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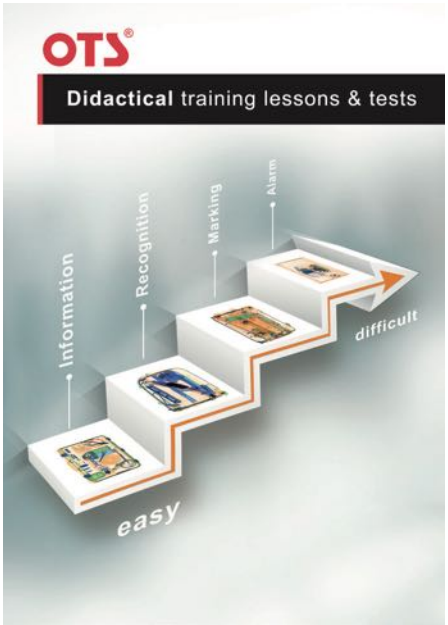
By Mark Robins

Examining Today's CBT Screening Updates

Twenty-five years after 9/11, CBT continues to evolve and improve to stop aviation threats.

The 9/11 terrorist attacks shook the world and changed the way airline passenger screening is conducted. In the past 25 years, aviation security has dramatically evolved to highlight the importance of continuous, realistic screener training. From detecting knives and box cutters, to increasingly concealed and unconventional threats such as explosives hidden in shoes, underwear and everyday electronic or personal items, computer-based training (CBT) has been on the front line. Security has been enhanced with more accurate means of threat detection with both 3-D and full-body scanners. CBT can now provide screeners with realistic imagery covering both known threats and potential new concealment methods. Additionally, 9/11 accelerated the shift from differing local training practices toward more regulated, standardized and competency-based approaches.

"The attacks of September 11 necessitated a global rethinking of aviation security … the years since have brought numerous innovations in screening technologies and detection algorithms," says Michael Flaherty, division manager, Battelle, Columbus, Ohio. "As technologies have evolved to find these threats, screener skills have had to evolve alongside to make effective use of these tools. What used to be 2-D X-ray image interpretation with limited tools has evolved to a highly complex 3-D environment with many advanced features to uncover even the most hidden threats. This emerging complexity requires that computer-based training solutions are built with high-fidelity interfaces that match each screening system and its features precisely. As our customers know, the closer the training looks to the real thing, the better the skill transfers to their staff in the field protecting our aviation assets."



STI training participants acquire theoretical knowledge first before applying and consolidating it in practical exercises using the concept of "from simple to complex." STI image.

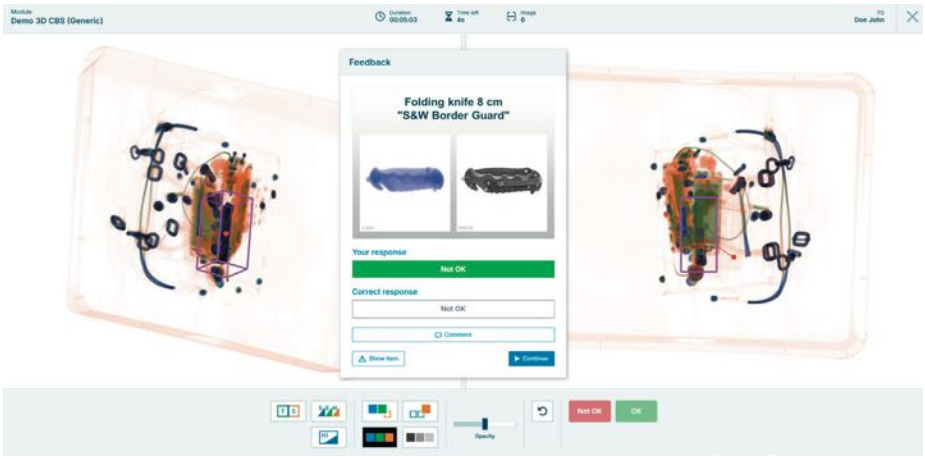
A Critical Component

Modern computer-based training is now a key component for the initial and continuing training of aviation security screening officers. It supports the entire learning process, from the very basics of X-ray image analysis right through to advanced threat scenarios.

"Following the principle of 'from simple to complex', participants first acquire theoretical knowledge before applying and consolidating it in practical exercises," says Carole Arnaud-Battandier, senior sales and marketing manager, Security

STI emphasizes that digital training is flexible and staff can utilize it anywhere, anytime. STI image.





