

# Transitioning towards CT screening

## An operator training- and monitoring perspective

A knowledge article by Point FWD in cooperation  
with various key industry players



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# About this article

With this paper we focus on the human aspect of CT implementation. Taking the security operator as the centre of attention; in our opinion the enabler for the quickest and most constructive way to success in state-of-the-art technology implementations. We invite you to gain more insight on how to manage the modern human-machine interaction whereas we focus on training, coaching on the job and continuous monitoring. Seeking to answer the 'why' questions to 3D image analysis difficulties, providing for solid grounds when approaching your implementation project in a broader sense. Security checkpoint stakeholders should perceive this integrated solution approach as keeping a marriage happy. This will only work if there is enough collaboration, communication and understanding.

## Various industry perspectives

The insights shared in this knowledge article have the purpose of including the experiences of a rather broad group of industry stakeholders to the CT transition in the security checkpoint. While many insights originate from Point FWD guidance during implementation projects, the bigger picture is being supplied by representatives from key industry players in the Aviation Security working field. We would like to sincerely thank all our contributing partners on their efforts to compose this series of papers.

## Authors

This paper is written by Point FWD's Femke Lettinga and Robin van Gemert. Femke is the former quality coordinator for training and development at security company G4S. In her prior role responsible for guiding operators through CT implementation at several national airports. Robin bringing his integrated view on CT implementation projects and the focus Point FWD has in providing data-driven guidance to airports and other security checkpoint stakeholders.

Femke Lettinga



Robin van Gemert



## About Point FWD

Point FWD is a Schiphol based consultancy company with a mission to bring security checkpoint environments to the next optimal state of performance. Our future is a world in where aviation security checkpoint stakeholders have 100% insight in their security operations, being able to adequately, promptly and coherently react to regulatory changes, strategy redirections and deployment expansions. In this paper we share our experience on CT equipment implementations, operator performance monitoring and guidance on operator CT training programmes. Point FWD exists as an innovation partner for our clients through conceptualization and (re)definition of the security process, always with a data-driven, yet human-sensible mindset.

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Aviation Security Consultancy

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# Supporting experts

In this paper, input from various industry experts is integrated to assess the 360° stakeholder perspective on CT implementation and 3D image analysis. Collaborating companies and their experts for this paper series include Airports, Security Companies and OEM of screening software as well as Training Software. Cooperating companies and their representatives are included on this page.

## Security Operators



### Securitas Transport Aviation Services

Jan Cuypers, Aviation Business Transformation Manager; Marcia Awouters, Aviation Technology Development Manager.

Securitas is a global knowledge leader in security. From a broad range of specialized services, technology solutions and consulting, Securitas Aviation customizes offerings that are suited to the individual customer's needs, in order to deliver the most effective security solutions.

### CTSN

Cheryl ten Brink, Service Delivery Manager

The security operator is the Dutch subsidiary of ICTS, having expertise in the deployment of CT and EDS in checkpoint situations in the early phases of the CT transition. CTSN has a collaboration with InnerEye - a revolutionary EEG (electroencephalogram) interface designed to facilitate real time threat analysis of visual data.

### I-SEC Netherlands

Aza Amin, Quality & Training Business Partner

I-SEC is specialised in delivering advanced aviation security. I-SEC provides services for airlines and airports worldwide. These include handling services, safety training, advisory services and security technology. I-SEC Netherlands has developed a complete portfolio of innovative services and technological solutions that create a safe environment for organizations.

## Airport Companies



### Eindhoven Airport

Mariëlle Sijm, Airport Operations Manager.

After a successful pilot, EIN started deploying a total of 8 ATRS security lanes by the end of 2019 to meet the airport's capacity requirements, while making optimal use of the limited available footprint. Eindhoven became one of the first airports in the world to screen 100% of its passengers' carry-on luggage with CT screening technology.

### Rotterdam the Hague Airport.

Alexander Dilweg, Aviation Security Policy Advisor.

Aligned with terminal expansions, RTM's central security checkpoint was upgraded with new equipment and is in operation since the start of 2020. After a short testing phase by the end of 2019, the airport implemented CT equipment, 5 ATRS security lanes and security scanners and therewith Rotterdam also belongs to those few airports operating on CT technology for 100% of their security screening.

## OEM's and Resellers



### Stage Gate II

Michiel Poppink, Chief Commercial Officer

Stage Gate 11 is a company focusing on improving the effectiveness and efficiency of airport security departments. They build bridges between technology and this market. They develop own technology and next to that bring third party computer based training software for CT equipment to the market.

