algorithm remains the single most critical deliverable of the 3D X-ray program of work. Without the screening automation capability delivered by the Biosecurity Algorithm the department will be unable to achieve the speed of processing and risk material identification to justify the substantial investment compared with 2D X-ray and detector dogs.

Screening of high volume throughput in mail, travellers, or air cargo using visual analysis by biosecurity officers is not operationally or resource feasible. As discussed in chapter 13.7, to screen a single flight would take between 6–12 officers using a centralised screening approach and in 2019 there were on average 290 international inbound flights per day. This also assumes that bag identification technology can tag a bag in real time once an officer has made a decision. Extrapolation of the number of required officers across travellers, mail, and air cargo quickly makes it apparent that manual screening, even in a centralised screening centre, is neither cost effective or practically achievable. Hence, it may only be practical to apply this approach (3D X-ray detection without automation) to tightly targeted cohort of travellers' baggage identified via pre-arrival profiling and digital passenger declaration (DPD).

The department has set as its benchmark for operational deployment of a Biosecurity Algorithm an 80% detection accuracy with a 20% false positive rate. The next round of algorithm deliverables under the October 2021 contract are unlikely to get the department to the point of having a functional Biosecurity Algorithm. With the deployment of the component algorithms for testing in the operational environment, it will be critical that the department develops a comprehensive metrics plan and collection strategy to ensure the data required to conduct a rigorous analysis of the results is collected at the time of trial.

Finding: The essential nature of the interdependencies of the MSBC program elements appears to have been lost, particularly the centrality of the Biosecurity Algorithm. This loss of connection has resulted in a project delivery schedule inadequately connected to capabilities that provide the improvements in biosecurity outcomes.

The current 3D X-ray deployment approach is at risk of deploying very costly 3D X-ray units that will be significantly under-utilised at the expense of other cost-effective improvements to the preventative biosecurity system.

Recommendation 11
The department should develop a comprehensive metrics plan and data collection strategy to ensure availability of the data required to conduct a performance analysis of the component algorithm trials.

Recommendation 12
Consistent with recommendations 1 and 10, the department should complete a review of the technical and infrastructure outcomes being evaluated across POCs, to optimise the collective learnings from 3D X-ray testing across the express air cargo and mail pathways.

14.2 Operational performance measurement

The department has relied on the performance measure 'detection to throughput' in most of its reporting that compares 3D X-ray performance with that of 2D X-rays and detector dogs. This measure is problematic if not accompanied by separate leakage surveys, as the ratio of biosecurity risk material, even within the same high-level cohort of mail and baggage, can contain different amounts of biosecurity risk material.

The department used a single origin-of-dispatch cohort for its MGF POC trials, but this was the largest origin-of-dispatch cohort that arrives in Australia. There is likely to be variation in the distribution of biosecurity risk material within a single origin-of-dispatch cohort, particularly if the origin is large and diverse. The department has recognised this fact: the traveller profile redevelopment project uses port, rather than country, because of the differences in approaching biosecurity risk material coming from within a single country. This issue may be further compounded where the sample sizes are also significantly different – the 3D X-ray screening sample was only 4% of the 2D X-ray and detector dog sample. The larger the sample, the more variation might reasonably be expected.

Across the traveller and mail POCs the department did not conduct valid leakage surveys for each trial to calculate the total biosecurity risk material in the stream of goods being screened. As a result, the value of the department's key performance measure for 3D X-ray performance is limited.

14.3 3D X-ray performance reporting

After the MSBC POCs in the mail gateway facilities, the 3D X-rays went into standard operational use. Table 12 shows EMS screening results for 3D X-ray and 2D X-ray plus detector dogs between July and December 2021. These results involve more screening throughput for both detection methods than during the POC trials and therefore should provide a better indication of detection effectiveness (as shown by comparing the data for the last column of Table 12)

Table 12 Results for 3(3D X-ray and 2D X-ray plus detector dogs), the 2D X-ray plus detector dogs outperformed 3D X-ray on the number of 'detections to inspections' (items referred from screening) in 5 of the 6 months. In terms of 'detections to throughput', 3D X-rays performed better than 2D X-ray plus detector dogs, although this result is caveated because the department did not conduct the necessary leakage surveys to determine the differences in the approach rates of biosecurity risk material.

Table 12 Results for 3D X-rays and 2D X-rays plus detector dogs (K9) for the Express Mail Service at Melbourne Gateway Facility, July to December 2021

	Throughput	Inspections	Detections	Detections % of throughput	Detections % of inspections
3D X-ray					
July 2021	22,276	1,342	223	1.00	16.6
August 2021	24,995	1,334	183	0.76	13.7
September 2021	19,741	929	141	0.71	15.2
October 2021	21,226	664	142	0.67	21.4
November 2021	11,710	550	58	0.50	10.5
December 2021	19,995	923	165	0.83	17.9
2D X-ray and detector dogs (K9)					
July 2021	13,066	180	35	0.27	19.4
August 2021	37,621	159	36	0.29	22.6
September 2021	24,567	244	52	0.21	21.3
October 2021	12,548	170	53	0.42	31.2
November 2021	10,789	425	54	0.50	12.7
December 2021	15,088	437	55	0.36	12.6

Source: Data supplied by the department for this review

14.4 Comparison of proof of concept with monthly KPI reporting

The 3D X-ray POC reporting was not aligned to the department's own risk-return KPI reporting framework, as reported in monthly traveller and mail KPI reports. The KPI reporting framework was developed by CEBRA to provide statistically valid measures of performance under a risk-return model. Under this model, the department focuses on the detection of high-risk biosecurity goods, not all biosecurity risk goods.

The review analysed the number of detections of high-risk noncompliant goods for each mail stream at MGF between January 2018 and June 2020. Mail has distinct seasonal trends in volume. Table 13 shows the monthly mean of high-risk detections at MGF by mail stream for the 30-month period (30 months), the period of the POC trial between April 2019 and March 2020 (3D POC), and a comparison period between April 2018 and March 2019 (comparison).

The 3D X-ray was located on the EMS line during the POC period. As seen in Table 13, the mean for detections of high-risk noncompliant goods in EMS was lower during the POC period than across the 30-month period and the previous year's comparison period. It is notable that the number of detections in the Other Articles (OA) stream was higher during the 3D X-ray POC, with most of those detections being made by detector dogs. It should also be noted that the number of high-risk items detected in EMS per month was not numerically large. A similar picture emerges in the analysis of NCE% (expressed as the percentage of noncompliant mail articles intercepted by the department). The NCE% is lower during the MGF 3D X-ray POC testing period in EMS. It is also lower than the detection method comparison period and slightly lower than across the 30-month period.

Table 13 Mean monthly number of detections of noncompliant mail articles and noncompliance effectiveness (NCE%) at Melbourne Gateway Facility

Monthly mean for	Other Articles		Parcels		Express Mail Service	
	Detections	NCE%	Detections	NCE%	Detections	NCE%
Operational period, January 2018 to June 2020						
	1,229	55	55	69	142	69
Proof of concept period, April 2019 to March 2020						
	1,909	59	52	53	125	70
Comparison period, April 2018 to March 2019						
	1,072	41	69	54	170	68

Source: DAWE, 2020b

It is notable that, in terms of selecting the EMS as the POC stream and subsequently the ASF project operational stream, the EMS has the highest NCE% over the 30-month period at both the SGF and MGF (Table 14). If looking to maximise the value of the screening efficiency of the 3D X-ray, it may have been more appropriate to install the 3D X-rays on an OA conveyor line, where volumes are greater, more items currently go unscreened and the NCE% is much lower (Appendix A).

Table 14 Mean noncompliance effectiveness (NCE%) for the Sydney Gateway Facility and Melbourne Gateway Facility, January 2018 to June 2020

Gateway facility	Other Articles	Parcels	Express Mail Service
Sydney	18	49	72
Melbourne	55	69	69

Source: DAWE, 2020b

The choice of EMS may be justified on the basis that the percentage of detections is higher in EMS; the weight of detected items is also greater than OAs; and the potential for 'fresh' products – in particular, meat – is also more likely due to the 'express' nature of the stream. The Inspector-General did not see any comparison by the department of the overall biosecurity risk posed by the 2 mail streams (OA and EMS) or the frequency of specific risk material (for example, meat products) in the 2 mail pathways.

Finding: The department did not assess 3D X-ray performance against its own risk-return KPI reporting framework. When assessed against this framework, 3D X-ray proof of concept activities appeared to have no advantage for the number of high-risk goods detected and noncompliance effectiveness (NCE%).

