Exploring Robotic Capability (Stage 1) Evaluation Report

Australian Government
Department of Agriculture, Water and the Environment

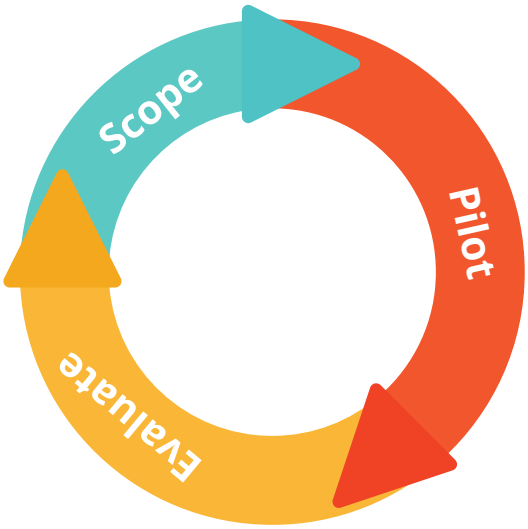
COREMATIC

Prepared by
Innovation Pilots

THE INNOVATION PILOT TEAM

The Innovation Pilots team forms part of the Research & Innovation Section, within the Analytics & Innovation Branch, Biosecurity Strategy & Reform Division.

The Innovation Pilots team brings our leaders, staff, and stakeholders together to generate and pilot ideas that optimise how we work today using technology available now.



We work in short, sharp cycles to test ideas which involves working with you to design the pilot (including support in developing key documents), helping to source assets (where required), supporting pilot activities and providing recommendations at conclusion of the pilot.

Once a pilot is complete and the evaluation plan has been finalised, it is handed over to the business area to file, park, scale or implement. Implementation considerations such as IT, legal, WHS, training is the business area's responsibility to progress following the pilot.

Melissa Hindle

Tony Brennan

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Improve how we manage risk in our daily activities

This report analyses the results of a pilot that was undertaken in March 2022 to test if Boston Dynamic's Spot could help us better manage biosecurity risk and Work Health & Safety (WHS) of our staff. The aim of the pilot was to test Spot's basic functionality including the ability to manoeuvrability across a range of surfaces, ability to provide clear images under a range of conditions and ability to identify biosecurity risk material (BRM) or allow officers to make an informed decision.

The testing involved collecting environmental data, collecting radiation readings and performing container and used machinery inspections.

Advances in robots could mean more devices in the market that may assist with our day-to-day activities

Pilot activities were undertaken in two locations as follows:

Darwin Port and Military Barracks

- Container inspection (internal, external and underside)
- Log stacks for export
- Used machinery and military vehicles

Ranger Uranium Mine

- Trial Land Form Survey (environmental data)
- Pit 1 radionuclide counts (radiation readings)

Overall, feedback from pilot participants was positive and with a few modifications and improvements, this technology could be a viable solution for container inspections, collecting environmental data and radiation readings. There is also opportunity for Spot to be a vehicle for other innovative technologies (such as hyperspectral cameras).

Pilots snapshot

Spot was successful in some areas (or parts of some areas) and not others, but that doesn't mean it won't be successful in the future with newer models available.

#	Pilot	Outcome
1	Container inspection (underneath a container stand)	✓
2	Container (external)	✓
3	Container (internal)	✓
4	Log stacks for export	Not Yet
5	Used machinery and military vehicles	Not Yet
6	Ranger Uranium Mine - Trial Land Form Survey	✓
7	Ranger Uranium Mine - Radionuclide counts	✓

Note: The ticks in the table indicate that the proof of concept was successful however, further modifications to technology or implementation considerations (e.g. exploring legal advice & policy considerations) would need to be explored to determine its feasibility for operations.

BACKGROUND

Container inspection

Currently the inspection of containers requires officers to gain access to the underside of these objects, often done by placing the container on a stand. Although containers need to be placed on stands that meet departmental standards there is still an inherent WHS risk when someone goes under these items to undertake an inspection.

Spot may be a supplementary inspection tool for biosecurity officers which will enable them to undertake inspections more safely and efficiently.

Ranger Uranium Mine Rehabilitation

Work is underway by the Supervising Scientist Branch (SSB) and Energy Resources of Australia Ltd (ERA) to monitor for potential environmental impacts during and after the rehabilitation of the Ranger Uranium Mine in Northern Territory (NT), and to undertake research to address knowledge gaps related to mine rehabilitation.