### Vanderlande PAX Solutions

Darren Durham, Product Manager

As part of Vanderlande's next generation of scalable solutions Vanderlande offers PAX CHECKPOINT. This combines state-of-the-art automated screening lanes with a configurable multiplex screening software to create a fully integrated checkpoint solution. Scalable and flexible, it offers increased throughput and an improved passenger experience while allowing for easy expansion.

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# Introduction

Explosive Detection Systems for Cabin Baggage (EDS CB) are becoming the new standard in screening cabin baggage on commercial airports across the world. Enhanced equipment enables automated screening of cabin baggage on explosives and is being implemented in various standards. For most of the bigger airports the transition towards EDS CB implicates the implementation of Computed Tomography (CT) x-ray equipment, therewith enabling the operational concept where liquids and electronics can remain inside the luggage during the security check. Replacing common x-ray equipment – mostly single and dual view systems – with CT equipment has various potential benefits.

**Gunther van Adrichem** (Managing Director, Point FWD) sees this transition as “the long awaited solution to make a step change in security checkpoints worldwide, providing for a better screening experience for both passenger and security operator.” He adds: “and this is just a beginning, introduction of these new technologies will allow for even bigger leaps in future detection and operational insights through available data.”

## Better inspection capabilities

Eliminating the need to take out liquids and electronics can mean less trays used per passenger, increased security throughputs, a more positive passenger experience and eventually a more cost-efficient security operation. One of the enablers for these benefits is the capability of 3D imaging. 3D image analysis can be used particularly to better analyse the more complex images, for example those with electronics inside of baggage. A 2D image provides difficulties for visual analysis since laptops could be bloc-

king the sight on other items, with the consequence to manually inspect a bag which in most cases means additional screening of belongings.

The overall experience operators have regarding 3D image analysis seems positive; operators experience increased visual analysis capabilities thanks to additional manipulation and analysis functionalities. This results in less manual searches, which eventually tend to become more targeted of aim. The introduction of 3D imaging however implicates a different way of screening as compared to 2D images. It provides for novel features – such as rotation and separation – operators have not worked with before, which take time and training to be successfully adopted into their standard image analysis capability.

To achieve CT implementation success it is crucial to have a quick and consistent operator adaption to new 3D screening capabilities. After all, the best equipment is of limited value if the people who operate it are not trained appropriately.

## The human factor to CT systems

With this article we focus on the human aspect of CT implementation. Taking the security operator as the centre of attention; to our opinion the enabler for the quickest and most constructive way to success. We invite you to get more insight on how to manage the modern human-machine interaction whereas we focus on training, coaching on the job and continuous monitoring. We seek to answer the ‘why’ question to 3D image analysis challenges, providing for solid grounds when approaching your implementation project in a broader sense. Security checkpoint stakeholders should perceive this integrated solution approach as keeping a marriage happy. This will only work if there is collaboration, communication and understanding.

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## Read all three parts of this paper

The content of this paper is built around three main pillars deep diving into the operator training perspective when transitioning towards CT. At first, the organization around training programs is looked at, setting the context and requirements for a CT training program. Then, focus is on the content of training and the actual transition of moving from 2D to 3D image analysis. At last, a perspective on the continuous monitoring and enhancement of operator performance is discussed.