The XRT5 training dashboard - screeners choose modules and track their own detection performance over time. CASRA image.



3-D CT training in action - screeners assess volumetric X-ray images and receive detailed, item-level feedback. CASRA image.

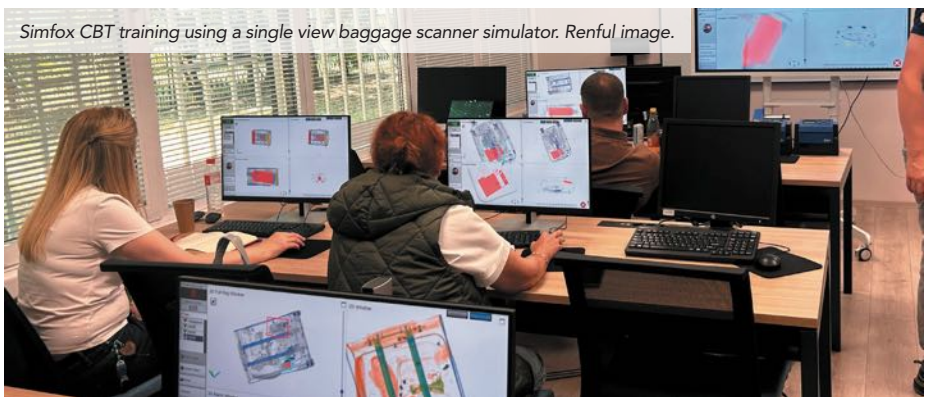
Training International (STI), near Frankfurt am Main, Hesse, Germany. "A particular advantage of digital training solutions is their flexibility. Security staff can learn anywhere and at any time, choose their own pace of learning and regularly update their knowledge. At the same time, modern analysis functions enable personalized support: learning progress is documented, strengths and weaknesses are identified, and training content is tailored accordingly. In this way, computer-based training not only supports the induction of new staff but also helps to ensure high standards of quality and security in aviation in the long term. Thanks to their assignments at numerous airports worldwide, real-life experiences are incorporated directly into the development of the training content. This results in training courses which, in addition to their educational quality, realistically reflect the actual conditions and challenges of day-to-day work at airports, a disruptive environment."

CBT has evolved from a standalone training tool into a core component of continuous competency management. "At its core is X-ray image interpretation: teaching screeners which items are prohibited, how they appear in an X-ray image and how to detect them reliably under operational conditions," says Dr. Diana Hardmeier, director at the Center for Adaptive Security Research and Applications (CASRA), Zurich, Switzerland. "Theory modules, knowledge checks, competency assessments and performance reporting support this process across the competency lifecycle, from selection and initial training to recurrent training and certification."

At CASRA, individual adaptivity is particularly important. CASRA's approach is grounded in decades of security screening research that began at the University of Zurich in 1999 and has been further developed at CASRA since 2008. "Training not only presents difficult, emerging or newly added threats more frequently, but also adapts to each screener's individual competency profile based on demonstrated performance, while closely reflecting the operational environment, e.g., realistic 2-D and 3-D imagery and automated alarms," Hardmeier adds. "This approach continues to be scientifically evaluated and refined, with ongoing research. Browser-based delivery also makes training available across sites, while central reporting helps organizations maintain consistent standards."

An Extremely Challenging Job

Screeners have an extremely challenging job. Not only do they need to find every potential threat; they have to do it more quickly and efficiently than ever. Furthermore, the needs of the screening workforce across the world vary widely: different technologies and



Simfox CBT training using a single view baggage scanner simulator. Renful image.