ERA established a trial landform (TLF) in 2008/2009 using waste rock to assess whether the final rehabilitated land can sustain mature vegetation. An extensive monitoring system was installed to assess the soil water holding capacity, runoff and infiltration of the landform as well as the revegetation performance. Monthly walk-throughs and drone flights are conducted to capture and/or monitor patterns and changes in revegetation on the TLF.

The varying terrain, harsh climate and unique wildlife in the NT makes for challenging working conditions. Also, the repetitive nature of scientific study and heavy equipment that is sometimes required can make it difficult for people to walk in the remote landscape comfortably and safely.

If Spot can help us make tasks safer and more efficient it could free up staff to undertake more complex activities.

For further information, including technology specifications, refer to the pilot plan at Content Manager: 2021/015226E-02

In scope

In collaboration with Corematic Pty Ltd, our Supervising Scientist Branch and Biosecurity Operations, the pilot tested Spot undertaking activities in the Northern Territory under different terrain, lighting and weather conditions.

- temperatures in excess of 45 degrees Celsius
- humidity
- wet season
- direct sunlight/cloudy overcast/raining
- different ground conditions
- varying types of terrain

Testing considered:

- manoeuvrability across a range of surface areas
- ability to provide clear images under a range of conditions eg lighting, environmental
- ability to provide clear images for officers to either identify biosecurity risk material (BRM) or allow them to make an informed decision
- opportunities for additional functionality

Out of scope

As this was a pilot to test the technology, implementation considerations were documented but not explored in depth, including:

- addition of the official Boston Dynamics arm
- hyperspectral camera attachment
- legal advice
- ICT integration with our systems
- policy considerations
- training considerations
- other similar technologies for comparison

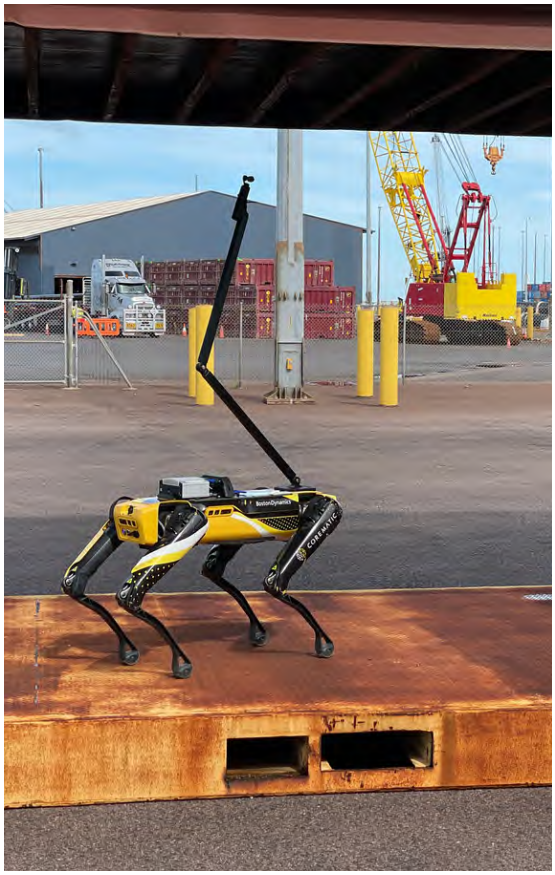
PHASE 1
CONTAINER INSPECTION

On 15 March 2022, a mock container inspection was conducted at the Port of Darwin. A Corematic engineer controlled Spot while staff observed closely. A pan-tilt-zoom (PTZ) camera, with adaptive Smart IR LEDs, was attached to Spot. This tested Spot's vision in the dark environment inside a container.

A modified arm was also attached with a small DJI Pocket to simulate an articulated arm to determine if this would assist with inspecting the hard to see areas on a container. This arm was moved manually, but was able to demonstrate how an articulated, remotely controlled arm would be able to get the camera in positions that provide better viewing angles for officers - when compared to the PTZ camera mounted on Spot.

Both external and internal inspections were undertaken, which included a container being placed on a stand so the underside could also be inspected. The video was streamed to the controller on an iPad and viewed by biosecurity officers. Simulated biosecurity risk material (BRM) was placed around the container.