14.5 Return on investment

The phase 1 trial report stated:

> *At face value, the cost of the 3D X-ray technology appears substantially more expensive than the current 2D technology. The basic cost to purchase a 2D X-ray unit is approximately $100,000 compared to the cost of a 3D unit of approximately $1,500,00. Sustainment costs of a 3D machine are also substantially higher.*
>
> *However, the additional cost for a 3D unit delivers a number of benefits – economic benefits, cost avoidance, financial savings and non-financial benefits:*
>
> - *Economic benefits – 3D units have the potential to create an economic saving of $730m per annum to Australian farmers.*
> - *Cost avoidance – 3D technology reduces the likelihood of a biosecurity outbreak which could cost Australia over $50b in the case of a Foot and Mouth Disease outbreak.*
> - *Financial savings – 3D units have the potential to reduce the cost of officers to screen for biosecurity risks.*
> - *Non-financial benefits – the 3D technology delivers increased effectiveness and efficiency in the biosecurity system.*
>
> *As part of the next phase of work, DAWE will be looking into the detailed cost viability of the 3D X-ray solution compared to current state. (DAWE, 2020d)*

The potential savings identified in the Power and Potential Report are hypothetical and could equally be applied to the more effective deployment of 2D X-rays and detector dogs, noting that detector dogs are generally responsible for a greater number of detections than X-ray units at mail gateway facilities.

The analysis of the operational performance of 3D X-rays indicates that the technology is not achieving the levels of efficiency or effectiveness (when appropriately measured) that it had been touted as delivering. Furthermore, despite the department stating that a cost benefit analysis would be undertaken to evaluate the relative value of investing in this technology, the department advised the Inspector-General that no ROI analysis has been completed.

Based on the purchase and installation costs of 3D X-rays to date, each machine costs approximately $2 million to operationally deploy in a mail gateway facility. This figure includes connectivity and non-sorting conveyers but does not include the substantial costs of algorithm development, screening centres, package identification technology or sorting conveyors.

At more than 20 times the cost of delivering a proven functional detection asset (2D X-ray or detector dogs), the department's approach to 3D X-ray purchasing and deployment represents a significant and currently unassessed opportunity cost and potential ongoing liability to the effective management of biosecurity risk at the border. This is particularly the case given the delays in conducting a POC for 2D X-ray algorithms.

Finding: The absence of a rigorous comparative performance analysis of the department's detection technologies and a corresponding analysis of the return on investment of the different detection technologies in different deployment scenarios is concerning. The department must optimise the deployment and effectiveness of the proven combination of 2D X-rays and detector dogs while examining the potential of potentially exciting but unproven 3D X-ray technology.

Recommendation 13
In order to optimise future decision-making and return on investment on the substantial capital and operational investment in 3D X-ray technology, the department should complete an independent analysis of the relative performance of the department's suite of detection technologies, including a detailed return on investment analysis.

14.6 Benefits realisation

The MSBC project plan identified 3 benefits. As the project approaches its initial completion date, the Inspector-General has made an assessment based on the information provided to the review and the above assessment as to whether the department has realised these benefits.

Table 15 Expected benefits and outputs from the MSBC project and Inspector-General assessment

Expected benefit/ output	Measure	Timeframe for benefit delivery	Inspector-General assessment (met / not met)
Identifying more efficient and effective technology and processes at the border to:		By project completion June 2022	
• improve confidence in decision making by officers	No measure		Met. Note: the measure is confidence (qualitative measure), not accuracy (quantitative measure).
• decrease interaction with compliant and low risk entities	Lower intervention rates with compliant entities		Unable to be determined as relevant data not collected.
• increase the detection of biosecurity risk material	Increased detection rates		Not met.
• decrease leakage	Decreased leakage rates		Unable to be determined as relevant data not collected.
• realise resource efficiencies through use of computer algorithms and adoption of in-line X-ray technologies	Reduction in resources required to screen the same amount of passengers, mail and air cargo where technology and processes have been implemented		Not met. Operational algorithm not delivered.

Expected benefit/ output	Measure	Timeframe for benefit delivery	Inspector-General assessment (met / not met)
Improve service and effectiveness through formalising and establishing partnerships with other border agencies	Partnership agreements and/or Memorandum of Understanding in place with NZ MPI and the Department of Home Affairs	By project completion June 2022	Not met. While arrangements have been delivered these have not led to improved service and effectiveness in the context of deliverables.
Reduce costs to the department through sharing infrastructure and costs with other border agencies	Infrastructure sharing arrangement in place with the Department of Home Affairs and Australian Border Force	By project completion June 2022	Not met. No infrastructure (3D X-ray) sharing.
	Cost sharing arrangement in place with NZ MPI		Met. In relation to algorithm development.
	Decreased expenditure compared to cost of purchasing and maintaining infrastructure and software as a single agency		Not met. No infrastructure (3D X-ray) sharing.

Finding: The department has so far not realised most of the proposed benefits of the Modern Seamless Border Clearance project. Furthermore, the significant additions to the program of work without strengthening of its project management has resulted in a rolling high-cost program without clearly traceable deliverables and defined benefits underpinned by rigorous analysis.

15. Agency and stakeholder relationships

The successful delivery of day-to-day biosecurity risk mitigation, and the significant body of reform work currently underway, requires strong interdepartmental relationships, particularly with the DoHA, ABF and Australia Post (AP), as well as with industry partners such as airport corporations and air cargo operators. During the review the Inspector-General saw good evidence of good relationships between the department, DoHA/ABF and industry at both strategy and operational levels.

The department is working closely with DoHA/ABF on future operating models for travellers, mail and air cargo. These are long-term projects that incorporate the outcomes of several significant interdepartmental projects, such as electronic advanced data (EAD) in mail and the digital passenger declaration (DPD) in travellers. This work also incorporates internal departmental reforms, such as TAMS and the 3D X-ray project.

The Future Traveller program sets 'aligning with other government agencies' and 'working in partnership with industry' as 2 of the 7 key strategic focus areas (DAWE, 2018c). These are appropriate foci given the shared nature of the border operating environment with ABF and that the border environment is also a commercial operation where the infrastructure is commercially owned and operated. While recognising these valuable relationships, the department's legislated role is to protect Australia from the entry of biosecurity risks. Therefore, it must move with appropriate haste to ensure an appropriate level of biosecurity protection by addressing known and emerging risks, both biosecurity and operational.

Operationally, and in relation to detection technologies, the Inspector-General was advised that the department generally has good working relationships with different areas of the ABF, including the detector dog breeding program and operational units at airports and mail gateway facilities.

Relationships with industry were also generally good but at times challenged by the conflict between biosecurity and commercial imperatives. During a regional visit for this review, the Inspector-General had the opportunity to attend an early discussion on 3D X-ray POC deployment. It was a positive discussion with both parties looking for opportunities to improve operations, but there was also an inherent tension in the requirement for a tangible commercial return – reduced space in another part of the airport or increased 'green-lane' passenger throughput. As discussed in chapter 13.7, given the current R&D / POC phases of the 3D X-ray program, it is far from assured that such outcomes can be delivered.

During another regional visit, operational staff referred to the ongoing limitations posed by the presentation of mail as a factor affecting the management of biosecurity risk and as a factor in the inability to deploy 3D X-rays in the Other Article (OA) screening line. The Inspector-General notes that the presentation of mail was an issue raised by the Interim Inspector-General of Biosecurity in March 2015 in the review *Managing biosecurity risks associated with international online purchases*:

> *In the larger facilities, Australia Post has difficulty separating and presenting international mail of interest to the department. Consequently, more international mail items than necessary are screened to ensure items of interest are assessed. Improvements in the presentation of mail of interest to the department would reduce the amount of mail that the department screens and increase the mail clearance rate. (IIGB, 2015)*

The Inspector-General is concerned that these types of operational issues have been unable to be resolved over an extended period of time. During that time, the issues have been exacerbated by substantial growth in mail throughput. Thus, while these strategic relationships need to be congenial, they also need to achieve productive outcomes and issues escalated where outcomes are not achieved in a reasonable time frame.

> **Finding:** The mail pathway through Australia Post continues to be a biosecurity risk pathway of significant concern and warrants engagement of Australia Post management by the department at the most senior level regarding commitment to options for improvement, including in collaboration with Australian Border Force.

16. Legislative and legal issues

16.1 Authority to use detection technology

The Inspector-General notes that, under section 553 of the *Biosecurity Act 2015*, 'Functions and powers', biosecurity officers are provided with the power to use dogs to inspect goods. A similar power does not exist for the use of X-rays or other detection technologies deployed, or in development, by the department.

