



# SCIENCE & SECURITY March 2016

## CASRA NEWSLETTER – ISSUE 12

In the first issue of Science & Security of 2016, CASRA is taking you around the world.

We start our journey in Europe. From the Dutch shipping ports all the way to transit checkpoints in Switzerland, our focus lies on the daily challenges customs officers face when scanning cargo for legitimate and illegal goods. In the article “Research Put Across”, we picture the EU funded ACXIS project.

In the section “Security in Practice”, we introduce you to MSS Security, one of Australia’s leading security companies. Marjie Bramham, Aviation Compliance Training and Development Manager at MSS Security, writes about the successful implementation of the CASRA solution for airport security officers at 24 airports across Australia - from Perth to Melbourne down to Devonport of beautiful Tasmania.

We hope you continue to accompany CASRA on an exciting journey in 2016 and wish you a pleasant reading experience. Bon voyage!

Dr. Diana Hardmeier  
Director

Prof. Dr. Adrian Schwaninger  
Chairman

### TOPICS IN THIS ISSUE:

#### RESEARCH PUT ACROSS

##### AUTOMATED COMPARISON OF X-RAY IMAGES FOR CARGO SCANNING

ACXIS (Automated Comparison of X-ray Images for cargo Scanning) is a research project funded by the European Union under the 7<sup>th</sup> framework program. The continuously growing cargo industry with an ever increasing amount of goods passing checkpoints requires efficient inspection procedures. This not only poses challenges to international logistics providers but is also crucial to the customs authorities. The aim of the project is to provide automated detection techniques of threats and illicit goods through dedicated algorithms and to develop a reference database for X-ray scans of illegal and legitimate cargo.

#### SECURITY IN PRACTICE

##### USING THE CASRA SOLUTION DOWN UNDER – AN INTERVIEW WITH MSS SECURITY AUSTRALIA

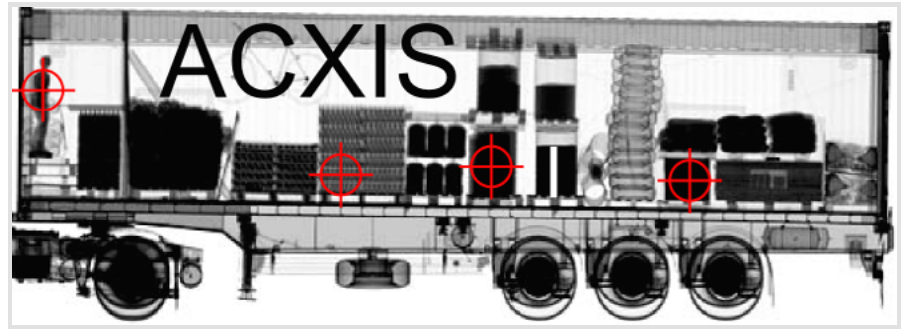
Every year, MSS Security airport officers screen 18 million passengers, 15 million checked bags, and a large proportion of air freight leaving Australia. Over the past year, CASRA has had the opportunity to collaborate with MSS Security on several initiatives. These included the introduction of our training program X-Ray Tutor 3 (XRT 3) along with the pre-employment assessment tool X-Ray Object Recognition Test (X-Ray ORT), both of which are part of our modular CASRA Solution. In our interview, Marjie Bramham, Aviation Compliance Training and Development Manager at MSS Security, tells us about working with the CASRA team. She also talks about the customer-centric approach to creating a secure environment in Australian airports and what the current “hot topics” are among Australian security experts.

## AUTOMATED COMPARISON OF X-RAY IMAGES FOR CARGO SCANNING

Text: Wicher Visser

ACXIS (Automated Comparison of X-ray Images for cargo Scanning) is a research project funded by the European Union under the 7<sup>th</sup> framework program (see infobox). The continuously growing cargo industry, with an ever increasing amount of goods passing checkpoints, requires efficient inspection procedures. This not only poses challenges to international logistics providers, but is also crucial to the customs authorities. The aim of the project is to provide automated detection techniques of threats and illicit goods through dedicated algorithms and to develop a reference database for X-ray scans of illegal and legitimate cargo.