PHASE 1
CONTAINER INSPECTION OUTCOMES



- Spot was able to traverse the port easily, however it slipped on oil in a container, which also indicated a hazard to our officers
- Connectivity between Spot and the controller was stable
- The camera and arm successfully demonstrated that this could be used to assist in undertaking a container inspection
- Using Spot, officers could identify BRM inside and outside of the container
- Biosecurity officers were able to make a decision or direction based on live-stream or image capture
- Positive feedback received from participants on their interactions with the technology
- Issue were raised around the weight of the unit and viewing the screen in sunlight
- Identify future needs or enhancements for subsequent pilot stages.

COREMATIC

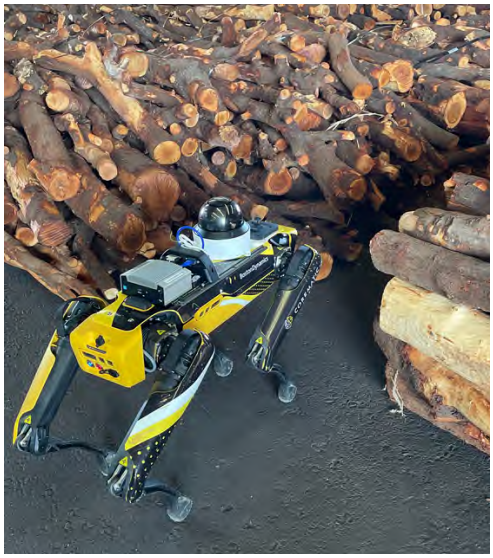
Spot was extremely capable in navigating in and around the shipping container, with both simulated pieces of inspection equipment performing reliably and producing acceptable results. Due to Spot's ability to position its body at a series of odd and complex angles, COREMATIC is confident in the belief that with an appropriately trained officer, Spot would make an extremely capable remote inspection tool for this task.

For this application, COREMATIC believes that the Spot Arm will provide an extra level of dexterity and viewing positions not possible with Spot CAM+.

COREMATIC confidence rating 10

OUT OF SCOPE ACTIVITIES

The design of the pilot allowed for additional payloads and activities to be tested, if time permitted, following the completion of the primary objectives.



While at Darwin port there were piles of sandal wood that were ready for export. It was decided to run Spot past these piles to assess if it could be used for such inspection activities. Spot was not fitted with the arm at this time and was unable to view low enough with the PTZ camera.

This activity could be re-run with the arm attached to determine if this would improve Spots ability to undertake this activity.

COREMATIC

It was observed that Spot was extremely capable in navigating around the log bundles where spacing would permit.

Using the simulated Spot Cam+, the operator was able to identify spider webs and various pieces of loose bark which may be a cause for concern for a biosecurity officer. It was noted that Spot would likely need the ability to remove pieces of loose bark, which could potentially be achieved using the Spot Arm.

COREMATIC confidence rating 9

Spot, with the articulated arm attached, was also used to undertake a mock vehicle inspection alongside the Hades-5Z unit. This involved inspecting the exterior of a number of four wheel drive vehicles and trucks.

Although Spot could not get under the vehicles, with the arm it was able to provide footage of the underside of vehicles. Further testing could be undertaken to determine how suitable Spot, when fitted with a robotic arm, could be to assist with undertaking vehicle inspections.

PHASE 2
RANGER URANIUM MINE

Trial Landform Survey

Spot was taken to the Ranger Trial Landform sites and fitted with the Leica BLKARC sensors to test how well Spot could traverse the terrain and the quality of the imagery captured by the Leica sensor.

Spot was capable of walking over the rocky ground and navigating around obstacles, such as trees. However, where holes and branches were hard to see due to ground cover and leaf litter Spot had issues and did fall over a couple of times. If people struggle to traverse terrain under grass then Spot will also find it challenging.

The weather on the day was partly cloudy with a temperature in the mid 30s, although no significant loss to it's battery performance was noticed, it appeared that the Spot Core (an additional payload) did over heat. Spot was shut down for approximately 10 minutes but the LiDAR could be continued to be operated directly.

Long grass, such as Speargrass (*Sorghum spp.*), did cause issues for Spot as it was unable to navigate through it. It was assumed that Spot was seeing the grass as an obstacle to avoid rather than something it could walk through. Speargrass would only be an issue in February and March when it is at it's tallest.

