



SCIENCE & SECURITY Issue 24

CASRA NEWSLETTER

This year is coming to an end and it is time for our last newsletter in 2020!

In this 24th issue, the section "Research Put Across" introduces the TRESSPASS project. It is co-funded by the European Union's Horizon 2020 Research and Innovation Program and introduces an innovative approach to border control. In the "Security in Practice" section, we present an interview with the Swiss Federal Customs Administration (FCA). It covers topics such as daily routines and experiences as well as training with X-Ray Tutor 3 (XRT3) and expectations to our new solution X-Ray Tutor 4 (XRT4).

As always, we are looking forward to receiving any feedback you might have as well as your input on topics you would like us to address in next year's newsletters.

This year has been challenging across the globe. Even more, reason for us to wish you good health and a contemplative and restful Christmas season.

With best wishes,

Dr. Diana Hardmeier
Director

Prof. Dr. Adrian Schwaninger
Chairman

TOPICS IN THIS ISSUE:

RESEARCH PUT ACROSS

TRESSPASS PROJECT

The following article introduces the TRESSPASS (robust Risk based Screening and alert System for PASsengers and luggage) project, explaining its innovative approach to border control. The overall TRESSPASS concept, its risk assessment methodology and the importance of ethical considerations are discussed, along with an overview of the contributions of CASRA to the project. Subsequently, the domain of training methodology and training development is delved into.

SECURITY IN PRACTICE

INTERVIEW WITH THE SWISS FEDERAL CUSTOMS ADMINISTRATION (FCA)

In our interview, Christian Küng and David Leclerc from the FCA talk about their X-ray screening experiences and their daily routines within the country, at the borders, and abroad. They also share insight with their use of X-Ray Tutor 3 (XRT3) and their expectations to our newly released solution: The complete suite X-Ray Tutor 4 (XRT4).

TRESSPASS PROJECT

Text: Slavtcho Groshev

TRESSPASS (robust Risk based Screening and alert System for Passengers and luggage) is an Innovation Action with co-funding from the European Union's (EU) Horizon 2020 Research and Innovation Programme. The TRESSPASS project aims to modernize checks at land, maritime, and air border crossing points through a novel risk-based border management concept. Traveler risk is modelled analytically and quantified via a set of indicators estimated from multiple information sources. Simulations will be used to test the proposed approach before implementing and validating it in three pilots covering all three modalities (land, maritime, and air). This article sheds light on the contribution of CASRA in the domain of training methodology and training development for novel risk-based border control components.

INNOVATING RISK-BASED BORDER MANAGEMENT

The TRESSPASS project is a three and a half year innovation action with co-funding from the European Union's Horizon 2020 Research and Innovation Programme (Grant Agreement No 787120) [1]. TRESSPASS started in June 2018 with 22 partners from across Europe, including innovative commercial entities, research institutes and a substantial number of operational experts and end-users.



TRESSPASS aims to modernize the way checks at land, air and maritime border crossing points (BCPs) are implemented. An analytic modelling framework and a systematic approach for quantifying risk