Switzerland and the Netherlands are both countries with a high turnover of cargo goods - the former as a transit route for cargo transportation across Europe, the latter as a major hub for shipping containers. The ACXIS project aims to promote scientific exchange in the European research area combining different partners with complementary expertise of the cargo industry. In collaboration with other partners, CASRA is working on an innovative screening system whose algorithms are improved continuously by the automated addition of unified X-ray data.



The ACXIS partners are:

- › Center for Adaptive Security Research and Applications (CASRA), Zürich, Switzerland
- › Dutch Tax and Customs Administration (DTCA), Heerlen, The Netherlands
- › Fraunhofer Development Center for X-ray Technology (EZRT), Fürth, Germany
- › French Alternative Energies and Atomic Energy Commission, Gif-sur-Yvette, France
- › Swiss Federal Customs Administration (FCA), Bern, Switzerland
- › Swiss Federal Laboratories for Materials Science and Technology (EMPA), Dübendorf, Switzerland
- › Smiths Detection (Smith Heimann S.A.S.), Vitry-sur-Seine, France

### UNIFIED X-RAY IMAGE STANDARD

To guarantee an efficient detection of fraudulent activities, customs organizations need to be able to exchange information on a regular basis and as speedily as possible. Amongst others, exchanging X-ray scans from different customs administrations is particularly important. These images recorded from different models of X-ray machines must be comparable, hence independent of the machine manufacturer. To ensure this, the ACXIS researchers work on establishing a unified X-ray image standard. This is a challenging task which is solved by a mathemati-

### INFOBOX: THE 7<sup>TH</sup> FRAMEWORK PROGRAMME

The 7<sup>th</sup> Framework Programme (FP7) for Research and Technological Development is a support program created by the European Commission. Its main goal is to support and strengthen research in the European research area by providing funding of over 50 billion Euros. CASRA is involved in another FP7 project: XP-DITE ([www.xp-dite.eu](http://www.xp-dite.eu)), see CASRA Newsletter, November 2015.<sup>1</sup>

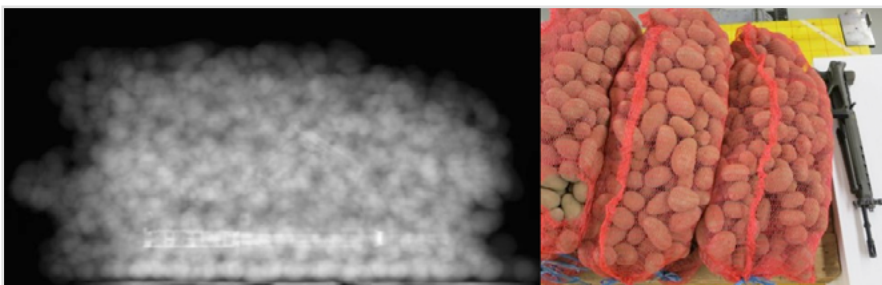


Figure 1: Weapon hidden between potatoes. Left: X-ray image (container side view), right: photograph taken from above, perpendicular to the X-ray image

<sup>1</sup> Science & Security Casra Newsletter Issue 11 November 2015, Research Put Across, XP-DITE – Introducing a system level approach to evaluating airport security checkpoints [[Download PDF](#)]