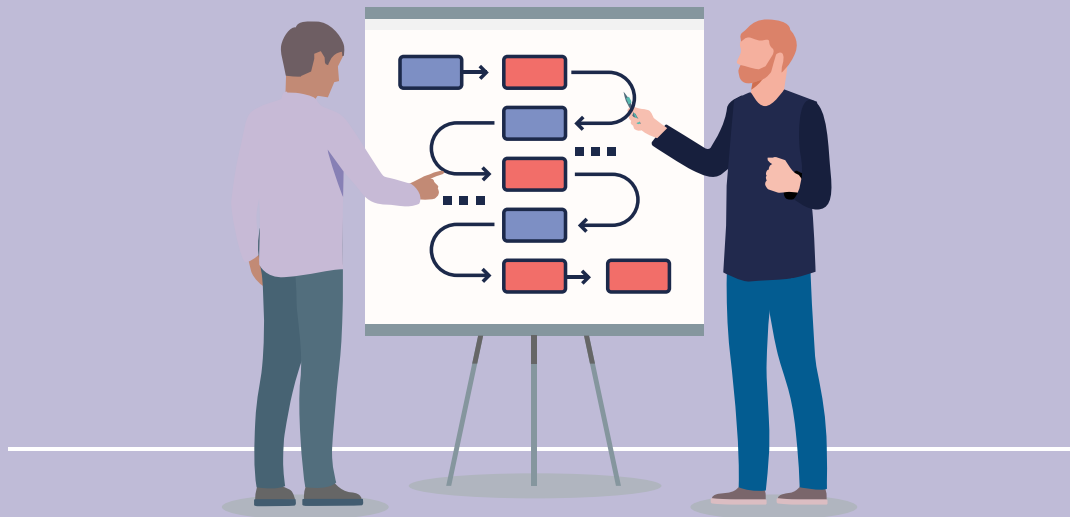
3. Coaching and progression monitoring

2. Training content and components

1. Training approach and organization

## Part I

### Training approach and organization



#### **Included in this part**

- Communication and stakeholder management
- Checkpoint baseline situation
- Type of (CT) implementation project
- Training programs and planning

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# Training approach and organization

## More than only 3D image analysis

Looking at the deployment of new security equipment; every deployment instance is experienced as unique in its own combination of equipment. Besides the technology itself, the implementation is impacted by available space, specific process measurements and CONOP considerations. It is for these reasons a so-called laboratory or factory environment will not provide any certainty of success in an operational environment with real passengers, failures, stops and other unforeseen interference.

The critical link in screening passengers and baggage is still the security operator. **Alexander Dilweg** (Rotterdam the Hague Airport) states. “It is the operator that holds the knowledge to successfully analyse a great part of the content and therewith determines the level of security, as well as the level of performance” he adds. As soon as operators start operation at a new machine and lack adequate training, a high chance exists to perform incorrect actions. As a result, the security lane setup may end up in an error status, jams are caused that may stop conveyors, having direct impact on the throughput of a security lane. In addition, insufficient training can lead to a lack of confidence in operation because the operator does not have the right expectations – and lacks knowledge. It is about avoiding the pitfall of assuming the system will be implemented with operational success immediately.

“The critical link in screening passengers and their baggage is still the security operator.”

**Alexander Dilweg**  
*Rotterdam the Hague Airport*

The first topic to discuss is the organization around training, coaching and operator monitoring, giving it the right place in CT implementation planning process. A fit-for purpose operator training and coaching program is very much essential to the overall success of implementation. In this point of view, se-



veral factors have big impact. For example, not all machine types demand for equal efforts on training. Furthermore, training should be planned and strictly aligned to greater project scoping and timelines, this in order to stay away from under-staffing due to untrained CT operators. At last, effective stakeholder management and communication structures should be in place to have a 360° engagement of all parties involved.

## Type of implementation

When defining a training approach and program, the type of implementation should match the steps to take. Practically this means; what is your current operation and what is your direction for change? For both Eindhoven Airport as well as Rotterdam the Hague Airport the implementation of CT equipment was incorporated in an overall security checkpoint transition, including ATRS, automated security lanes, Security Scanners and CT equipment. The transition from 2D to 3D screening relied on much more than only a change of screening equipment, as many of common and conventional procedures change at the same time. We take a close look at what differences should be accounted for, where to expect any risk and thus focus on when preparing the approach to train operators in such a transition.

## Baseline situation

At first, your baseline situation is worth a first evaluation. In this perspective it might be of interest to draw the current context (or multiple contexts) of service for security operators. What machines are deployed and what procedures and CONOPs are followed. In this regard, a good understanding can be gained of the current levels of operation, providing for a good starting point in order to define the delta between the current and the future operation model.

Next to this, checkpoint profiles can help approaching training preparations. Passenger types differ in their behavior passing through security, looking at specifically leisure or business passengers. Furthermore, language barriers might impact the effectiveness of verbal instructions and therewith impact the means to communicate.

### Type of implementation equipment

A next important focus for assessment is the configuration to be implemented. Practically this is the variety in technology set-ups that will be deployed after completing the implementation project.

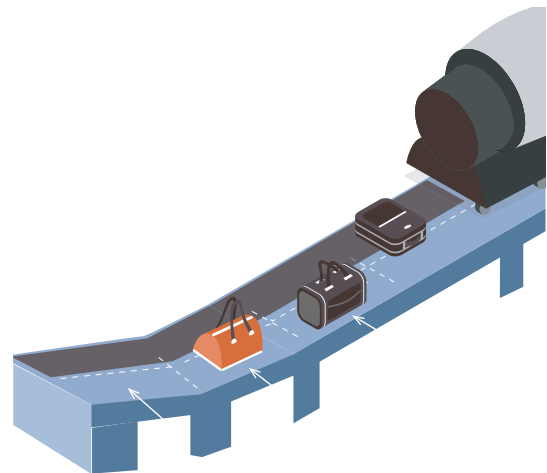
**Mariëlle Sijm** (Eindhoven Airport) explains what this meant at Eindhoven Airport: “as much of the checkpoint processes were subject to change, we focused on closely assessing the complete integration of new equipment and the dynamics that emerged and procedures that followed from these changes.” Below is a list of the various enhanced security lane components commonly implemented in parallel, impacting the CT operator in its coherent work procedures.