The Inspector-General notes that ABF officers operating under the *Customs Act 1901* when exercising powers of search (sections 186 and 186AA) are specifically authorised to use a range of detection technologies, including X-rays. A review of the Explanatory Memorandum for the Bill introducing this section into the *Customs Act 1901* provides no guidance on why this provision was included. However, in the context of X-rays having automated decision-making capabilities using artificial intelligence (AI) based algorithms (chapter 13.10), the Inspector-General considers it would be appropriate and timely for the department to review the requirement for this type of provision to be included in the Act.

16.2 Dealing with goods released from biosecurity control

During the review several constraints to the effective deployment of detection technologies in different pathways were identified, particularly for sea and air cargo. These constraints relate to the automatic release of goods from biosecurity control if not profiled as of biosecurity concern at the time of arrival in Australian territory.

Under the Biosecurity Act all goods entering Australia are subject to biosecurity control on entry into Australian territory. For cargo (air and sea) that is screened electronically based on reported documents, the cargo is released from biosecurity control unless profiled as being of biosecurity concern. When considering the use of detection tools – for example, detector dogs screening break-bulk cargo, such as motor vehicles, or X-ray screening of express air cargo – the goods are currently already released from biosecurity control, so biosecurity officers are unable to exercise powers of inspection (which requires goods to be under biosecurity control (section 123 of the Act)). To ensure that biosecurity officers are able to exercise their powers in these circumstances, the department must identify the goods it intends to screen through electronic profiling, thereby retaining the goods under biosecurity control.

The department currently does have the power to bring goods back under biosecurity control (section 164 of the Biosecurity Act), but the power can be used only where the biosecurity officer 'suspects on reasonable grounds that the level of biosecurity risk associated with the goods is unacceptable'. It would be the exceptional circumstance where an officer would be able to satisfy the requirement of 'suspects on reasonable grounds' to bring the goods back under biosecurity control. To screen goods already released from biosecurity control, without some other mechanism to enliven the biosecurity assessment powers, would involve biosecurity officers operating outside of the Biosecurity Act.

This issue does not affect traveller and mail pathways, as the release from biosecurity control is based on the goods leaving a designated geographical area – the mail gateway facility or the airport terminal. To support the effective use of detection tools in certain operating environments, the Inspector-General recommends that the department consider alternative mechanisms, such as:

- whether the use of detector dogs to screen break-bulk cargo on a wharf is permitted under the Permanent Biosecurity Monitoring Zone powers (sections 378 and 379) of the *Biosecurity Act 2015*. The zone may enable biosecurity officers to exercise their assessment powers in relation to the goods without them needing to be retained under biosecurity control or, if so, that control ceases when the goods are moved from the wharf. This can be done without the need for a specific release authority. If a biosecurity risk were identified, biosecurity officers could then exercise their powers under section 164 to bring the goods back under biosecurity control in order to manage the risk
- if the department intends to conduct mass screening of express air cargo as an ongoing concept of operation, whether the release from biosecurity control can be amended from a systems-based release to a geographical release, as occurs with travellers' baggage and international mail under section 22 of the Biosecurity Regulation 2016.

16.3 On-body searches by detector dogs

During discussions with staff and in departmental reports on detector dog activities, reference was made to the value of detector dogs in screening travellers for on-body concealments of biosecurity risk goods.

In the New South Wales jurisdiction, the use of detector dogs for the detection of drugs on the person by police officers was found to constitute an illegal search even though the police officer handling the dog has the power to conduct personal searches. Because of this situation, the New South Wales Government enacted the *Police Powers (Drug Detection Dogs) Act 2001* (NSW), which formalised the legality of the use of drug detector dogs in personal searches (NSW Ombudsman, 2006).

Unlike police, biosecurity officers operating under the *Biosecurity Act 2015* do not have personal search powers. Detector dogs also do not possess any special authority under the Act to perform personal searches.

In cases where a biosecurity officer considers that a traveller may be concealing items of potential concern on their body, including within worn clothing, they are required to seek the assistance of an ABF officer. An appropriately authorised ABF officer, based on their determination of reasonable suspicion that the person is unlawfully carrying prohibited goods, is empowered to conduct a frisk search (*Customs Act 1901*, section 219L).

The Inspector-General recommends that the department clarify the legal position on the use of detector dogs for on-person screening and, if necessary, address legislative powers and/or update relevant policy and operational instructions.

16.4 Managing large numbers of low-value biosecurity risk goods

A by-product of mass screening of goods in the mail pathway is that there are large numbers of low-value noncompliant goods. Under the *Biosecurity Act 2015* the department is required to seek advice of the consignor as to how they wish to manage the noncompliant goods – treatment, export or destruction. The exception to this is where the goods are assessed as posing an immediate biosecurity risk, in which case a biosecurity officer may take steps to immediately mitigate that risk.

Where advice is sought from the consignor, and the consignor responds within the required 14 days, the goods are usually exported or destroyed because the value of treatment or export exceeds the value of the goods by many times. This process is time consuming, and therefore costly, for the department, with most items being either exported or destroyed after a period of approximately 20 days.

The current legislative framework for the management of biosecurity risks goods is undifferentiated – whether it relates to a bulk shipment of grain, a container load of timber or a 50-cent packet of seeds in mail. The legislative ability for the department to streamline its management of low-value biosecurity risk goods, possibly by designated pathways, through either immediate export or destruction would provide significant efficiencies to its mass screening operations. It would also reduce the cost impacts of large quantities of low-value items – under current legislation it costs $80–$90 to manage each item – when dealing with items worth a fraction of that cost.

It is recommended that the department consider a 'differentiated management of biosecurity risk goods framework', which provides for the exclusion or significant limitation on the requirements of neutrality and fairness in the exercise of discretionary powers as it relates to low-value biosecurity risk goods. Any such framework should provide clear boundaries associated with where the powers can be applied (for example, mail gateway facilities), the things to which the powers can be applied (for example, mail items) and the value threshold (for example, as declared on the mail item).

Recommendation 14

The department should review legal questions relating to the department's current use of detection technology, proposed future use and operational impediments stemming from its use; and, where necessary, pursue appropriate legislative amendments and procedural updates.

17. Conslusions

This review examined critical issues regarding the deployment of well-established detection technologies (detector dogs and 2D X-ray machines) and the work undertaken to assess and deploy sophisticated 3D X-ray technology.

The very nature of Inspector-General reviews under the *Biosecurity Act 2015* is that the reviews must examine evidence on past and current performance and future plans to assess capability and infer future performance of the preventative biosecurity system. In that sense, an Inspector-General's review will often be viewed as overly negative by current department managers who have not yet been able to lay down a documented track record of current outcome and standards of delivery and must rely on assurances of commitment to remedy the significant and often long-running deficiencies of the past.

There is much to celebrate from 3 decades of successful deployment of detector dogs and more than 2 decades of successful use of X-ray machines to detect biosecurity risk material. However, this report details significant past management weaknesses that have led to suboptimal deployment of detection tools and inadequate biosecurity risk mitigation from the resources available. The report also outlines recent weaknesses in governance that complicate the evaluation of costly 3D X-ray technology for (semi-) automatic detection of biosecurity risk material and distract from optimising Australia's biosecurity protection from existing technology (2D X-rays plus detector dogs) until the new technology is adequately assessed and risk-return demonstrated. Some of these weaknesses may have their genesis as far back as 2018 but are still underpinning or influencing current decision-making.