PHASE 2
RANGER URANIUM MINE

Trial Landform Survey Outcomes

- Spot was able to traverse the waste rock surface easily
- The images captured could provide scientists with enough detail for their analysis and reporting requirements
- Spot had issues with some aspects of the terrain, especially long grass, however this could be addressed by reducing Spot's sensitivity or with AI.
- Spot would be useful during the early ecosystem establishment phase, prior to a dense understorey forming.

COREMATIC

Spot surpassed the expectations of all persons involved, including the support operator from COREMATIC. It was able to navigate the terrain effectively and efficiently with very limited issue and would have likely performed even better had the ability to navigate autonomously been given to the robot. The loose rocks, fallen branches and leaf matter appeared to cause minimal concern to the robot's navigation and forward movement, however it was observed that longer grass formations would create false object detections in the collision avoidance system, meaning the robot was unable to move forward in those areas.

The system navigated comfortably in manual mode and would likely navigate even better in an automated sense, however, would require a level of GPS guidance as the scene will change too frequently for SLAM technologies. DAWE personnel commented that the vegetation in the scene had established over 12 years and would likely become far 'grassier' with a few more years growth, meaning it may no longer be possible for Spot to navigate through.

COREMATIC confidence rating

8

PHASE 2
RANGER URANIUM MINE

Radionuclide counts

In order to test the radiation levels at Pit 1 a gamma radiation device is used. This device records measurements at regular intervals (20m) and at a height of 1 metre.

To test Spot's capability to undertake this activity, a fixed arm was attached to Spot, raising the sensor to the approximate height. The sensor was operated as a stand alone unit and in the future work would need to be done on integrating the device with Spot. Additional work is already required to build a more sturdy solution for the arm as it fell off shortly after initial testing.

As the vegetation was less developed and the ground seemed smoother, Spot had no issues walking over the test site. The openness of the test site could be ideal for autonomous activities.

Spot did not interfere with the sensor's ability to take readings.

PHASE 2
RANGER URANIUM MINE

Radionuclide Counts Outcomes

- Spot was able to traverse the environment easily
- The gamma sensor was successfully mounted and operated
- Further work required to develop a stable attachment for the gamma sensor and integration with the Spot unit
- A solution for ongoing charging capability would be required for this activity
- Spot could provide a more efficient way for the department to undertake this activity

COREMATIC

Spot was able to navigate all aspects and areas of the terrain and exhibited little issues even with muddy ground. Due to the sparseness of the region, standard SLAM navigation would likely be ineffective for automated navigation, and the system would likely require a GPS based navigation capability. Aside from navigation, Spot was more than capable of carrying the gamma sensor payload and would likely only require a more rigid and purpose-built mounting mechanism than that which was used during the trial.

COREMATIC confidence rating 9

PILOT PARTICIPANT FEEDBACK

What did they like...

Really like its ability to move and its sensors

SPOT is very well suited for these sorts of routine and repeatable actions. Can see how with the smart programming how SPOT could navigate in, around and under containers

Reduce WHS risk for officers

I was surprised at how well Spot could traverse the trial landform.

Excited that the department is looking at using technology that will put additional safety measures in place for officers

The cameras on board were able to provide views of biosecurity risks such as sticks, spider webs and mud/dirt.

What didn't they like....

Will need to have two officers during inspection and takes three people to carry

At midday one of the core processors overheated

I'd really like to see SPOT attempt to undertake more autonomous surveying

Limited by height of machinery it can go under, camera arm required some manual adjustment in order to get camera into favourable position for viewing certain aspects of the underside of military vehicle

Spot had limited maneouverability when tasked to inspect export logs. SPOTS's sensors did not allow SPOT to walk between rows of logs and was unable to climb the stacks due to uneven terrain. The camera did not pick up spider webs, even when pointed out, could not view on the screen.

TESTING CRITERIA CHECKLIST

Pilot participants were asked to complete a survey as well as the below testing criteria checklist. This document ensured that pilots were undertaken consistently across activities and locations.