#### CT equipment and analysis stations

Every machine differs in multiple factors. At first, operator interfaces between CT machines slightly differ from each other. However, small differences in operator interfaces can have a significant impact, such as the location of function or buttons. Furthermore, conveyor speeds, algorithm times, lane dimensions and multiplexed screening situations all determine the time that is available to have a continuous screening flow at the security lane. For this purpose, it is of great importance to have original training programs set-up for the various CT equipment OEMs. There is software available to provide a single user interface for different CT setups, a mixed fleet concept.

“We focused on closely assessing the complete integration of new equipment and the dynamics that emerged and procedures that followed.”

**Mariëlle Sijm**  
Eindhoven Airport



#### ATRS systems

When transitioning from a manually operated lane to an ATRS, procedures for operators change due to the functionalities of an ATRS. Passengers can divest with little interference of the operator. The operator can act more as a host and have less focus on divest. Operators will communicate less with each other because of the length of the lane. Therefore, instructions for handling prohibited items might change as well and can in some instances change toward a more remote communication approach.

#### Mixed fleet setups

Across the airport, or even within one checkpoint environment, various combinations of security equipment can be present. With each of these equipment combinations, a delicate integration between processes and components demands a specific resolution of system alarms or operational failures. Determining the root cause of a failure might therefore differ across setups.



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## Future CONOPS

Looking at the operational concept of a future situation, some important choices determine the ground basics for image analysis and thereby heavily impact the security process as such. Eindhoven Airport worked together with G4S as their security company, “we have been really redefining the way security operators perform the security check for passengers and staff.” **Mariëlle Sijm** says.

### EDS conops evolution

At first, there is the EDS algorithm that is configured to run. For CT deployments, the target CONOPS is to run a C3 algorithm, enabling all system capabilities. When in the phase of trialing however, most airports tend to never make a hard shift going from a non-EDS towards an EDS CB C3 CONOPS. This might first pass the C1 and C2 standard before going into C3 deployment, to gradually assess the impact on the coherent process and get acquainted with new procedures to follow.

### On-screen resolution

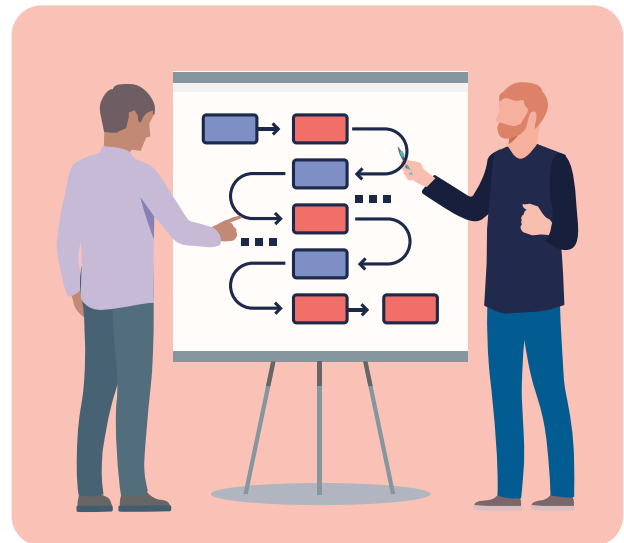
Next, if approved by the local regulator, there might be the choice to implement OSR on EDS alarms. OSR exists in various ways, which each has a unique impact on the coherent security process. CONOPS for both the primary and secondary screener very much differ from a non-OSR CONOPS. When OSR is being applied this can result in less rejected trays but have the primary operator to review all trays with EDS alarms. On the contrary, in a non-OSR CONOPS, an airport might choose to send all trays with EDS alarm directly to reject without interference of the primary screener. The primary screener should then search for all prohibited items, except IED's. Other scenarios of OSR might implicate the combination of EDS on specific items (such as LAGs or electronics), resulting in a specific way of process impact and procedures. In short, every local authority has its own way of seeing things in this regard.