In summarising the significant weaknesses in the department's handling of the critically important areas of traveller and mail biosecurity risk mitigation, the Inspector-General makes the following observations regarding the issues that the department must address. The department:

1. has not adequately utilised evidence-based pathway process-mapping approaches to better understand and demonstrate to current and new managers how the traveller and mail pathways (including commercial and regulatory steps) operate
2. has not fully utilised the significant system performance data already available to it regarding the efficiency, effectiveness and national consistency of deployment of critical resources, including detector dogs, frontline biosecurity officers and X-ray machines

3. has not critically analysed available data essential to sound risk-return decision-making in traveller and mail risk pathways, including the relative risks posed by biosecurity risk material in passenger baggage, hand luggage and on-person, and mail categories for Express Mail Service (EMS) and Other Articles (OA)
4. has not applied sufficiently rigorous project and resource planning prior to major capital expenditure on 3D X-ray machines that would have identified the airport baggage handling processes, number of baggage conveyors needing to be covered, and the processing pressure points that are fundamental to successful deployment of 3D X-ray machines
5. does not appear to have routinely utilised process design and modelling experts to enable it to fully understand both commercial and biosecurity processes (for travellers and mail) and how these may be optimised for the desired outcomes of both the department and commercial partners
6. has not established effective arrangements with critical partners ABF and Australia Post that would deal adequately with the long lead times for supply of detector dogs to replace ageing dogs and expand the dog fleet in a timely way and drive optimisation of both biosecurity screening and sorting of large volumes of incoming mail in major mail sorting centres
7. has a history of management behaviour that plays to the organisational and operational weaknesses generated by relatively short-term governments, short-period and headline-named budget allocations, and management personnel turnover. This results in critical preventative biosecurity measures being driven more by knowledge and attitudes of senior managers at various times than by optimised longer term biosecurity delivery needs and strategic opportunities
8. appears significantly more prone to pursue new, potentially exciting technology developments with long development times and costs than to be fully accountable for exploitation of the biosecurity benefits of established, proven technologies and methods. This creates a double-jeopardy problem because the intervening period before availability of the new technology may be subject to suboptimal biosecurity risk mitigation performance using existing technologies, unnecessarily exposing Australia to elevated biosecurity risks
9. of its own volition, and in support of the government of the day, is prone to serious over-promotion of the benefits of new technologies and the implied scale of their application, to the extent that Australian stakeholders may be given the impression that certain biosecurity risks are being more effectively mitigated than is the reality
10. has not routinely applied good-practice project management in the past, particularly with respect to accurate scoping and performance management (with welcome recent uplift in this regard)
11. has not applied an effective approach to project enabling, by addressing foundation legal issues that would enable full assessment of operational deployment of the most cost-effective biosecurity measures, and adequate lead times to overcome impediments governing application of new technologies
12. has not effectively utilised the national reach of the department’s biosecurity operations to assess performance and trial new methods in different airports and mail centres that are then incorporated into the ‘nationally consistent best-practice business-as-usual approach’.

The Inspector-General has publicly and positively commented on substantial recent improvements in the department's biosecurity management. The improvements are impressive. However, the scale of organisational change management required, ongoing delivery of reliable risk-return biosecurity services, and implementation of new prospective technology initiatives is a major challenge, not to be underestimated. Optimised risk-return delivery of preventative biosecurity functions for Australia's international airports and mail centres towards 2030 will require a level of discipline demonstrably possible but too often not seen in the past.

18. Glossary

Term	Description
ASF	African swine fever. ASF is a highly contagious disease that poses a significant biosecurity risk to Australia's pig industry.
AIMS	Agriculture Import Management System
Beale review (Beale et al., 2008)	Independent review of Australia's quarantine and biosecurity arrangements by a panel chaired by Mr Roger Beale AO. The report, *One biosecurity: a working partnership*, was released by the Australian Government on 18 December 2008.
Biosecurity Act 2015	The *Biosecurity Act 2015* (Cth) commenced 16 June 2016 and replaced the *Quarantine Act 1908* (Cth).
Biosecurity Algorithm	The Biosecurity Algorithm includes component algorithms for meat, seafood, fruit, vegetables, and plants.
Biosecurity risk	According to the *Biosecurity Act 2015*, biosecurity risk means (except as provided by section 310): (a) the likelihood of a disease or pest: (i) entering Australian territory or a part of Australian territory; or (ii) establishing itself or spreading in Australian territory or a part of Australian territory; and (b) the potential for any of the following: (i) the disease or pest to cause harm to human, animal or plant health; (ii) the disease or pest to cause harm to the environment; (iii) economic consequences associated with the entry, establishment or spread of the disease or pest.
BOD PMO	Biosecurity Operations Division Portfolio Management Office
BRM	Biosecurity risk material. BRM is any plant and animal material, and inorganic material, that is of biosecurity risk or concern.
Biosecurity risk owner	Positions or groups within the department who are the ultimate advisors on managing specific biosecurity risks of different commodities, processes or pathways.
CAPEC	Conference of Asia Pacific Express Couriers (DHL, FedEx, TNT and UPS)

Term	Description
CCV	Cargo compliance verification. CCV is a statistical based end-point survey conducted on the containerised sea cargo pathway to evaluate the effectiveness of its operational biosecurity controls. These controls include community protection profiles, document assessment and broker arrangements.
CEBRA	Centre of Excellence for Biosecurity Risk Assessment. CEBRA is a longstanding biosecurity research initiative of the Australian Government and is integral to the department's response to managing biosecurity risks. Its activities help ensure that governments are leaders in biosecurity risk management by providing collaborative research that informs a range of regulatory activities – such as risk analysis (assessment, management and communication), the setting of regulatory interventions, inspection activities and surveillance.
Compliance	Status whereby all aspects of a product, facilities, people, programs and systems meet regulatory requirements and, where applicable, importing country official requirements.
Concept of Operations	A document that describes a proposed system concept and how that concept would be operated in an intended environment. The concept of operations is developed by the operational policy leads to communicate the vision for the operational system (cargo, traveller, mail pathway etc.) that is then implemented by operational management.
Department	Department of Agriculture, Fisheries and Forestry
Director of Biosecurity	Secretary of the Department of Agriculture, Water and the Environment, responsible for managing biosecurity risks and ensuring Australia's international rights and obligations are met.
DPD	Digital Passenger Declaration
EMS	Express Mail Service
EAD	Electronic Advance Data. EAD is data capture by Australia Post for border clearance purposes.
IQI	Increased Quarantine Intervention. In the May 2001 Budget, following the outbreak of foot and mouth disease in Europe, the department received additional funding of some $281.4 million for the Australian Quarantine Inspection Service (AQIS). This funding was to be used, inter alia, to substantially increase intervention and effectiveness levels at the major border entry points. The government initiative was referred to as IQI.
Integrated Business Model	Departmental system that deploys workforce to meet demand that is influenced by changing risk and informed targeting.
ICS	Integrated Cargo System
K9	Canine, dogs
Leakage	Refers to the detection of biosecurity risk material during end-point surveys rather than detection by biosecurity intervention processes.
MAPS	Mail and Passenger Service. MAPS is a departmental system used for reporting purposes and recording of noncompliance information within the airports, international mail, seaports and detector dogs programs within the department.
MGF	Melbourne Gateway Facility
MOU	Memorandum of Understanding
MSBC	Modern Seamless Border Clearance project

Term	Description
Non-CAPEC members	International express air courier companies that are not part of the CAPEC group and process SAC consignments under approved arrangement classes 1.2 (Air cargo terminal) or 1.3 (Sea and airfreight depot (restricted)).
NCE%	The Non-Compliance Effectiveness is a measure of how effective the department is at detecting noncompliance. In mail, it is expressed as the percentage of noncompliant mail articles (those with biosecurity risk material) intercepted by the department.
OA	Other Articles
Pcl	Parcel
PFG	Perth Gateway Facility
POC	Proof of concept
RTT	Real Time Tomography. RTT X-ray units can produce 3D tomography images or slices in real time as the item passes through the X-ray unit. This is done without the need to slowly rotate an X-ray emitter and detector around the object.
ROI	Return on investment. ROI is a performance measure used to evaluate the efficiency of an investment or compare the efficiency of several investments.
Risk mitigation	Implementation of biosecurity risk measures to address a known or foreseeable biosecurity risk.
Risk profiles	Generated by comparing descriptions of SAC consignments with profile criteria in the ICS to identify potential biosecurity risks. Profiles are also generated for travellers based on application of specific policy rules that are used to identify travellers for referral to a biosecurity officer
SAC	Self-Assessed Clearance. SAC is a procedure for imported non-commercial goods that have a value equal or less than A$1,000.
SAC Pathway	The movement of imported non-commercial goods via express air courier transportation.
SCC	Statistical Consulting Centre at the University of Melbourne
SGF	Sydney Gateway Facility
Screening	The use of X-rays and detector dogs to screen international travellers and mail for biosecurity risk material.
Training	Departmental accredited training required by a person associated with the management of biosecurity risk at an approved arrangement site.
TAMS	Traveller and Mail System. TAMS is a decision support workflow of the traveller clearance process (to be extended to Mail). It will replace MAPS.
TMM	Traveller and Mail Modernisation

19. References

ABF (AUSTRALIAN BORDER FORCE) 2021. Future operating model for international mail, draft for discussion. Internal document: Australian Border Force.

ABF (AUSTRALIAN BORDER FORCE), AP (AUSTRALIA POST), DAWR (DEPARTMENT OF AGRICULTURE AND WATER RESOURCES) & DoHA (DEPARTMENT OF HOME AFFAIRS) 2019. International mail, blueprint draft June 2019. Internal document: Australian Border Force.

BEALE, R., FAIRBROTHER, J., INGLIS, A. & TREBECK, D. 2008. One Biosecurity – a working partnership. The independent review of Australia's quarantine and biosecurity arrangements. Report to the Australian Government. Canberra: Commonwealth of Australia.