Train the eye that

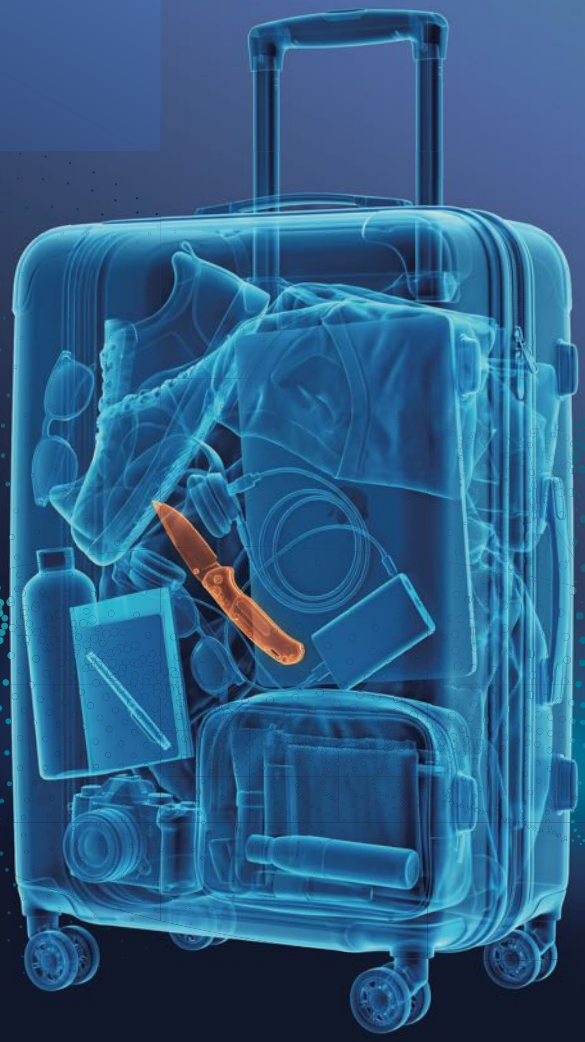
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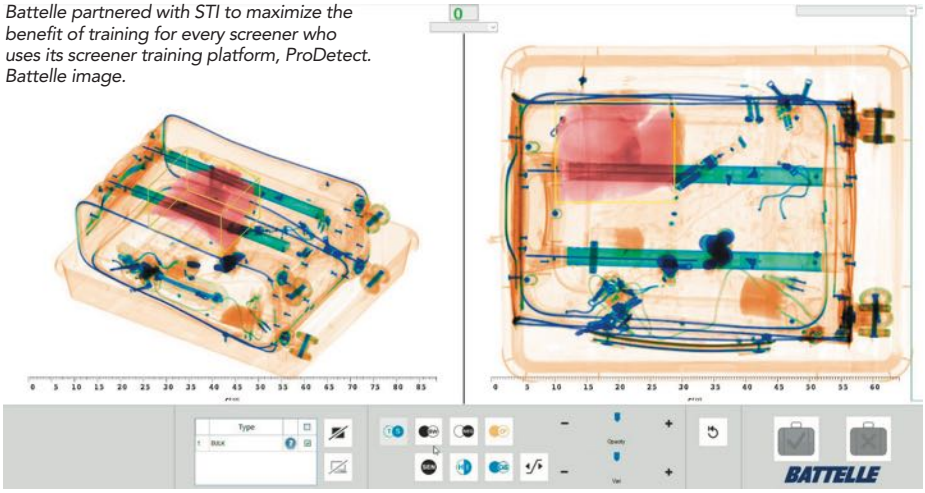
Critical infrastructures

Airports

Ports

Customs

Museums



Battelle partnered with STI to maximize the benefit of training for every screener who uses its screener training platform, ProDetect. Battelle image.

systems, different screening protocols and operations, different baggage types and content. In addition, training must be capable of being tailored to each specific screener's needs; a one-size-fits-all approach doesn't work, especially as airports around the world adopt new and evolving solutions to their specific screening needs.

To meet these challenges, today's CBT combines theoretical learning with realistic, hands-on X-ray and CT image interpretation. Agnes Vaspori, head of product development at Renful Premier Technologies, London, explains that Renful's LMS delivers and manages theoretical courses and assessments, while Simfox allows screeners to practice on simulated versions of the screening equipment they use operationally, using real X-ray and CT imagery. "Together, they support initial, recurrent, assessment and remedial training, with detailed performance monitoring. Browser- and cloud-based delivery also allows the same standard of training to be provided across multiple airports and locations without relying on dedicated training facilities."