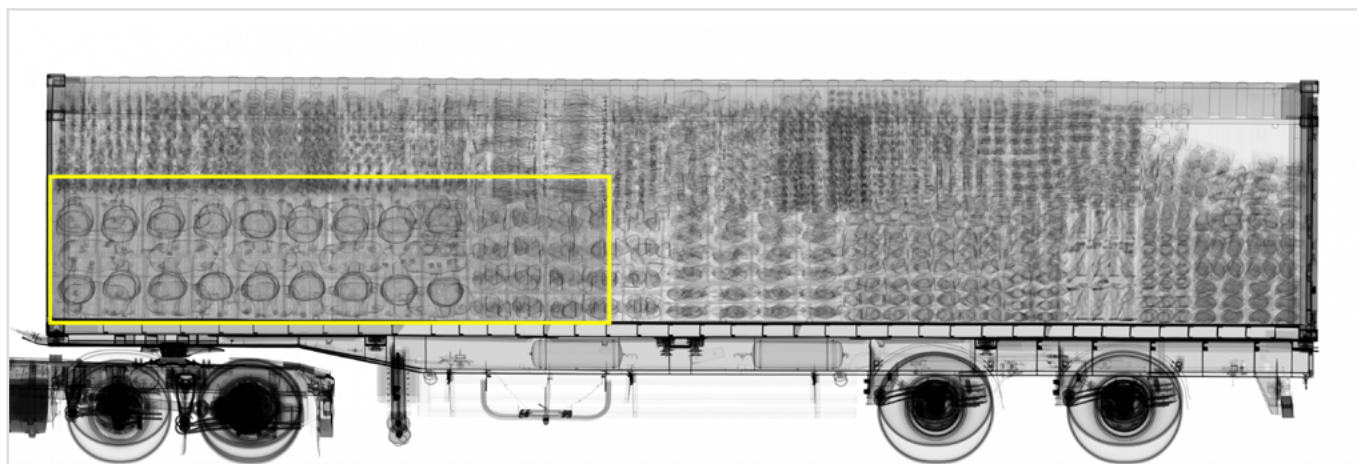


Figure 2: Example of automated threat detection in cargo

cal model that describes various physical aspects of an X-ray acquisition such as geometry, spectrum, contrast and noise levels. Through such a model, conversion between formats can be accomplished while ensuring a high quality standard of the X-ray data.

#### REFERENCE DATABASE

The X-ray data once converted into a standardized format is stored in a database which can be shared with other agencies (Figure 3, “Centralized database and network”). The database is filled with over 30’000 X-ray scans from a large variety of containers and trucks provided by the two custom organizations and processed by CASRA. The data goes through a quality assurance process, where experts determine if the content is relevant and representative for customs organizations. Attention is paid to the image quality, the composition of the load and the information available from the waybill. Going forward, customs organizations will be able to add their own content, and thus significantly expand the number of images.

#### REFERENCE MATERIAL AND MOCK-UP SCANS

In order to increase and improve the initial reference material, a variety of mock-up settings were created containing examples of real threat items and simulations, combined with regular goods (Figure 3, “Data acquisition”). Primarily cigarettes, drugs and weapons were scanned from different perspectives to obtain realistic representations of smuggled goods. The items were recorded using either laboratory systems or a scanner commonly operated by cargo officers.

#### AUTOMATED DETECTION

ACXIS develops Assisted Target Recognition (ATR) methods to automatically detect regular and illicit goods through dedicated algorithms. For this, several goods detection scenarios were selected and prioritized. These include image comparison, load characterization and direct target detection. Methods for cigarette detection based on texture analysis are being developed and show excellent first results (Figure 2). Other envisioned scenarios, such as hidden weapons (Figure 1) and narcotics and the screening of homogeneous goods

and empty containers, were also taken into account. For instance, the seemingly simple step of detecting empty containers on a passing truck, offers great potential to significantly increase performance. The system, based on the aforementioned algorithms, identifies small nuances in the vehicles freight corpus, and flags only containers in need of further inspection. The ATR methods are an optional system feature which can be enabled by the user. They support the customs officer’s screening skills by directing his focus only on areas in the image that require further inspection.

#### THE ACXIS SYSTEM AS A WHOLE

The ACXIS research partners are working on creating a system (Figure 3) that can leverage latest technologies to enhance the effectiveness and efficiency of customs controls. With this system in place, customs officers would have available automated signaling of potential illegal and legitimate goods. Their evaluation is stored consistently in the reference database along with the unified version of the X-ray image data. In addition, information from the waybill can be made available (Figure 3, “Customs inspection”, top row) as well