#	Action	Factors to consider in response	Complete	Ease rating: E = easy M = moderate D = difficult	Quality rating: C = clear U = unclear[1]	Observations
1	WIFI connection	Were there connectivity issues at different locations? Did it drop out (was there a reason for this)? Was it hard to connect or reconnect?	☐		NA	
2	Manoeuvrability	Did Spot traverse the port and/or environment easily? Did he move over rough terrain with ease? Could he move left, right, forward, backward?	☐		NA	
3	Zoom in on a specific area or part		☐			
4	Take a photo		☐			
5	Livestream footage		☐			
6	Functionality	Describe if the articulated arm or the attachment for the gamma sensor (whatever is relevant) were practical and performed the task well.	☐			
7	Efficiency	Did Spot make the activity more efficient, did the robot perform as well as a human?	☐			
8	Environmental factors	Did factors such as temperature, humidity, sunlight (glare), cloud, different ground conditions (including wet) affect vision or the battery life?	☐			
9	Payloads	Were additional payloads added and what were they – thermal camera, LiDAR Backpack, TLS scanner	☐			
10	Ease of use overall	Was Spot intuitive to use?	☐			

TESTING CRITERIA CHECKLIST SUMMARY(DARWIN)

Overall, participant feedback on Spot's basic functionality was as follows:

- Establishing WIFI connection was easy.
- Manoeuvrability was easy
- Zooming in on a specific object was easy to medium as it took Spot some time to focus in. At times, it was moved back to get a clearer view.
- Taking a photo was not tested.
- Taking footage was easy. The footage displayed on the laptop was clearer than the controller.
- Functionality was medium as it had an articulated arm to test the concept that needed to be adjusted each time. The official Boston Dynamic's arm can be moved with the controller.
- Efficiency was medium as the real efficiency benefits would be realised once Spot was programmed to undertake a task autonomously.
- Environmental factors was medium based on sun glare on the controller screen.
- Payloads were easy (camera only).
- Ease of use overall was easy, noting that Corematic was in control of the robot most of the time and present for on-ground support.

TESTING CRITERIA CHECKLIST SUMMARY (RANGER)

Overall, participant feedback on Spot's basic functionality was as follows:

- Establishing WIFI connection was easy to medium,
- Manoeuvrability was difficult as stumbled on sticks and small shrubs, which is also a challenge for a human. Identified long spear grass as an obstacle. Spot did well in traversing the more open understory of the TLF and Pit 1 landform.
- Zooming in on a specific object was medium. Spot used the BLK LiDAR sensor to take a set of LiDAR scans across the Trial Landform. This data has the potential to be useful to our botanists and ecologists.
- Taking a photo was easy. Both continuous and stationary scans were undertaken successfully.
- Taking footage was not tested. LiDAR data needs to be processed after the fact and viewed back at the office.
- Functionality was medium as it had an makeshift stand to ensure the gamma sensor was 1m off the ground. The gamma sensor arm fell off shortly after walking along a transect but would be an easy fix
- Efficiency was easy and Spot has potential in these remote areas.
- Environmental factors medium as the Spot Core overheated and stopped for 10 mins.
- Payloads were easy (Leica BLK LiDAR scanner, gamma sensor).
- Ease of use overall was easy to medium, noting that the real benefit is in automation of Spot to undertake tasks on a pre-defined route.

POTENTIAL IMPROVEMENTS TO THE TECH

Testing of a movable robot arm is recommended as the arm fitted for the pilot could not be moved. This process was manually done and could not be done from the controller.

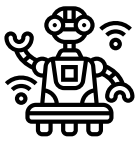
A stronger, more durable mount for the gamma sensor.

A solution for longer battery life e.g. Spot kennels or a spare interchangeable battery onboard the Spot unit.

A solution is needed to prevent glare on the controller screen, perhaps a glare cover.

A solution to keep Spot's Core cool to avoid overheating in extreme temperatures for long periods of time.

Ability to send photos, footage or screenshots to the department's network.



Program Spot to work autonomously in port or remote environments (Note: a project is already underway in Biosecurity Integrated Information System Enabling Services to explore this function.

Better screens for viewing as the remote screen was not used as much and the laptop got better photos.

A solution to transport Spot easily or carry on/off a vehicle.

WORK, HEALTH & SAFETY

The Innovation Pilots team worked closely with the department's Work, Health and Safety (WHS) team throughout the pilot process. A WHS representative was also present at the Darwin pilot to observe the technology in action.

A number of WHS considerations were highlighted and the below recommendations should be considered for future stages or development.