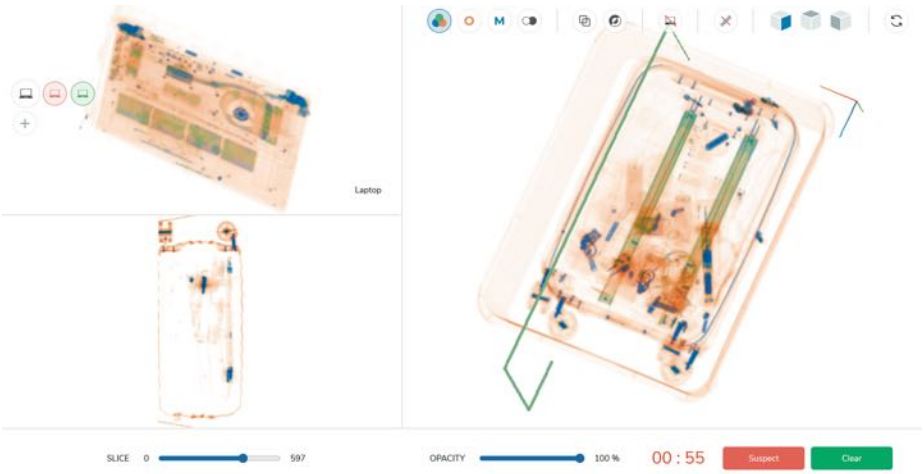
Battelle has partnered with STI with the goal of maximizing the benefit of training for every screener who uses Battelle's screener training platform: ProDetect. With technologies and tools constantly evolving while training time is limited, training time should be impactful and support real-world performance. "ProDetect was built using Battelle's human factors expertise to ensure that training is accessible, accurate and adaptable to effectively meet the demands of today's screening workforce," Flaherty says. "ProDetect is highly adaptable to meet evolving needs. Its high-fidelity user interfaces are designed to precisely mimic each screening system and the ability to rapidly implement user interfaces for new systems coming to market. ProDetect is accessible from anywhere in a browser window, giving clients the optionality they need to successfully deliver training to their staff, without compromise. Screeners get the training they need wherever they are, whenever they need to, on a single platform that can integrate with native learning systems."

Toulouse, France-based LOGYX's CBT-LOGYX Detect, is fully online, which makes training accessible at any time without having to worry about which computer the software is installed on. The challenge was to make this accessibility possible even with the emergence of new technologies such as EDS.

"EDS images are significantly larger than single- or dual-view X-ray images, so without evolving the application, our clients would have had to invest considerable sums to upgrade their IT infrastructure," says Dr. Matthieu Gualino, director at LOGYX. LOGYX says it was one of the first providers to offer a fully online version of CBT capable of training officers with both 2-D and 3-D images. "At LOGYX, we're not fans of the idea of providing only a standard image bank. While our product is packaged, we always take the time with our clients, new or existing, to understand the regulatory framework in which they operate. We also place great importance on customizing training content. We have a very strong presence in Europe, as well as on the African and Asian continents, and we work with local authorities and our clients to provide images from their own airports. We use real bags from real passengers, sourced through a network of partners around the world. This approach allows us to obtain training images composed of current, everyday objects."

CBT Innovations and Advancements

Arnaud-Battandier says the most significant CBT technological development in recent years has been the



LOGYX says it places great importance on customizing training content and works with local authorities and its clients to provide images from their own airports. LOGYX image.



WHEN SCIENCE CREATES **IMPACT IN X-RAY SCREENING**

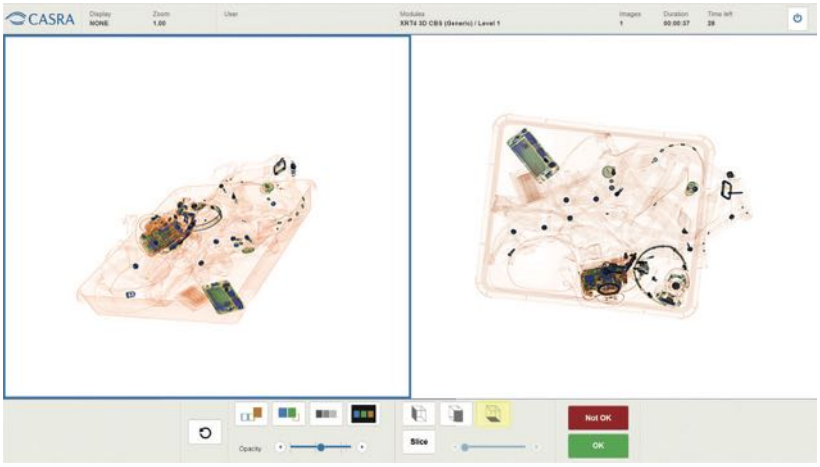
Aviation Security

CASRA is collaborating with airports and security service providers around the world in order to provide them the best possible solution based on their needs and requirements.