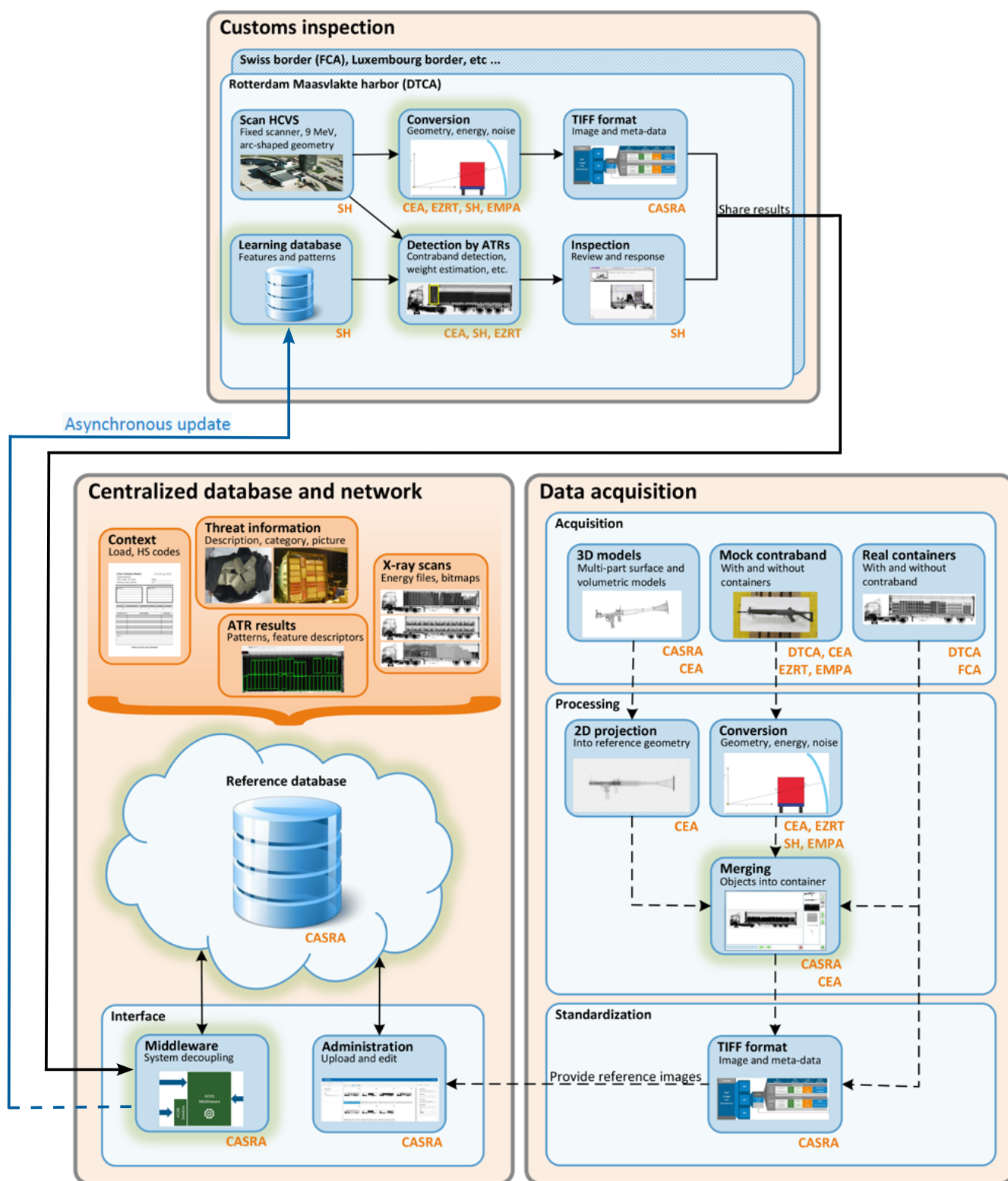


Figure 3: AXCIS system overview

as the results from the ATRs. Other case specific information provided by the officer (Figure 3, "Customs inspection", bottom row) can also be added to the database. This information can be reviewed at any time through a web-based user interface, and shared with national and international colleagues (Figure 3, "Centralized database and network"). All the while, the detection algorithms may be continually improved using these results (Figure 3, "Customs inspection", "Learning database").