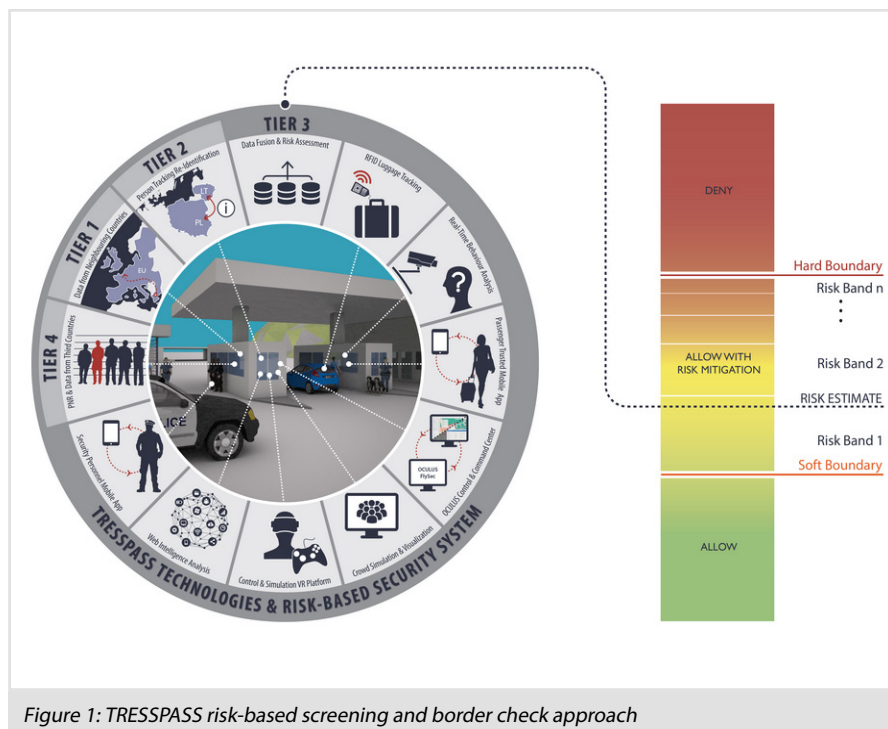


Figure 1: TRESSPASS risk-based screening and border check approach

related to threats such as irregular migration, smuggling, cross-border crime, and terrorism are proposed, addressing the European Integrated Border Management (IBM) [2]. Through risk indicators estimated from various data and information sources, the risk profile for each traveler is assessed so the system can help border guards adjust the number and types of checks per traveler (Figure 1). Crucially, a coherent approach for assessing ethical, legal, and societal impact is employed, with a special focus on potential privacy, data protection, transparency, accountability, and discrimination issues. The validity of the single cohesive risk-based border management concept is to be demonstrated through red teaming, simulations and pilot demonstrators of the TRESSPASS system (Figure 2) in the Netherlands, Greece, and Poland.

TRESSPASS involves a combination of innovative and well-established technologies in a novel risk-based border man-

agement approach, leveraging data and information from multiple sources to arrive at well-informed traveler risk assessments on a case-by-case fashion. Border guards are to be supported during screening and checking of travelers, while facilitating trust, data protection "by design" and smooth mobility. TRESSPASS aims to increase the rate of true positives and reduce the rate of false positives in BCP checks without increasing the number of border guards, addressing the needs of modern BCPs faced with increased traveler flows and ever more inventive criminal actors.

On the strategic (national) level, risk analyses are carried out on a regular basis to determine the risks that have to be mitigated by border control. They result in specific risk profiles and risk indicators of relevance for BCPs. On the tactical level, the situation at a BCP is assessed and in case of e.g. new modi operandi, the set of risk profiles and corresponding risk indicators