BRACCESCHI, S. 2021. The challenges of X-ray image analysis and the value of training. *WCOnews*, 96, 74–77. [Accessed 7 June 2022]

BROWN, W., SMITH, J., MOSER, A., BROSNAN, A., BOSHOFF, J., BLAZKIEWICZ, P. & LEECH, C. 2021. Innovation in biosecurity detector dog operations, lab report. Armidale: University of New England, Canberra: Department of Agriculture, Water and the Environment.

BITRE (BUREAU OF INFRASTRUCTURE AND TRANSPORT RESEARCH ECONOMICS) 2022. Airport traffic data. Canberra: Department of Infrastructure, Transport, Regional Development and Communications. [Accessed 9 June 2022]

CLARKE-ERREY, S. & FINCH, S. 2020a. Results of a replication of a simulated trial comparing 2D and 3D technologies, report no. 1119. Melbourne: Statistical Consulting Centre, School of Mathematics and Statistics, University of Melbourne.

CLARKE-ERREY, S. & FINCH, S. 2020b. Results of a simulated trial comparing 2D and 3D technologies at detecting specific risk items in baggage, report no. 1124. Melbourne: Statistical Consulting Centre, School of Mathematics and Statistics, University of Melbourne.

CLARKE-ERREY, S. & FINCH, S. 2020c. Results of a simulated trial comparing 2D and 3D technologies at detecting specific risk items in mail, report no. 1127. Melbourne: Statistical Consulting Centre, School of Mathematics and Statistics, University of Melbourne.

CLARKE-ERREY, S. & FINCH, S. 2019. Results of simulated trial comparing 2D and 3D technologies, report no. 1108. Melbourne: Statistical Consulting Centre, School of Mathematics and Statistics, University of Melbourne. [Accessed 9 June 2022]

DA (DEPARTMENT OF AGRICULTURE) 2019. Inspections group WA, Perth detector dog K1 trial overview. Internal document: Department of Agriculture.

DAFF (DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY) 2012. Reform of Australia's biosecurity system. An update since the publication of One Biosecurity – a working partnership. Canberra: Department of Agriculture, Fisheries and Forestry.

DAFF (DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY) 2010. Annual report 2009–10. Canberra: Commonwealth of Australia. [Accessed 7 June 2022]

DAFF (DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY) 2001. Annual report 2000–01. Canberra: Commonwealth of Australia. [Accessed 9 June 2022]

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2022a. Biosecurity matters, edition 2, 2022. Canberra: Department of Agriculture, Water and the Environment. [Accessed 21 June 2022]

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2022b. New 3D x-ray unit installed at Sydney gateway facility – 2 May 2022. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021. 2021–22a CEBRA full research proposal. Air cargo (non-commercial) assurance program survey models, 29 September 2021. Internal document: Biosecurity Operations Division, Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021b. Budget estimates back pocket brief – detector dogs, August 2021. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021c. Proposed increase to detector dog fleet. 10 December 2021. Internal document: Biosecurity Operations Division, Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021d. Biosecurity detector dog program overview. Internal document: Department of Agriculture Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021e. National list of X-ray units, 27 July 2021. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021f. Biosecurity operations division emerging technology projects, 16 August 2021, 2021/011646E. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021g. Number of biosecurity officers by location – dogs and X-rays, 30 August 2021. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021h. Budget 2021–22, Biosecurity. Canberra: Department of Agriculture Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021i. Detection technologies, August operational report. Internal document: Department of Agriculture Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021j. Contract for services for biosecurity development program (number C07569), October 2021. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021k. Biosecurity algorithm development, software and networking. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2021l. Project plan – 3D Xray wildlife automatic algorithm detection. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2020a. Key performance indicators. Pathway: airports. Months: January 2018 to February 2020. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2020b. Monthly statistic reports – international mail, January 2018 to June 2020. Internal document: Department of Agriculture Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2020c. Khapra detection capability – detector dogs, 7 October 2020. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2020d. Modern seamless border clearance – the power and potential of 3D X-ray technology and automated detection algorithms. Internal document: Department of Agriculture Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2020e. Project status report – New 3D Xray (RTT) into air cargo facility. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2020f. Media releases on 3D X-ray machine technology. Internal document: Department of Agriculture Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2019. Executive report – international mail, April 2019 quarter. Internal document: Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) 2018. Travellers strategic outlook 2018–2023 Internal document: Compliance Division, Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) n.d.a. Low energy X-ray for seeds. Internal document: Biosecurity Operations Division, Department of Agriculture, Water and the Environment.

DAWE (DEPARTMENT OF AGRICULTURE, WATER AND THE ENVIRONMENT) n.d.b. Biosecurity innovation project proposal 2020–2021. Automatic detection of wildlife trade. Internal document: Department of Agriculture, Water and the Environment.

DAWR (DEPARTMENT OF AGRICULTURE AND WATER RESOURCES) 2018a. Modern seamless border clearance measure (MSBC) 2018–2022, emerging X-ray innovation trial (EXIT) 2019–2019, communication plan. Internal document: Department of Agriculture and Water Resources.

DAWR (DEPARTMENT OF AGRICULTURE AND WATER RESOURCES) 2018b. Detection of biosecurity risk materials using innovative x-ray technologies. Canberra: Department of Agriculture and Water Resources.

DoHA (DEPARTMENT OF HOME AFFAIRS), ABF (AUSTRALIAN BORDER FORCE), AFP (AUSTRALIAN FEDERAL POLICE) & DAWE (DEPARTMENT OF AGRICULTURE WATER AND THE ENVIRONMENT) 2022. Canine – detector dog facilities reference group. Draft terms of reference. Internal document: Department of Home Affairs.

NAIRN, M.E., ALLEN, P.G., INGLIS, A.R. & TANNER, C. 1996. Australian quarantine – a shared responsibility. Canberra: Department of Primary Industries and Energy.

NSW OMBUDSMAN 2006. Review of the *Police Powers (Drug Detection Dogs) Act 2001*. Sydney: NSW Ombudsman.

IGB (INSPECTOR-GENERAL OF BIOSECURITY) 2021. Robustness of biosecurity measures to prevent entry of khapra beetle into Australia. 2021–22/02. Canberra: Inspector-General of Biosecurity.

IGB (INSPECTOR-GENERAL OF BIOSECURITY) 2020. Adequacy of preventative border measures to mitigate the risk of African swine fever. 2019–20/02. Canberra: Inspector-General of Biosecurity.

IGB (INSPECTOR-GENERAL OF BIOSECURITY) 2019a. Pest and disease interceptions and incursions in Australia. 2018–19/05. Canberra: Inspector-General of Biosecurity.

IGB (INSPECTOR-GENERAL OF BIOSECURITY) 2019b. Effectiveness of biosecurity measures to manage the risks of brown marmorated stink bugs entering Australia. Canberra: Inspector-General of Biosecurity.

IGB (INSPECTOR-GENERAL OF BIOSECURITY) 2019c. Biosecurity risk management of international express airfreight pathway for non-commercial consignments. 2019–20/03. Canberra: Inspector-General of Biosecurity.

IIGB (INTERIM INSPECTOR-GENERAL OF BIOSECURITY) 2015. Managing biosecurity risks associated with international online purchases. Canberra: Department of Agriculture.

IIGB (INTERIM INSPECTOR-GENERAL OF BIOSECURITY) 2013. The effectiveness of controls for imported uncooked, cooked and cured pig meat. Canberra: Department of Agriculture, Fisheries and Forestry.

RAPISCAN SYSTEMS 2021. Biosecurity program FY22–23. Executive summary, 6 July 2021. Internal document: Rapiscan Systems.

RAPISCAN SYSTEMS 2020. Biosecurity program 2020–21. An R&D program for the Department of Agriculture, Water and the Environment, March 2020. Internal document: Rapiscan Systems.