#### TRAINING: SIGNIFICANT INCREASE IN DETECTION PERFORMANCE?

The impact of the assisted target recognition (ATR) method, as well as the impact of a systematic computer-based training for cargo officers on their performance, is assessed through a validation study. Operators from the Dutch and Swiss customs administrations will participate in the study. Cargo officers are divided into three experimental groups based on their abilities. All three groups will start with an X-ray test either with or without ATRs. Two groups will then get specific computer-based training.

The training module includes three different difficulty levels. Every user receives system generated feedback after each image (Figure 4, left box "Training mode"). Only one group will do the training with ATRs. After three months of training, all cargo officers will take the same test again. The performance of the three study groups can thus be compared against each other and conclusions about the effectiveness of ATRs and computer-based training can be drawn. Final results and publications are expected by late 2016.

For an in-depth description of this study please contact us at [info@casra.ch](mailto:info@casra.ch).

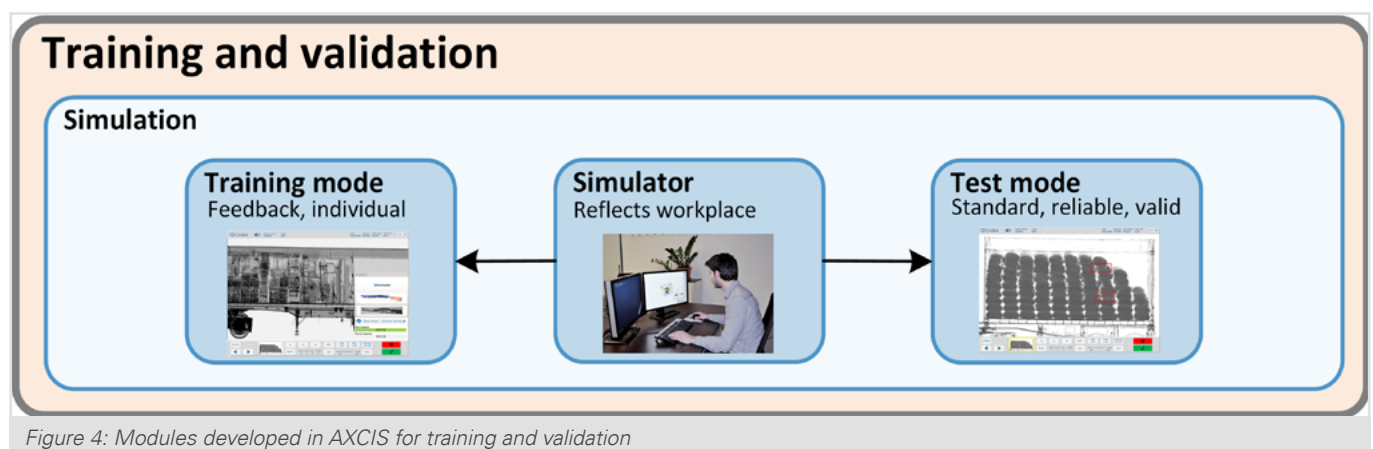


Figure 4: Modules developed in AXSIS for training and validation

## USING THE CASRA SOLUTION DOWN UNDER – AN INTERVIEW WITH MSS SECURITY AUSTRALIA

Text: Alex Kunz

At the core of aviation security is the protection of people, infrastructure and assets. Every year, MSS Security airport officers screen 18 million passengers, 15 million checked bags, and a large proportion of air freight leaving Australia. As one of the market leaders, MSS Security provides security services from capital cities to regional airports in Australia. This unique network of heavily frequented city airports and smaller, remote airports spreads across an entire continent and necessitates equally unique, customized security solutions.

Over the past year, CASRA has had the opportunity to collaborate with MSS on several initiatives. These included the introduction of our training program X-Ray Tutor 3 (XRT 3) along with the pre-employment assessment tool X-Ray Object Recognition Test (X-Ray ORT), both of which are part of our modular CASRA Solution. In our interview, Marjie Bramham, Aviation Compliance Training and Development Manager at MSS Security, tells us about working with the CASRA team. She also talks about the customer-centric approach to creating a secure environment in Australian airports and what the current “hot topics” are among Australian security experts.