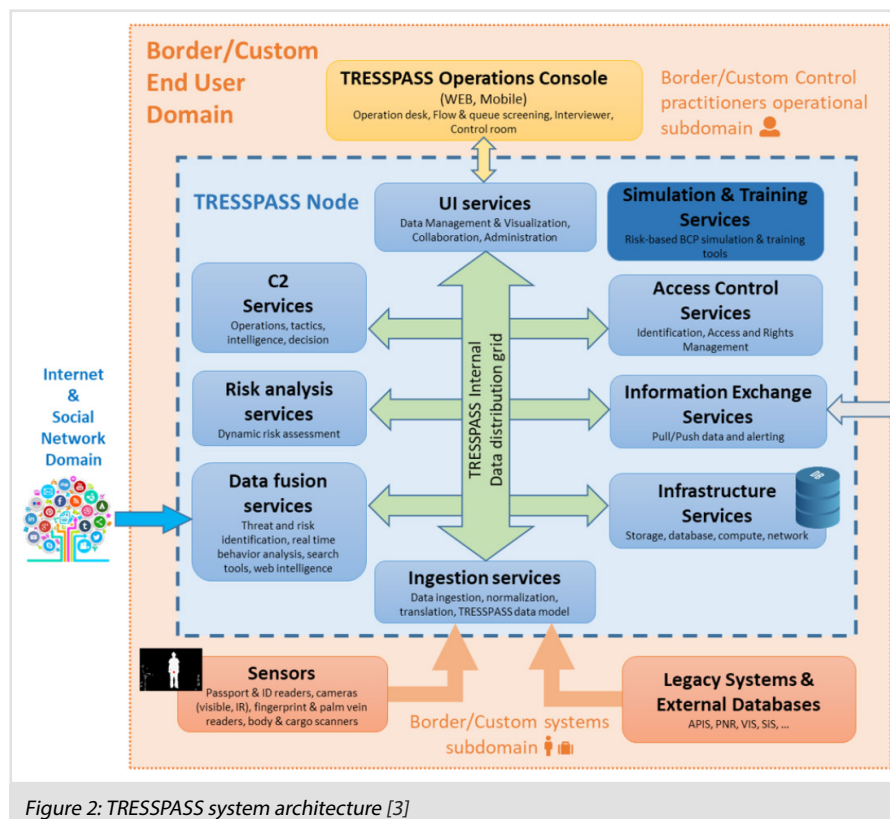


Figure 2: TRESSPASS system architecture [3]

CASRA supports various project activities, including the risk-based border management concept and methodology development and red teaming. Additionally, we strongly support the training methodology and online training material development and delivery for the novel risk-based border management concepts and components. Central aspects of the training development are examined more closely in the following chapter.

TRAINING DEVELOPMENT AND EVALUATION

The fifth overall objective of TRESSPASS is to demonstrate the validity of the single cohesive risk-based border management concept by using the developed pilot demonstrators, red teaming and simulations. In support of this objective, training regarding the newly developed concepts and processes is provided to border guards and other affected personnel in the pilots

adjusted. On the operational level, screening and detection information is fused and used to calculate values of risk indicators that are compared with the risk profiles applied at the BCP. Finally, the result of this assessment can be used by the border officials to select the type of check, taking into account risk acceptance as determined at policy and/or strategic level.

Rigorous ethics monitoring in TRESSPASS aims at ensuring that demanding standards for responsible research and innovation are met throughout the project. Relevant ethical, legal, and societal aspects (ELSAs) of risk-based border management have been identified and are monitored as technologies and methods are developed. TRESSPASS builds on a coherent approach for assessing ELSA impact on the travelling public, with a special focus on potential privacy, data protection, transparency, accountability, and discrimination issues.

Options for mitigation and minimization

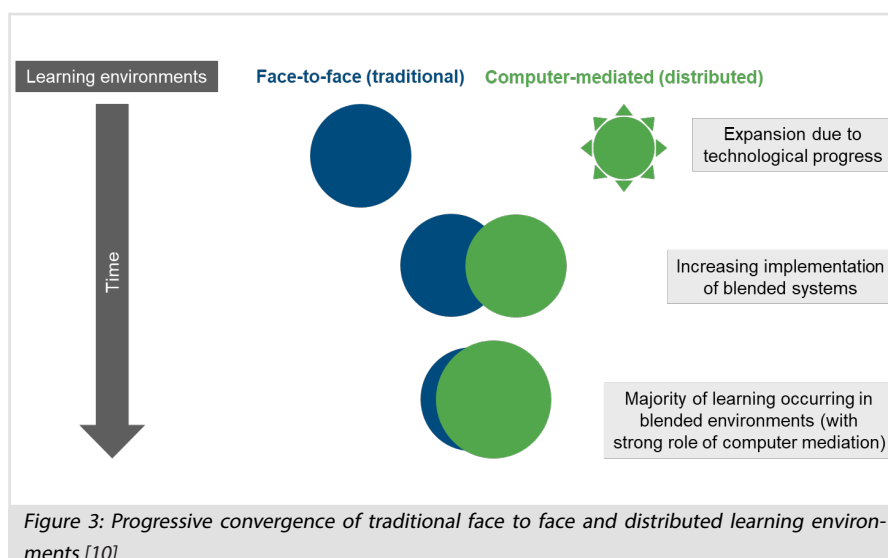


Figure 3: Progressive convergence of traditional face to face and distributed learning environments [10]

of ethical impact for TRESSPASS methods and tools are suggested and guidelines for decision makers generated, additionally identifying foreseeable indirect ethical impact of risk-based concepts.

under coordination of the Hellenic Center for Security Studies (KEMEA). For our contribution to the training development and delivery in TRESSPASS, CASRA builds upon a decade of experience in developing and delivering web-based training [4].