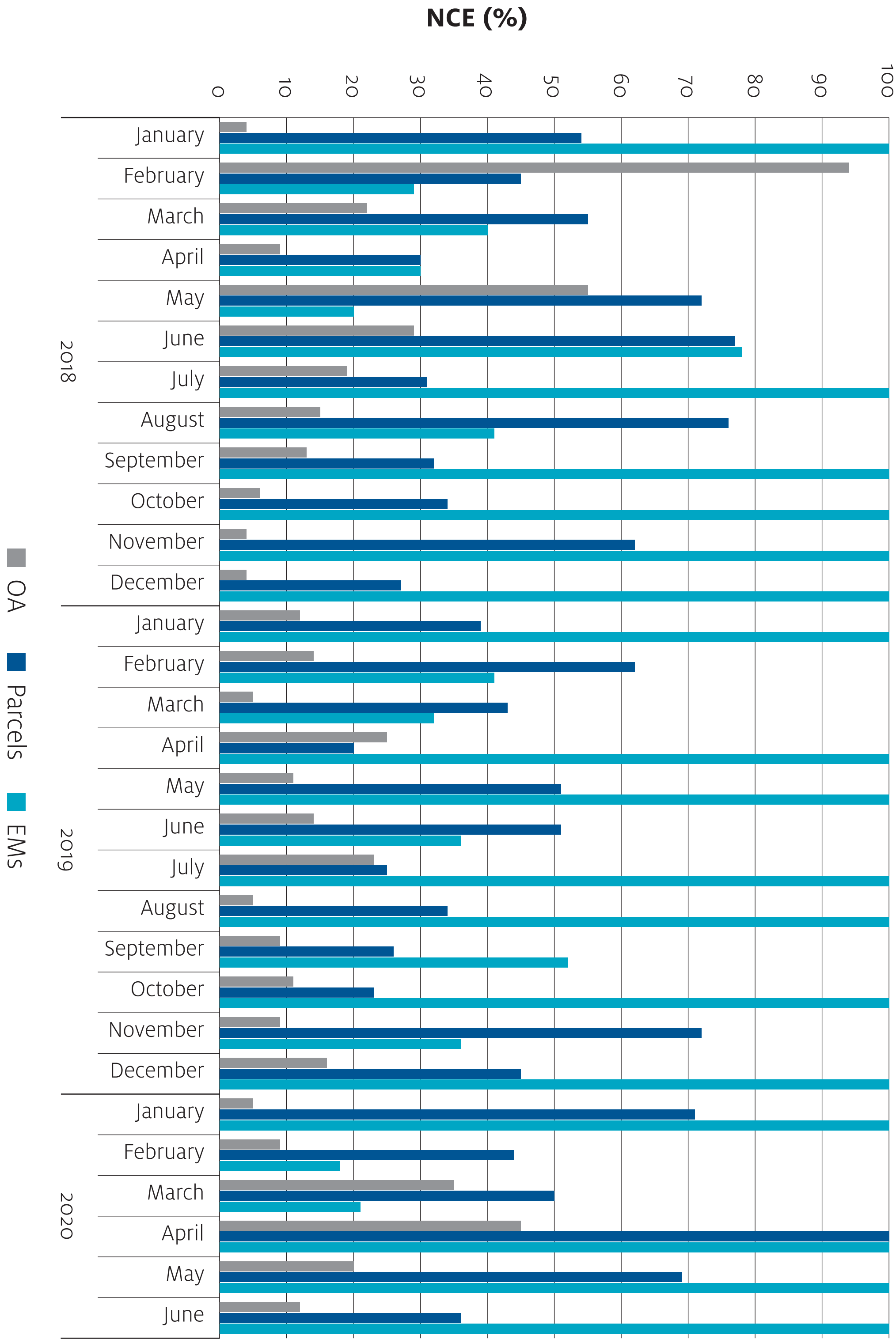
RAPISCAN SYSTEMS 2019. Proposal – low energy scanning of seed. Internal document: Rapiscan Systems.

SMITH, J. 2022. BMSB detector dog pilot – investigating the detection capability of detector dogs on exotic plant pests. Internal document: Department of Agriculture, Water and the Environment.

20. Appendix

Estimated noncompliant articles and noncompliance effectiveness at Sydney Gateway Facility and Melbourne Gateway Facility

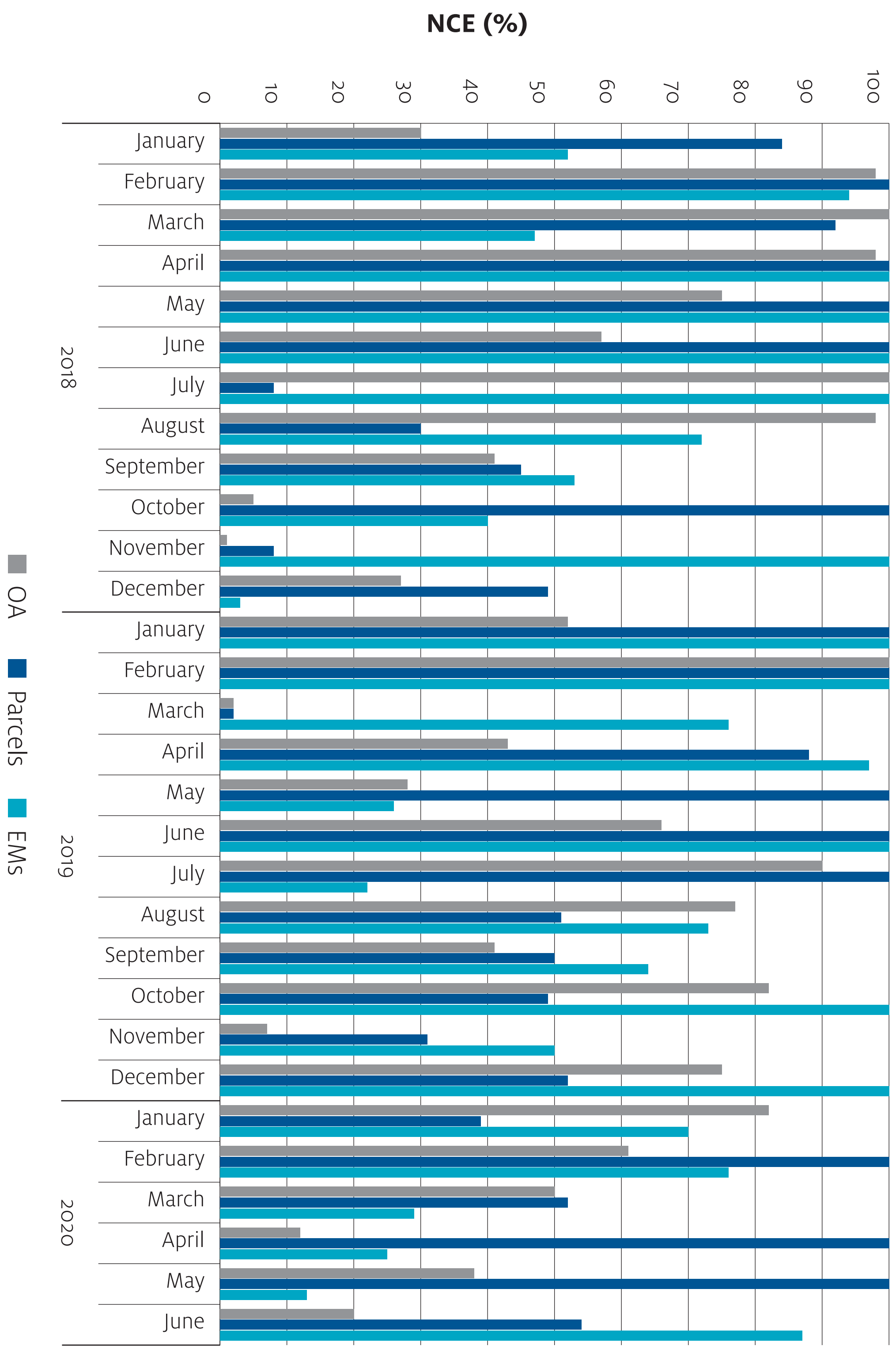
Figure 14 Noncompliance effectiveness (NCE%) at Sydney Gateway Facility, January 2018 to June 2020



Note: EMS: Express Mail Service; OA: Other Articles.