Manual handling - The Spot net weight is 32.7kg (as per pilot plan) and is transported in a large pelican case with wheels with gross weight of over 45kg. The task of moving this heavy technology would require several persons to lift, lower, push, pull, carry or other otherwise move when transporting it from the office to field locations and then unloading it from the various size vehicles (most likely non 4wd vehicles). There would be a health and safety risk of acquiring a musculoskeletal disorder associated with this manual task and controls would need to be used to ensure the risk is eliminated or minimised.

RECOMMENDATIONS:

- Review whether the business area can eliminate the need to transport the equipment out into the field and it be available at the point of use to eliminate multiple handling i.e. Can it be stored in a port office and be activated from the office to walk to the inspection location?
- Replace the heavy Spot with a lighter, smaller and/or easier to handle piece of technology
- Use of a mechanical lifting aid be considered

Photos: Picture of pelican case in 4wd, two staff unloading the spot technology

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Situational awareness - Operator was focused on the direction/functionality of the Spot device and was missing watching for biosecurity infestations in the container itself. Also noted, staff were distracted from watching for movement of vehicle traffic and containers around them. Situational awareness of their surrounding environment decreased during use with the device.

RECOMMENDATION - When using the Spot, a spotter officer be in place to assist in monitoring traffic hazards around the operational area

Photos: Staff focusing on Spot activity

WORK, HEALTH & SAFETY

Mobility and Accessibility - Due to Spot's size and flexibility, it had the ability to enter containers or climb up on ledges of container stands with ease. By being accessible into these areas, it confirmed it would reduce the risk of staff having to enter into a container or do inspections under a container. However, if Spot ceased working while in or under a container or machinery, a staff member would have to retrieve the equipment, thus causing a risk if Spot was used to identify fumigants or dangerous goods.

RECOMMENDATIONS - Evaluation and consideration be put in place as to what procedures and equipment would be needed to retrieve the ceased Spot while in a container or while under a vehicle or machinery.

Photos: Clearance difference of Spot to Hades-5Z into/out of container

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Stability - When entering a container, Spot slipped and lost its footing in several areas within the container due to wet grease residue on the floor. After falling sideways, it was able to use its own mechanical ability to turn itself over and stand on its legs. If an operator was standing next to Spot when this happened, the weight of 45kg against or on top of a person could cause a serious injury. In the examination of military machinery, additional payloads such as an extension arm and camera to look over a vehicle body was conducted. If extra payloads are to be placed on Spot, a further evaluation will be needed to assess how the extra payload affects its mobile stability on different ground surfaces (both wet/dry).

RECOMMENDATIONS:

- When in use, there is an exclusion barrier between Spot and staff members
- Retrieval and safe distance procedures be incorporated into work instructions
- PPE – it be mandatory that steel capped shoes be worn when handling this technology
- Innovation team explore options of different types of grips to be placed on the feet of Spot to strengthen its stability on wet surfaces
- If extra payloads get added to Spot, a secondary evaluation be conducted to test its stability on different ground surfaces

Photos: Spot in container after it slipped over onto its back and Spot inspecting machinery

WORK, HEALTH & SAFETY CONT...

Glare off screen - It was noted that the controller of the laptop had no semi-antiglare screen in place, so sun glare coming off the screen went into their eyes.

RECOMMENDATIONS - Staff member wear sunglasses that meet AS/NZ standards when working on screen-based work outside to avoid eye damage. An anti-glare screen be incorporated to the screen-based controllers and the laptop.

Photos: Sun glare on Spot controller

Laptop Weight/Muscular Strain - While one staff member was controlling Spot's movements with the controller, another staff member was examining the images on a laptop. Carrying an open laptop that weighs between 1.7 – 2kg for an extensive period would cause arm fatigue and muscular strain.

RECOMMENDATION - To minimise strain, would recommend use of light weight laptops. Consideration of use of a portable table or bench to place laptop on, thus minimise walking/standing with laptop for long periods of time.

Environmental exposures - At 09:15hrs when commencing the exercise, it was 27.2 degrees and by midday it was 30.7 degrees, which was a semi-cool day in Darwin. However, the heat off the wharf, road bitumen and containers can cause heat stress and fatigue.