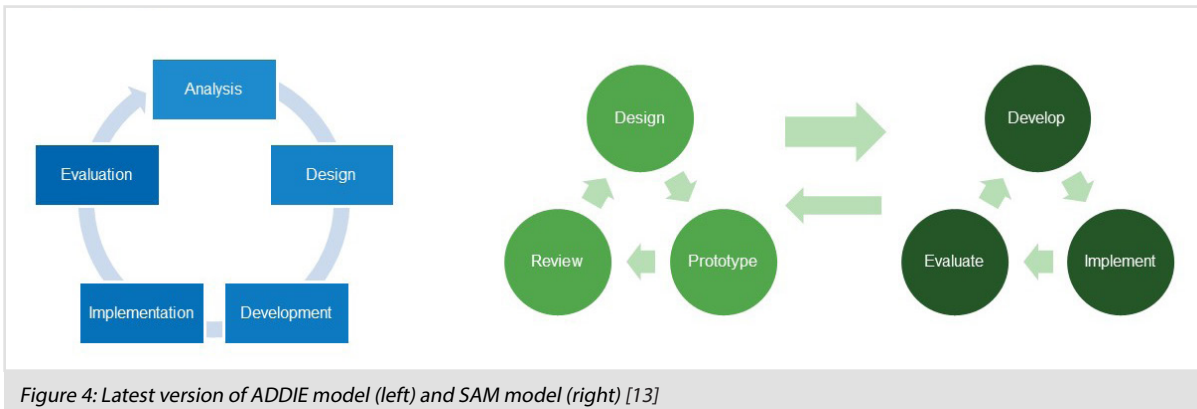


Figure 4: Latest version of ADDIE model (left) and SAM model (right) [13]

It is important to briefly discuss the terms learning, training, and instructional design here. Learning has been described as a persistent change of knowledge, attitudes and/or behavior that occurs as a result of formal education or training (or, of course, informal experiences) [5]. Training has in turn been characterized as targeted learning facilitation aiming at some form of individual, team, and/or organizational effectiveness improvement. Finally, the development of instructional design procedures and tools has been conceptualized as the technology for development of learning experiences and environments [7].

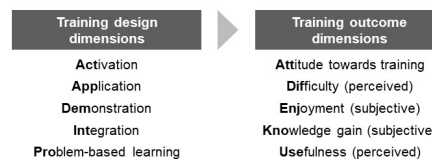


Figure 5: Dimensions of the TEI [8]

Studies have investigated the impact of training design on training outcomes, illustrating that training design does indeed impact training effectiveness [8]. Within this context, it is important to note the significance of blended learning as the combination of instruction from two historically separate models of teaching and learning, namely traditional face-to-face learning systems and distributed learning systems (Figure 3). The importance of computer-mediated learning has recently been emphasized in reaction to the COVID-19 pandemic by international organizations [9].

Step	Description
Explain	Used to motivate the trainees by explaining the lesson's purpose and connected benefits.
Clarify	The main part where theory and the learning content in general is being presented.
Look	In this part, one or several examples are being presented to illustrate what was previously discussed in theory.
Act (& share)	In this part, trainees are supposed to act and work with the learning content, for example by solving problems, write summaries, give presentations, engage in group discussions, etc.
Self-evaluate	In the self-evaluate part, trainees solve test questions autonomously to verify whether they have reached the lesson's learning objectives or not. Based on this verification, they are supposed to go back and restudy relevant parts or move on to the next chapter, discussions, etc.
Summary	The summary provides a "take home message", in other words the most important parts of the lesson condensed into a few short sentences to be more easily remembered.

Figure 6: Modified E-CLASS model [14, 15]

Various models have been proposed to direct designers through systematic planning and delivery of instructional events [11]. One of the most widely known model is the Analysis, Design, Development, Implementation, Evaluation (ADDIE) model (Figure 4). The instructional development process as described by its latest version involves analyzing and determining what instruction is needed, designing the instruction to meet that need, developing instructional materials to support system requirements and then implementing the instructional system. Evaluation is seen as a central function taking place at every phase. More agile versions of ADDIE have also been proposed, such as the Successive Approximation Model (SAM) that utilizes a more iterative process with emphasis on prototyping [12].

Course development approaches like the Explain, Clarify, Look, Act, Share, Self-Evaluate/Submit (E-CLASS) model are available to guide the structured development of distance (or blended) learning content. A modification of the E-CLASS model combines the steps Act and Share and adds a summary step (Figure 6).