### CASRA: Could you shortly describe MSS Security?

Marjie Bramham: We provide security services at 24 airports across Australia. Sites include Perth, Sydney, Melbourne and regional airports such as Karratha in Western Australia and Gove, at the top of the Northern Territory where they have about one flight a day. Then at the southern end, there is Devonport in beautiful Tasmania. We have quite a diverse audience of participants, in total

about a thousand aviation security employees across the country.

### What is your role at MSS?

Marjie Bramham: As a Compliance Training and Development Manager I am responsible for developing and executing the national aviation divisions’ organizational development, compliance and learning strategy. I collaborate with stakeholders to implement efficient and effective initiatives that build capability and drive engagement across all sites.

### Which goals would you like to achieve with your security screening services?

Marjie Bramham: Our vision is to be the clear leader for the provision of manpower security solutions to the Australian market by offering outstanding security services. It is important to us to be seen as a customer-centric service provider in all aspects. Our goal is to be providing a customer focused approach to ensuring the safety and protection of customers, airport employees and property. In security it is important to be aware of body language and what is

appropriate given the situation. One of our goals is to continue to support our employees to understand how subtle facial expressions, vocal intonation and appearances can make the difference in our environment. Effective communication to improve customer experience is an important focus.

### INFOBOX: MSS SECURITY

MSS Security is one of Australia’s leading security companies with more than 5’000 employees and a national infrastructure with offices in the capital cities of all states and territories. In 2008, MSS Security was acquired by Security and Intelligence Services (SIS) India. SIS is Asia Pacific’s largest security personnel company, employing and managing more than 100’000 staff. Formed in 1974, SIS has forged its success on exceptional customer service, delivering customer focused services to key global corporations across a range of sectors including government, mining, manufacturing, retail, hospitality, defense, and educational institution sectors.



### Is this part of MSS Security's customer satisfaction strategy?

Marjie Bramham: Indeed. We believe security plays an important role in creating a positive experience in the customer's journey. It's about being able to interpret the subtle behaviors and recognizing that it is the little things that mean everything. Our employees are encouraged to look for opportunities to create a positive experience. When we greet customers with a friendly approach we reduce their level of stress, they feel more comfortable and the process moves efficiently.

Since the beginning of last year you have started to train your security screeners with the computer based training program XRT3. What kind of results did you achieve?

Marjie Bramham: We had a 150% increase in use between October and December! Initially I thought we could only use the CASRA Solution in major

#### INFOBOX: XRT3 & X-RAY ORT

X-Ray Tutor 3 (XRT3) was created to provide easy-to-use training software that enables security officers to detect prohibited items quickly and reliably and increase their visual knowledge for X-ray image interpretation.

The X-Ray Object Recognition Test (X-Ray ORT) has been developed to provide a fair, reliable, valid and standardized assessment method to measure the visual abilities of an applicant. The test is designed for people with no previous knowledge of how items are displayed on an X-ray machine. It is a fast, easy-to-use and very effective tool for scientifically based pre-employment assessment.



Figure 4: MSS Security expert training with the XRT3

airports, because I thought we were restricted by internet connectivity. However, after a comprehensive introduction of the system to our organization and thanks to the help of the professional CASRA support team, I learnt that the XRT3 is a secure cloud based product that I could use anywhere where broadband is available. This was a real positive for me.

#### Are there any other areas where you are planning to put the XRT3 to use?

Marjie Bramham: Yes, there are. The program is a great addition to our freight division. Even though our freight officers are already doing a lot of explosive threat detection as it stands, they need to develop skills for X-ray screening because they are not exposed to possible threat items as often as our airport security staff. At the moment, I have got several officers at the Sydney site that perform exceptionally well thanks to XRT3 training. The results are very impressive.

Your software works really well.

#### How did your security staff react to the introduction of the training program?

Marjie Bramham: We are sometimes working with an audience that is not IT savvy. Some officers were slightly uncomfortable initially. There was a little bit of fear around performance quotas. They thought that the results will show they weren't as good as they should be. I think we shouldn't exclusively concentrate on underperformance but rather make people understand, that this program is just a great tool to develop their skills, to encourage them at their workplace. Overall, 90% of the feedback I am receiving is positive. I firmly believe this is the way of the future. We need to do, what I call, "meta learning"; to teach our screeners how to teach themselves.