RECOMMENDATIONS - To reduce the time out in heat environments when using equipment have:

- A well refined set up/pack up process to minimise time in hot/open outdoor environments
- Inspections completed early in the day with less heat, humidity and sun glare in place
- Staff proficient in the use of the equipment prior to using in the field
- Staff consider the feasibility of using this technology while in a vehicle or airconditioned office environment.

Handling and cleaning of Spot - When Spot is utilised on the ground in a wharf or warehouse environment it can encounter dangerous goods residue on the ground i.e., fertilizers, chemical spill areas etc. The officer handling this equipment is most likely not wearing gloves which means they are inadvertently encountering this dangerous residue.

RECOMMENDATION - A cleaning program be implemented with the feet and/or body (if falls on the ground) before it is packed up in the case for re-use. Procedures incorporate a cleaning process for the technology and staff are reminded to clean hands after use.

WORK, HEALTH & SAFETY CONT...

Photos: Storage of spot in vehicle

Lithium Batteries - Due to environmental heat, including ground heat, the lithium batteries will get hot and there is a risk they could expand and become dangerous. Care must also be taken when Spot in use and while being transported to outdoor operational areas. The average runtime (no payload) is 90 minutes which means staff will have to locate a safe power source when out in the field or have accessibility to extra batteries.

RECOMMENDATIONS:

- Spot battery packs not kept in hot vehicles for long periods of time.
- A battery management process be implemented that ensure lithium batteries are checked for swelling and can be stored safely and disposed of when required. A Safety Data Sheet be made available with the technology.
- Accessibility to safe power sources will need to be evaluated by the business areas who utilise Spot while away from the DAWE offices.

FUTURE OPPORTUNITIES

Utilise Artificial Intelligence to operate the device, identify obstacles in its path and detect/alert an officer when biosecurity risk material or organic material is found for further inspection.

Explore the capability for Spot to communicate and collaborate on a task/activity with other drones e.g. the drone does 'wide area' surveillance/mapping and if it detects something of interest Spot heads out to get a closer look.

A potential use case could be for cleanliness inspection of vessel holds. Spot could be harnessed/lowered into the hold without the officer needing to go in and can view from an observation deck.

A potential use case could be for Spot to conduct remote inspection of High Volume special operations (HSVOs). This activity currently involves a physical inspection of FCX Personal effects by an officer. This activity has a high volume of inspections and a significant impact on our resources.

Explore smaller four legged robots to reduce the weight and size of the device and to compare with Boston Dynamic's Spot robot.

Explore additional add-on's such as a robotic arm and full integration of payloads.

Keep in mind other Research & Innovation projects for future opportunities or integration such as:

- handheld hyperspectral camera
- RingIR technology
- livestreaming pilots (smartglasses)

RECOMMENDATIONS

The Innovation Pilots team recommends that Spot capability continue to be explored and where appropriate, implemented into business-as-usual

The Innovation Pilots team recommends the following:

1. Work with Corematic to modify Spot to address challenges identified in Stage 1 (such as longer battery life, remotely operated arm, self-cooling functionality)

2. Identify if there are other similar technologies on the market that could be trialled side-by-side

3. Progress to Stage 2 to undertake further testing in other environments, taking into account WHS considerations

4. Ensure users have adequate training in the technology

5. **IMPORTANT:** Work closely with the supplier/developer to troubleshoot issues along the way

The Innovation Pilots team are working closely with Biosecurity Integrated Information System Enabling Services who are undertaking a similar project funded through the Science Innovation Program. Their project will focus on adding additional payloads to Spot for pest identification, exploring Spot's automation function and building departmental capability in operating/programming the robot. Lessons will continually be shared across the two areas as work progresses.

Note: Implementation of Spot (or similar) robot will require additional consultation with Legal Division, ISD, Work Health and Safety and any other relevant areas of the department.

ACKNOWLEDGEMENTS

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By individual:
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By Business Area:
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Thank you also to the external participants that gave up their time and premises in order to participate in the pilot or demonstrations: Port of Darwin, the Darwin Military Barracks, Jabiru Area School and Jingili Primary School.

And last but not least a very big thank you to Corematic Pty Ltd, specifically Cyril Delorme, Elodie Ghestem, Scott Hansen, Tania Erhart and Tiphanie Costeur.

The pilot plan and other related material is available on Content Manager: 2021/015226E-02

Reach out to us and we'll help you take your idea to the next level

Contact us at **innovationpilots@awe.gov.au**