Crucially, and as highlighted in both ADDIE and SAM, training evaluation is an important process to determine how successful the training is at achieving learning objectives. A scientifically validated tool in the domain of training evaluation is the Training Evaluation Inventory (TEI), assessing five training outcome dimensions as well as five training design dimensions with rating scales (Figure 4).

Learning Management Systems (e.g. the CASRA Learning System [16]) allow for an easy delivery of structured e-learning content to train participants of the pilot demonstrators on the use of novel components supporting multi-modal communication analysis, web intelligence, thermal counter spoofing, and dynamic risk assessment amongst others [1]. The training content

testing and evaluation is scheduled to start at the end of 2020.

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X-RAY SCREENING AND TRAINING AT THE SWISS FEDERAL CUSTOMS ADMINISTRATION

Text: Mahé Becker

The Federal Customs Administration (FCA) stands for comprehensive security at the border for the benefit of the population, economy, and the state. In our interview, David Leclerc, the deputy head of Zurich Airport Department, and Sgt. Christian Küng, deputy team leader of the Railway team and screening-instructor responsible at Zurich Airport for more than hundred border guard screeners, talk about their routines, share experiences, and answer questions about the use of X-Ray Tutor 3 (XRT3) as well as the expectations of XRT4.

HOW DOES THE DUTY AT THE NATIONAL BORDER DIFFER FROM THAT AT THE AIRPORT?

At the national border, mainly mobile devices are in use, which are built into Mercedes Sprinter Vans. These devices are used by a team of technical specialists who were trained to handle this equipment. Heavy weight check with X-ray machines can be conducted to analyze the content of various kind of containers, such as luggage, fire extinguishers, spare wheels, and even whole shipments. Without this equipment, searching for hidden items in heavily filled containers, such as shopping bags, can be a difficult task. X-ray machines facilitate the disassembly of containers to define whether the content is harmful or harmless or whether there is, for example, a Value Added Tax (VAT) violation. However, if there are items in the container that seem to be suspicious, a more extended search needs to be conducted. The mobile devices also enable to check whole passenger buses with passenger luggage in a very short period of time, or even trucks at the domicile inspection at the place of unloading the goods. In cooperation with the Swiss Cantonal Police Force, we are even deployed for major inspections. For these tasks, we use the mobile device.

INFOBOX: THE FEDERAL CUSTOMS ADMINISTRATION (FCA)

The main task of the FCA is to contribute to the safety and protection of the population, the economy, the Swiss state and the environment. The FCA employs around 4500 people, 250 of them are screeners. The FCA is active within the country, at the borders and abroad [1].

Their broad range of specialized tasks include contribution to internal security by combating illegal activities, protecting the population and the environment, and maintaining public security but also cooperation with foreign authorities and the organization of international missions. Other duties derive from a more economic aspect, which include taxations or creating statistics on foreign trade and transit traffic [1].

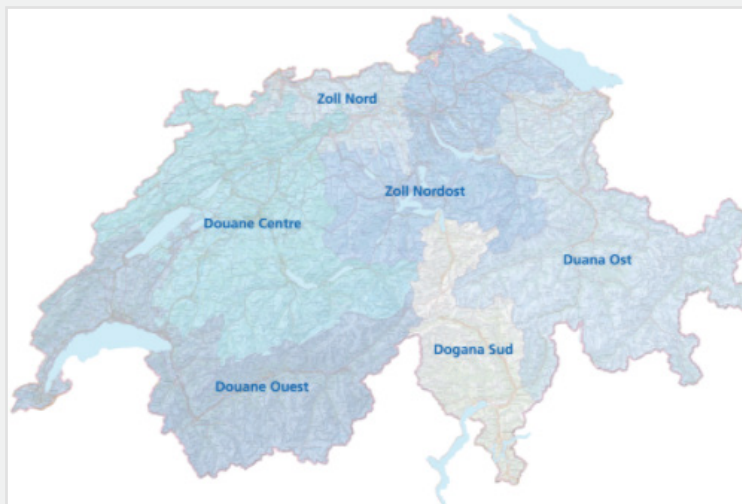


Figure 1: FCA Territory with regional structure [1]

Working with X-ray machines supports and simplifies their mission. The FCA performs X-ray screening nationwide, including border control, airport control, and controls within the country. Discovering threats or forbidden items is crucial for the national security. To train their screener team, XRT3 has been implemented as a training system.