We talked about the ongoing training of your existing staff. What kind

of pre-employment assessment process does MSS Security have in place? Have you had a chance to use CASRA's X-Ray Object Recognition Test yet?

Marjie Bramham: The X-Ray ORT is a great tool indeed. We have been running a few tests with a small number of candidates and are planning to expand. The ORT provides a fair and comparable assessment method to measure the visual abilities of our applicants. In my view, this additional step should be mandatory in the recruitment process.

**Aside from pre-employment assessments, what other topics are currently being discussed among Australian security experts?**

Marjie Bramham: Well, there is the concern about lone shooters<sup>1</sup>. That is definitely a hot topic, not only in the aviation space but also within the community. We had an incident in one of our suburbs here in New South Wales where an administrative assistant was killed.

There are growing concerns within the aviation and in particular the airline community about 'disruptive or unruly passengers' on flights. I guess the main concern is around the confinement of the cabin and keeping everyone calm. The 'disruptive or unruly passenger' can cost airlines dearly, by having to divert flights or delay them.

As a society we also have problems around alcohol addiction, which brings along mental health issues, which in turn impacts our airport security. Domestic violence is another issue we are seeing more of. We don't always have federal police close by in the outback either. For instance, if you find a threat item, you have got to wait 20 minutes for the police force to arrive. Those big

distances have a real impact on security procedures. As a result, we take a different approach to screening and employ, quite befittingly, a different type of caliber of people at regional airports.

**Speaking of recent security problems that require innovative solutions: Have you tested remote screening yet?**

Marjie Bramham: We are exploring this innovative approach to screening. We were very fortunate to attend the Smart Security Technology Showcase (2015) where a combined trial, between Melbourne Airport, Airport Council International (ACI), International Air Transport Association (IATA) and Qantas, demonstrated how moving X-ray screeners to a remote location impacts their performances. Remote screening seems to reduce the risk of distraction from the airport environment. The approach also mitigates the risk of any perceived bias, such as 'They picked my bag because they saw me coming through and this is what I look like'. However, when you are in a remote location, the screener can't see the customer so it removes that particular obstacle. What we saw at Melbourne airport was very impressive.

**On a more personal note, what are the rewards of your work as Training and Development Manager?**

Marjie Bramham: To introduce innovative ways of thinking in this industry can be challenging. I love sitting down with new people, introducing innovative products and helping people to be successful. We work in remote locations so one size doesn't fit all. I need to explore lots of different ways of developing a very diverse work force that is aged between 18 and 73. It is a truly unique industry.

**Moving from your personal rewards**

**to the highlights of working with CASRA - How did you experience joining forces with us?**

Marjie Bramham: I love talking to members of the CASRA support team. If I send a message, your team is very quick to respond. I also love the way the product shows the image on the screen and helps to enhance the officer's understanding of integral parts. What has been a highlight for me was the delivery of new Smiths machines at our Brisbane airport last October. CASRA helped us to transition into the new equipment and formed a very important part of our strategy. As a result, we reached our TIP (Threat Image Projection) figures within five weeks, closing with 89% which was exceptional. The same situation will be happening in Perth this summer and we are looking forward to working with CASRA on this transition as well.

We thank Marjie Bramham, Compliance Training and Development Manager at MSS Security, for the interview.

<sup>1</sup>The term "lone shooter" refers to a person armed with a firearm(s) who is actively engaged in killing or attempting to cause serious harm to multiple people in a populated location.

Science & Security – CASRA Newsletter

ISSN [1664-5715](#)

Published three times a year

Editors:

Dr. Diana Hardmeier

Prof. Dr. Adrian Schwaninger

Editorial Managers:

Alex Kunz

Daniela Kirin

Elia In-Albon

CASRA

Thurgauerstrasse 39

8050 Zurich, Switzerland

Phone +41 (0)43 336 01 01

Fax +41 (0)43 336 01 00

E-mail [info@casra.ch](mailto:info@casra.ch)

Web [www.casra.ch](http://www.casra.ch)