Source: DAWE, 2020b

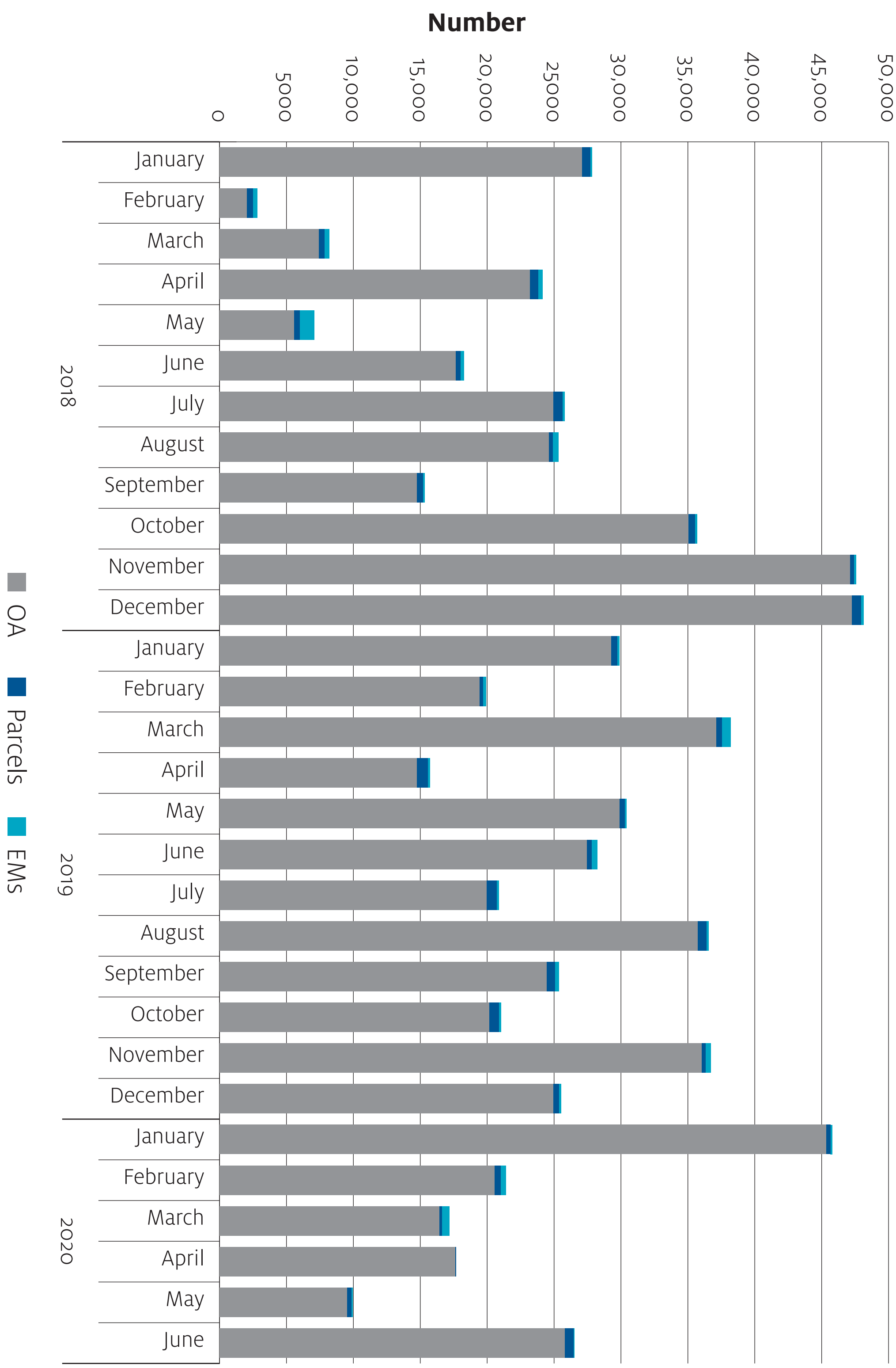
Figure 15 Noncompliance effectiveness (NCE%) at Melbourne Gateway Facility, January 2018 to June 2020



Note: EMS: Express Mail Service; OA: Other Articles.

Source: DAWE, 2020b

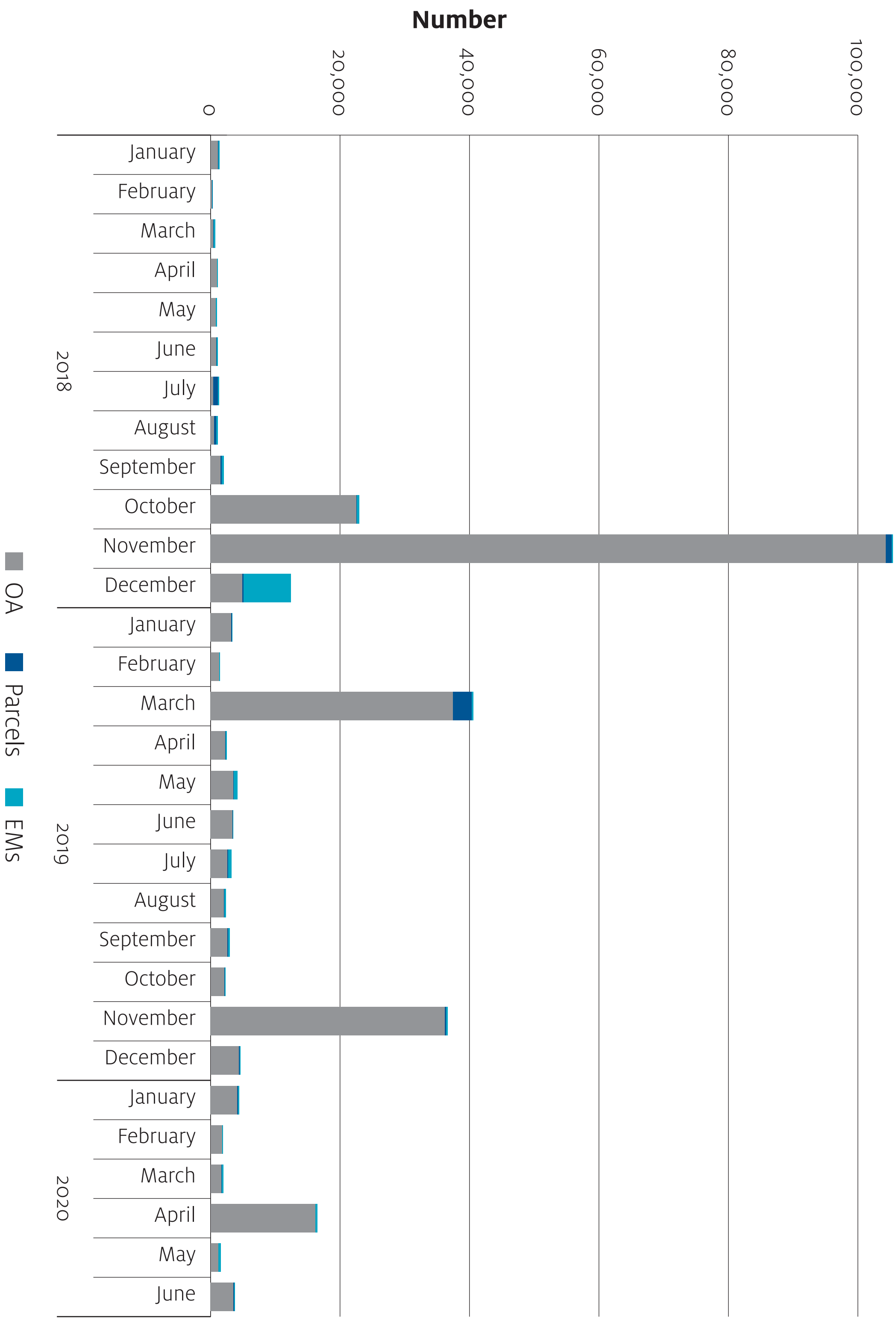
Figure 16 Estimated number of noncompliant articles at Sydney Gateway Facility, January 2018 to June 2020



Note: EMS: Express Mail Service; OA: Other Articles.

Source: DAWE, 2020b

Figure 17 Estimated number of noncompliant articles at Melbourne Gateway Facility, January 2018 to June 2020



Note: EMS: Express Mail Service; OA: Other Articles.

Source: DAWE, 2020b

21. Agency response

Australian Government
Department of Agriculture, Fisheries and Forestry

ANDREW METCALFE AO
SECRETARY

21 July 2022

Mr Rob Delane
Inspector General of Biosecurity
c/o Department of Agriculture, Fisheries and Forestry
GPO Box 858
Canberra ACT 2601

Dear Rob

Thank you for your correspondence of 7 July 2022 providing your review report, *Efficacy and adequacy of department's X-ray scanning and detector dog screening techniques to prevent the entry of biosecurity risk material into Australia.*

I appreciate the observations and insights provided by this comprehensive review, both in identifying areas for improvement and in acknowledging the department's progress in implementing major reform to help protect Australia from current and future biosecurity threats. In particular, the department is committed to the delivery of screening capability that enables greater effectiveness, consistency and reliability in achieving our goals.

I agree with all fourteen recommendations contained within your report, as many align with planned improvements and reform work already initiated by the department

The department's response to each recommendation is at Attachment A.

The department assessed the report in relation to whether information contained within in it could be considered as prejudicial to the public interest. No content was identified that should be excluded from public disclosure.