Checks at airports are mainly conducted with stationary equipment for passenger traffic in the arrival hall and in the freight hall for the delivery of goods. However, the mobile X-ray device allows us to conduct pre-checks right at the aircraft. At the Swiss airports, every employee of the border guard corps received a special training, whereas at the border only a few specialists are allowed to maneuver the mobile X-ray device to the specific locations.

WHICH ITEMS OR SPECIFIC QUANTITIES ARE SUBJECT TO THE IMPORT BAN AND ARE SPECIFICALLY SOUGHT AFTER?

Items such as narcotics, weapons, and items listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), as well as meat from certain regions are subject to the import prohibition. Allowed goods with quantity restriction are meat, alcohol, and tobacco. However, depending on the origin of the

flights, we focus more on certain items.

Animal products such as meat, dairy products, plants, vegetables, and fruits are prohibited for import from countries outside of the EU. Whether it is banned or allowed depends on its origins. Screeners especially look out for it, as it is a tricky topic. In fact, it is remarkable what travelers carry with them depending on their flight destination. The case, in which an unrefrigerated pig's head was identified on the X-ray machine, caused an immense agitation among the screeners. One of the main issues was that the pig's head could be contaminated. In Switzerland, rabies has already occurred in domestic animals, which is why spreading any diseases should be prevented. The impact of a disease on agriculture, food industry and general health could be vast.



Figure 2: Illegal drugs confiscated at Zurich airport

For the import of animals, a special permit is needed. However, it is remarkable how many animals are coming through the checkpoint. At times they are not even visible since they are carried inside the traveler's luggage.

Obviously, looking out for weapons and identifying them is key, even if the traveler was checked at the departure airport. Weapons are allowed in checked-in luggage, since they are stored on the lower part of the airplane and do not cause a dan-

ger to aviation security. However, when the traveler passes through the customs and a weapon is discovered through the X-ray images, the immediate follow-up questions are: Are there violations of custom laws, i.e., value of goods, VAT and is the weapon legal or illegal to import according to the Swiss weapon legislation. If it is legal, a permit has to be presented. These are additional factors to consider. The threat emanating from the weapon is a different aspect. In conclusion, weapons incorporate different factors which are decisive for a control.

In general, prohibited items can easily be identified with an X-ray machine. Nonetheless, it is important to know that the more a screener works with X-ray machines, the more experience he or she will have, the better he or she can interpret X-ray images. An experienced screener identifies within seconds whether a luggage is harmless or not. It is important to mention that in very few cases the import of prohibited items is done with malicious intention.

WHICH OBJECTS OR SITUATIONS REQUIRE SPECIAL ATTENTION BY THE BORDER GUARDS?

Weapons, narcotics, unknown liquids, i.e. chemicals, but also animal smuggling, explosives, organized smuggling with tobacco, cash, and money laundering definitely require special attention.

It is essential to differentiate between personal consumption of narcotics and organized crimes. People who bring along narcotics for personal consumption carry maybe 0,5 grams to have a souvenir from their vacation destination such as Amsterdam, whereas for organized crime it is more important to know how the narcotics are hidden (see Figure 2). Thus, X-ray machines are very helpful. Usually the narcotics are hidden very well, which is why training and experience are key to detect and identify contents. Training with XRT enables the screeners to recognize uncommon items. It is crucial that screeners learn, for example, how a drill with a motor looks like in an X-ray image. This is what we appreciate the most about CASRA's XRT training, that

screeners gain experience, since it displays unusual objects in different rotations. However, screening a piece of luggage is usually not enough. Other factors such as the persons appearance, passport, flight destination, etc. need to be considered as well.

An accidental smuggling case is treated and organized differently on site than an organized crime case. Money laundry, for example, is an immense business, which is very hard to recognize in an X-ray image. It is up to the screener to identify whether it was done by mistake, or if it is a bigger issue, which needs more investigation and a more thorough check. The screener has to be already on alert when the luggage is being X-rayed. And we like to stress once again, it is essential that screeners train and start realizing what an ordinary piece of luggage looks like and that they are able to identify when something is off. The main goal of training is to identify unusual items and we constantly repeat at the airports that training is crucial for every screener.