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## Project scope and timeline

When a clear overview exists of the type of implementation in terms of equipment and security concept, it is essential to assess the scope, size and timelines of implementation. The scope includes the project in its complete structure, meaning the various roll-out phases it might exist of. One specific airport may have several security checkpoints, having various plans for the roll-out of CT equipment across their check points. From having an overview of the implementation project, more detailed deliverables, tasks, deadlines and costs should provide basis for filling in the specific check point upgrade projects. Doing so, much more focus can be set on the size of the (potentially) various roll-out waves or phases. Getting a clear sight on the complete transition provides the starting point for training planning and eventually successful deployment.

A big challenge here is to align the planning of the various perspectives, from airport to security companies. Note that holiday seasons coincide with great peaks of high demand for security personnel, introducing extra difficulties when implementation is set in that same period. At the same time, airport construction works in parallel to equipment implementa-



tion could cause bothersome interference with lane implementation, and eventually the planning for training. The puzzle is complex and therefore project management should be thoroughly integrated. **Aza Amin** (I-SEC Netherlands) explains that security companies have collective agreements related to planning their staff. “We must schedule shifts and inform our staff in advance. Therefore, the implementation planning must be defined in advance.”



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## Stakeholder management and communication

The success of CT implementation is achieved by a collaborative and collective effort of all checkpoint stakeholders involved and this is shared by **Alexander Dilweg** (RTHA Airport): “Communication between stakeholders should be one of the focus areas”. He adds: “It is together with our security operator Trigion we should benefit from the advantages CT screening is providing and therefore must establish a common understanding about future operation goals. Cooperation in this case is very much essential to the overall success.”. This means the airport (all relevant dept.), airlines, security companies, maintenance companies and manufacturers should be included from start.

The training program and training material should be developed with the consensus of interests from all stakeholders. The interest of airlines or airports can go in direction of KPI’s on passenger throughput and a consistent happy flow of passengers.

At the other hand, security operators could have more focus on screening performance and operator

well-being. If different security companies operate at an airport, cooperation between companies is needed in the field of planning, training and development. Due to the market competition for security companies at airports, guidance by the airport in this process could contribute to the success of an integrated operation between different companies.

Besides, training and monitoring has a significant financial aspect. Which stakeholder(s) cover the costs of training and coaching in terms of trainers, meeting rooms, development of a training program, work instructions and coaching on the job? And next to that, who should carry the risk in terms of delays or other issues in implementation planning. And beyond costs, **Cheryl ten Brink** (CTSN) adds: “guidelines regarding training and coaching must be clearly communicated to all stakeholders”, She explains: “if different security companies work together, it is important that they all follow the same training, duration and content”.

“If different security companies work together, it is important that they all follow the same training, duration and content.”

**Cheryl ten Brink**  
CTSN

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## Training program and planning

To plan and organize a robust training program, the primary focus should be on alignment with overall project planning including the waves of equipment installations and operational go-lives. Specifically looking at the components of a training program, generally a distinction can be made between three common elements: off-line training, on the job training and coaching. The list included gives a brief explanation of the several components of training, which are being explained in more detail in chapter 2 of this paper.

“Vendors should provide operator manuals and train-the-trainer sessions with CONOPs from the viewpoint of the operator.”

**Aza Amin**  
I-SEC Netherlands

For the development of training, both off-line and on the job training, vendors should in the first place provide for training content. **Aza Amin** (I-sec Netherlands) explains: “Vendors should provide operator manuals and train-the-trainer sessions with CONOPs

from the viewpoint of the operator”. Operator manuals are usually written from a technical viewpoint with specifications that are not relevant for the end-user, the operator.

### 1 Off-line training

Includes classroom and computer-based training, making the first step towards CT operation and specifically CT image analysis. Usually operators need to pass a CT exam in order to screen in operational instances.

### 2 On the job training

Training in live operation with help of active trainers and senior or lead CT operators acting as a coach. In this phase of training, all possible interference is present and operators deal with visual inspections in real operational situations.

### 3 Coaching and recurrence training

This proceeds into the phase of achieving the target level of operator performance, focused on the opti-

mization of CT deployment. This is very airport specific in terms of approach. This might as well include recurrence training.

To get the best results in operation, both in screening times as well as screening performance, timing of the separate training program components is essential. Results from the field show that there is a direct relationship between the operator learning curve and timing between off-line training and on-the-job training. When operators are trained in advance of equipment implementation and the gap between their first moment in CT operation is one month or more, a sufficient knowledge level is lacking. The bigger the time gap, the greater the need for a secondary training. Eventually this impacts the total costs spend on training and coaching. Furthermore, a too wide timeframe for training and coaching seems to decrease confidence levels of the operators in their capability to operate a CT system.