We offer airports and security service providers pre-employment selection tests, individually adaptive computer-based training, and X-ray image interpretation competency assessment tests in 2D single-view, 2D multi-view and in 3D CT, displayed with different user interfaces, which are developed in close collaboration with end-users and are based on scientific research.

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- **and many other areas**



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- Individually adaptive algorithm with large image library
- Increased operator's performance while reducing response time

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Shown here is Simfox CBT training using a hold baggage CT (3-D) scanner simulator. Renful image.

transition from conventional X-ray systems to high-performance 3-D CT scanners. "This technology enables a much more detailed analysis of luggage and helps security staff to identify potential threats more quickly and accurately. With the introduction of these modern systems, training requirements have also increased. Computer-based training programs have therefore been continuously refined to optimally prepare security staff for the use of new technologies and to enhance their image interpretation skills. Many of these advances are based on innovations from the medical and military sectors. In particular, the further development of computed tomography (CT) has had a lasting impact on aviation security and now enables realistic training scenarios that meet the current challenges in the security sector."

Hardmeier agrees that 3-D computed tomography has changed the visual task for screeners and requires realistic 3-D training. "Screeners must learn both how prohibited items appear in volumetric imagery and how to use the technology effectively."

Vaspori has witnessed major advances in realistic CT simulation, cloud and mobile delivery, adaptive training and new methods of creating training imagery. Renful's ArchiteCT technology allows scanned 3-D objects to be digitally concealed within 3-D composite images of baggage, trays and cargo, creating realistic new threat scenarios without the need to physically rescan every combination. Simfox then allows screeners to analyze these images using realistic scanner functionality, while adaptive training uses their performance to provide targeted practice in areas where improvement is needed.

"Perhaps the most important point is that effective CBT should not be viewed simply as a regulatory requirement or a test to be passed, but as continuous preparation for a threat that is constantly evolving," Vaspori says. "Modern systems such as Simfox can expose screeners to thousands of realistic scenarios — including rare threats they may never encounter during normal operations — and use performance data to focus training where each individual needs it most."

The push for open architecture (OA) continues to grow, and Flaherty says separating the detection algorithm from the scanner hardware across the industry means that CBT training must adapt to new systems as they arrive. "This is where rapidly customizable solutions are key to effectively delivering training. As a solution built on the DICOS image standard, ProDetect is natively designed with OA in mind, making it easy to create training environments that accurately mirror what screeners will see in the field."

Hardmeier agrees that both open architecture and browser-based delivery have made CBT more connected and scalable. "Standardized formats and APIs support functions such as user synchronization, single sign-on, performance-data exchange and central content management."

At LOGYX, Gualino explains that AI integration is key to its upcoming developments. Here, AI is used to improve and strengthen the reliability of its content, and it will be offering it as a tool to help drive and manage training. "We see AI as a powerful tool for interpreting results, statistically analyzing performance, analyzing and managing our library of several tens of thousands of images, and automatically creating exercises and training content adapted to your profile. We are currently working on a new version of our software that we believe will revolutionize the industry. That said, AI must be kept under control, and the confidentiality of the data we handle is paramount. We consider it unthinkable — and we are not permitted — to use public AI tools for our code or content generation, as this would jeopardize the confidentiality of our information."

AI has indeed presented an incredible opportunity for screener training. It's provided a new approach to creating training images, which was once a labor-intensive process. "From fully synthetic bags built by models trained on real world data, to advanced threat insertion approaches that can accurately place threats in benign bags, the ability to create new training images is continually evolving," Flaherty says. "Battelle has made significant investments in AI that allow us to convert images from one screening system to another with full accuracy and detail, providing a rapid way to transfer full training libraries specific to one system to another system without sacrificing image fidelity."

AI and Automated Prohibited Item Detection Systems (APIDS) are changing both screening operations and training. "APIDS shift part of the screener's role from unaided visual search towards interpreting machine-generated alarms while remaining alert to relevant items automation may miss," Hardmeier explains. "AI therefore does not remove the need for training; instead it changes the competencies that need to be trained. One important research question is therefore how humans and automated systems perform together. CASRA has been researching this human-machine interaction for many years, including collaborative studies with airports and screening providers. For us, the key question is how well the screener and the automated system perform together, rather than the human or the algorithm in isolation." TSI

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