Best wishes

Andrew Metcalfe AO
Director of Biosecurity

Attachment A
Department of Agriculture, Fisheries and Forestry – Agency response to the IGB report: *Efficacy and adequacy of department's X-ray scanning and detector dog screening techniques to prevent the entry of biosecurity risk material into Australia.*

T +61 2 6272 3933
F +61 2 6272 5161
18 Marcus Clarke Street
Canberra City ACT 2601
GPO Box 858
Canberra ACT 2601
agriculture.gov.au
ABN 34 190 894 983

ATTACHMENT A: Department of Agriculture Fisheries and Forestry – Agency response to the IGB report: *Efficacy and adequacy of department's X-ray scanning and detector dog screening techniques to prevent the entry of biosecurity risk material into Australia.*

Recommendation 1 – agreed

The department should subject its current and future mail and traveller operating models to more rigorous operations research analysis as a priority.

> *The department is continuing to progress modernisation of systems and data in the traveller and mail pathways. This includes priority work to improve data collection through the new Traveller and Mail System (TAMS). Planning and development for an algorithm-based biosecurity risk engine for both pathways are also underway, which enable better profiling and targeting. Other supporting initiatives in progress include the collection and use of additional datasets. These advances will increase data holdings and enhance analysis, enabling optimal decision-making and risk-return outcomes. Many of these initiatives are already funded and underway for implementation over coming financial years.*

Recommendation 2 – agreed

The department should prepare multi-year resourcing plans to support current and future demands for detector dogs. The plans should include advanced formal commitment by the department to take at least the number of dogs needed to maintain the approved size of the dog fleet.

> *The department agrees the preparation of multi-year resourcing plans will support current and future demands for detector dogs.*
>
> *The department currently forecasts up to 12 months in advance to meet known resourcing needs and allow for increased capacity as required, noting ongoing funding commitments are a matter for government. This enables the Australian Border Force to plan and maintain the approved size of the dog fleet.*

Recommendation 3 – agreed

The department should finalise the supply of detector dogs annex to the Department of Agriculture, Fisheries and Forestry / Australian Border Force memorandum of understanding by December 2022.

> *The department is seeking to formalise arrangements for the supply of detector dogs through a new annex to the Department of Agriculture, Fisheries and Forestry / Australian Border Force Memorandum of Understanding. Dialogue with the Australian Border Force has already commenced.*

Recommendation 4 – agreed

The department should maximise detection outcomes by applying a cross-pathway and multi-detection technology perspective to the redeployment of existing and new detector dogs.

> *The department currently deploys detector dogs flexibly across locations and pathways in response to risk and volume. Work is underway in the traveller pathway to assess the best deployment options for the different detection tools across the pathway. Underpinned by data, this work will set out principles for deploying detector dogs to complement x-rays and profiling*

tools. It is planned that this work will be expanded to cover mail and cargo pathways for detector dogs and x-rays.

Recommendation 5 – agreed

With the resumption of international traveller movements post COVID-19, the department must lift detector dog utilisation in the traveller pathway. If current traveller pathway deployment models cannot deliver adequate detector dog utilisation then alternative models need to be employed, either through a national process or as direct by airport-based operational risk managers.

The department agrees that detector dog resources should be utilised to their full capacity.

The department is lifting its use of detector dogs in the traveller pathway to increase detections of undeclared high-risk goods. Detector dog deployments will be expanded so that they are fully utilised throughout the entire arrivals period and not just on travellers that fall within optimal risk return margins.

Recommendation 6 – agreed

Before traveller numbers resume to pre-COVID levels, the department should undertake a formal operational test of its traveller screening, detection and leakage survey functions to ensure their efficacy.

Endpoint surveys provide information about the detection efficacy of screening and inspection methods. The department already conducts these surveys and will continue to do so to report on the performance of its screening and detection tools. The implementation of TAMS v2.0 will provide additional information about the performance of detection methods, relative to traveller cohorts and the goods they carry.

The Centre of Excellence for Biosecurity Risk Analysis (CEBRA) has provided the department with independent, expert advice around the conduct of surveys to ensure their validity and reliability. The department adopted the recommendations that were operationally feasible and will fully automate the survey selections within TAMS v3.0.

The Regulatory Assurance team within the Compliance and Enforcement Division will continue to undertake assurance testing on its key regulatory controls.

Recommendation 7 – agreed

The department's traveller pathway assurance dashboard should include focus on understanding and evaluating the relative success of the department's risk-return measures additional to the efficiency of its resource deployment.

The department will ensure that metrics to measure the effectiveness of biosecurity measures is included and communicated through the Traveller Assurance dashboard delivered by the Biosecurity Analytics Centre. The first iteration of the dashboard with the metrics is expected before the end of 2022.

Recommendation 8 – agreed

The department should seek to deploy its detection tools more actively and flexibly in the screening of travellers until data and systems enable a high level of effectiveness of cohort profiling.

To ensure that detection resources continue to optimise effectiveness outcomes, the department is deploying detection tools flexibly and in complementary ways. As indicated under Recommendation 4, work is underway in the traveller pathway to evaluate which detection tools work best in which scenarios.

The department will use a series of trials to evaluate:

- *deployment of x-rays inline in addition to secondary examination areas, particularly for flights originating from heightened risk areas*
- *complementing inline x-ray screening with detector dog screening, in place of automated cohort profiling*
- *deployment of detector dogs flexibly to improve screening levels on profile-matched or heightened risk travellers and to increase detection of undeclared high risk goods*
- *deployment of detector dogs to direct exits during periods of low utilisation and/or increased biosecurity risk (e.g. FMD).*

In line with Recommendation 1, the department will accurately record flexible deployment activity and outcomes and will ensure these requirements are included in business requirements for TAMS v2.0.

Recommendation 9 – agreed

The department should strengthen its use of noncompliance effectiveness (NCE%) reporting as the key measure of risk-return effectiveness in designing and managing the preventative biosecurity system. While activity performance (resource-return) has its place, it is not an effective measure in understanding the department's impact in mitigating the biosecurity risk.

A range of work is underway across the import pathways to measure the effectiveness of biosecurity controls and improve data collection and non-compliance measures. This multi-year program of work will deliver benefits progressively.

Recommendation 10 – agreed

The department should establish clearer processes for the consideration and integration of new or enhanced detector dog detection capabilities into operational biosecurity risk management.

The department has initiated work on a framework for evaluation and integration of detector dog capabilities across traveller, mail and cargo pathway operations. This will include processes for reviewing outcomes of detector dog innovation projects and determining operational viability and readiness.

Recommendation 11 – agreed

The department should develop a comprehensive metrics plan and data collection strategy to ensure availability of the data required to conduct a performance analysis of the component algorithm trials.

The department agrees the importance of a comprehensive data collection strategy to enable performance analysis of the biosecurity algorithm trials and has commenced work to improve algorithm performance reporting metrics.

In addition to the engagement of specialist data analyst resources, the department continues to engage the University of Melbourne, an independent party that provides analysis of algorithm *validation data. In the 2022-23 financial year, deliverables by the University of Melbourne will include oversight and advice on development of a metrics plan and data collection strategy to support performance analysis for component algorithm trials.*

Recommendation 12 – agreed

Consistent with recommendations 1 and 10, the department should complete a review of the technical and infrastructure outcomes being evaluated across POCs, to optimise the collective learnings from 3D X-ray testing across the express air cargo and mail pathway.

The department is committed to leveraging the collective learnings from new and existing installations to ensure that proof of concept project outcomes are optimised.

The improved program frameworks recently implemented by our project leads in collaboration with the BOD PMO have already provided a strengthened and more sustainable path to project evaluation, particularly when it comes to Proof of Concept (POC) work.

In line with recommendations 1 and 10, in 2022, the department will facilitate an analysis of outcomes being evaluated across current POCs. This will include the department's investment in physical and technical infrastructure. Quantified findings will inform effective integration into operational biosecurity risk management in the express air cargo and mail pathways.

Recommendation 13 – agreed

In order to optimise future decision-making and return on investment on the substantial capital and operational investment in 3D X-ray technology, the department should complete an independent analysis of the relative performance of the department's suite of detection technologies, including a detailed return on investment analysis.

The department agrees that an independent analysis of the relative performance of the suite of detection technologies, including a detailed Return on Investment (ROI) will optimise future decision making.

The department will engage dedicated resources to undertake the independent analysis in the 2022-23 financial year.

Recommendation 14 – agreed

The department should review legal questions relating to the department's current use of detection technology, proposed future use, and operational impediments stemming from its use; and, where necessary, pursue appropriate legislative amendments and procedural updates.

The department conducts continuous review of the biosecurity legislative framework and will progress legislative amendments as appropriate.

www.igb.gov.au

ABIO437.0622