WHAT EXTRAORDINARY DISCOVERIES WERE MADE DURING INSPECTION OF GOODS?

At the borders' checkpoint it is very common to X-ray a complete passenger bus with the luggage.



Figure 3: Suit made out of snake leather confiscated at Zurich airport

Last year, a screener X-rayed a piece of luggage and identified an item which looked like a grenade. This led to a shutdown and evacuation of the complete control room. The bomb squad from Zurich Cantonal Police Force was called into action to analyze the threat item. When the luggage was opened, it turned out to be a perfume bottle shaped like a grenade.

On another occasion a screener was scanning the luggage while the passenger was next to it, when all of a sudden, the message came through the intercom: Attention weapon! The passenger was secured and handcuffed right away in order to maintain security. The luggage was inspected, then we realized it was only a lighter. This is a classic story, of how each time it causes first fear and then laughter among the staff.

These two examples show how difficult it is to identify the content of an item in an X-ray image. It is sometimes challenging to differentiate whether it is a real weapon or a toy, even more with 3D printed weapons, however, we appreciate that our staff is ready to take actions.

SINCE WHEN IS THE X-RAY TUTOR 3 (XRT3) PART OF THE TRAINING AND FURTHER EDUCATION OF FCA?

XRT3 was implemented in fall 2019. Prior to CASRA's XRT we worked with another software at a stationary facility. We used it only for basic instruction and refresher courses, since it was available on just one specific computer. Unfortunately, there was no variety in images, neither in amount nor in category, why it was possible to learn them by heart. Accordingly, the frustration rate was high within the team and even more problematic was that if you know the image by heart and have a high hit rate, it just radiates a false sense of security.

As you may have noticed by now, our work field is very diverse and we need to train with many various items. It is truly important to differentiate between the tasks of customs and the tasks in aviation security. In aviation security, it is crucial to recognize

hazards, e.g. explosives, to prevent an airplane from a crash. For us it is certainly also vital to recognize improvised explosive devices (IEDs), however, it is just as important to be compliant with customs regulation for import. Looking out for items such as cigarettes, animals, and food is part of our daily business as well.

WHY DID YOU CHOOSE XRT3? WAS THERE A SPECIFIC REASON OR TRIGGER FOR THE DECISION?

There were multiple factors that led us to XRT3. FCA has a very decentralized structure due to our work all around the country in different shifts. We do have a training center, however, it is not convenient to have to travel to the location or to wait until the next refresher course is due. This is why we were looking for a training software accessible at all times from everywhere to ensure a high flexibility. Screeners should be able to train whenever they want, wherever they



Figure 4: Lynx skin confiscated at Zurich airport

are, even from home if they desire.

It was also essential to have the option to implement our own content to the training software. So many different items are important for customs and not just weapons and IEDs, therefore it is great that we are able to screen our own items and train with these images. For example, it takes training

to identify a belt buckle in a packed piece of luggage in an X-ray image. And items such as belt buckles should also be part of the training to ensure trade mark protection. With XRT3 all our needs are satisfied thanks to the specifically tailored solution.

WHAT ARE YOUR GOALS REGARDING THE USE OF XRT3?

Our team should have a 24/7 access to the training platform. Our goal is that our team trains constantly and individually. The continuous improvement through training shall lead to more success and discoveries at the checkpoints. It is not fun to keep analyzing the same X-ray images over and over again, as we had it on our previous training. Users were bored and it does not lead us to our goal to be sensitized to look for items that are in fact uncommon.

Ever since we use XRT3 and are able to implement own content, we can also motivate our team to look out for unusual items found directly at the checkpoints. These real-life images can be used to train other screeners. Knowing that each employee can improve the training keeps motivation high in every day life to look for rare real-life images that could be implemented in the XRT3.



Figure 5: Turtle shell confiscated at Zurich airport

We constantly bring items to be X-rayed, such as for example gold coins. Certain coins can have a value of around 6000 Swiss francs, which means VAT is due. But to be able to identify a gold coin in a piece of luggage, you first need to know what it looks like in an X-ray image. And the same happens with jewelry. Screeners also need to

identify whether it is real gold, the value of the piece, etc. But that makes the work very varied and exciting.

WHAT DOES THE BASIC COURSE AT FCA INCLUDE?

The basic course takes three to four days and is divided into a theoretical part, in which you are taught basics of X-raying, and a practical part, in which items are screened. At site we have a mobile device that the participants have to set up and put into operation. A part of the practical training is like hide and seek; participants hide objects, which have been collected and confiscated throughout the years, into a fully packed piece of luggage. The hidden object needs to be identified afterwards on the X-ray image. This technique teaches you in fun way, because you try to make it hard for your co-participants. It also teaches how to hide items and how the items look like in an X-ray image. One of these training days actually takes place at the mail center Mülligen of the Swiss Post, where participants need to screen real packages and envelopes. This adds the factor of time pressure. One advantage of the mail center is that there is no additional pressure from the passengers, as it would be at the airport, but still real items in every shape and size are screened. This gives the participants time to extensively discuss what they see on the screen.

The screening technique is also taught. After finding something in a piece of luggage, there is a tendency to focus all your attention on that one item. But it is important to

keep screening the whole luggage, since it might contain other forbidden objects as well. If you train constantly with XRT3, you start noticing that you have to keep searching for a second or even third forbidden item.

WHAT DO USERS APPRECIATE THE MOST ABOUT THE CASRA SOLUTION?

There are several aspects that are valuable to the users. One of the more basic one is that they have access at any time and any location. Very highly appreciated are the different views of the forbidden item. It allows them to learn to identify a forbidden item in every possible rotation in a different environment combined with various other items in it. This means they can continuously increase their "internal" image library. Furthermore, the fact that they notice they become faster and more secure about their decision, whether the luggage is harmful or harmless, is very valuable.

We have also noticed that one user starts training, and all of a sudden two or three people more are sitting around the computer and have a competition who will first identify the forbidden item. This is a great aspect of XRT3; it really motivates the users.

Another feature that motivates the users is the ability to track their own hit rate. If you notice that your average hit rate decreases and you want to improve it, you start training. You start by telling yourself: "Let's analyze 15 images". But you keep telling yourself "another 15" and somehow you end up

analyzing 100 within 15 minutes. Since XRT has so many images, you never have to be worried that at some point you have seen them all.

HOW DOES FCA ASSESS THE COOPERATION WITH CASRA?

The communication with CASRA employees works really smoothly and is really professional. It is valuable that meetings between CASRA and FCA take place continuously in order to discuss our necessities, wishes, and ideas. In addition, if we have confiscated items, which need to be implemented into the training, we simply make a phone call, schedule an appointment and the item will be screened. The cooperation is extremely uncomplicated.



Figure 7: Reptiles and snake leather boots confiscated at Zurich airport

VERY SOON YOU WILL BE TRAINING WITH OUR NEW SOLUTION XRT4. WHAT ARE YOUR EXPECTATIONS?

It would be an added value for FCA if there are even more items relevant for customs integrated into XRT4. A big factor for us is not only the item but also the origin of the item. Was the item imported from a country in the EU or not? It would be interesting if the origin could be included into the training, since it has an immense influence on the screening technique and the further process. We are aware that the implementation will be very difficult, however, we are confident it would be great. We let you surprise us.

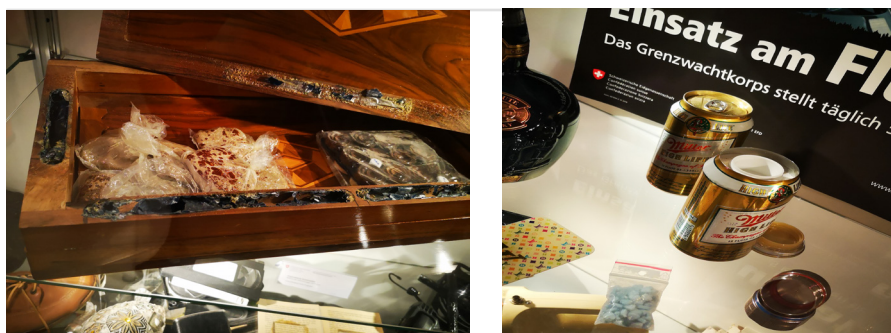


Figure 6: Prepared box to smuggle drugs (left) and prepared can to smuggle drugs (right)

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