Now, the important part for airport, security operators and OEMs, is to make their choice on the approach to train their personnel, with regards to their specific implementation project. At Eindhoven airport, because of the radical change for the whole security check and moving towards a 100% CT operation, “we chose to take a rather exploratory approach to training.” **Mariëlle Sijm** (Eindhoven Airport) explains. She continues: “Meaning, two trial lanes have been installed and made available for every security stakeholder to get acquainted with, get trained on and to obtain a sufficient level of knowledge before final deployment would start. This meant that all operators have been trained with operational and uncontrolled factors present in full effect.” Then, “together with G4S we chose to provide an extensive classroom on the full new configuration and then directly switch to training on-the-job, to let operators deal with the changing processes as an integrated system. The trial setup continued for one year and training of security staff continued throughout this year.”

“Younger operators were more at ease on a technical level (use of mouse, touchscreen, etc.) and were able to adapt faster to the 3D possibilities of CT.”

**Jan Cuypers**

*Securitas Transport Aviation Services*

Such a trial setup is in favor by many bigger mid-size to larger airport, providing for a situation to get

familiar with a new set-up, being able to find an optimal integration of equipment and the new way of working around this. Next to training security operators, a lot of technical knowledge of integration between components is obtained by various types of stakeholder parties, training (external) maintenance crew, BI specialists and for example asset managers, **Alexander Dilweg** explains. He adds: “at Rotterdam the Hague, guidance in our trial and first phase of deployment was especially provided on the equipment and technical part of the implementation project.” an asset manager is the point of contact for all parties including the security operator, the OEM, maintenance crew and other internal and external parties. On behalf of their security department Alexander has been supporting the RTHA asset manager in terms of procedures, process changes and system functionalities, acting as a sounding board for the installation.



## Training planning

**Alexander Dilweg** further specifies their change towards CT (and ATRS' and Security Scanners) at Rotterdam the Hague Airport: “for our operators the change was experienced as a big one and was felt across the complete group of security operators over the first months of operation.” It denotes the demand for accurate planning, to provide for a security operation that is staffed with enough trained personnel at the right phase(s) of deployment. The focus areas for planning operator training are versatile, but in the basis include size and compositions of teams for example. **Jan Cuypers** (Securitas Transport Aviation Services) gives his perspective: “We did see that there was a factor that influenced the speed of adoption of working with CT, namely age. The

younger the operator, the faster they were able to start using the technology. Although it has not been proven scientifically, we had the impression that the younger operators were more at ease on a technical level (use of mouse, touchscreen, etc.) and were able to adapt faster to the 3D possibilities of CT.” Next to generation differences, also frequencies of training are important for overall planning. The following points might require some attention when planning for training operators on CT screening.

- Assessing the size and variance of your operator workforce that needs CT training. Doing so, a good overview can be defined for the efforts to take.
- Compositions (different generations, experience levels, authorizations etc.) and sizes of groups can then be defined based on ideal group characteristic and dynamics. Sufficient level of interaction is seen to be impacted by size and experience levels.

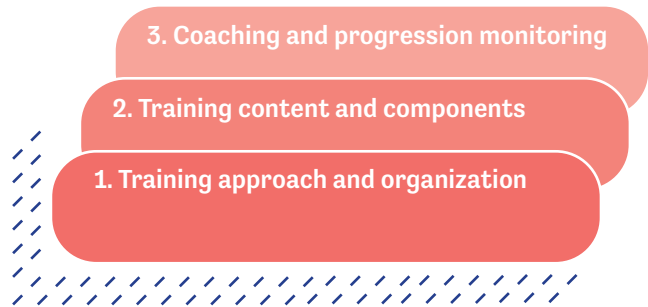
- The frequency of training (that might differ per operator) and duration of the training. This ranges from a couple of hours to two days, depending on operator experience and generation differences.
- Security personnel of bigger airports tend to be more acquainted with transitions and change and adapt faster.
- The master planning of equipment roll-out is leading in the planning for training operators. That means, at all times, training planning should provide for a sufficient number of trained CT operators.
- Whenever an airport outsources the security task, it can be picked up by multiple security companies simultaneously. Security companies can differ in HR policy and their working instructions and planning models. For this reason, there should be a consensus in the way training is being done, which can result eventually in stable screening results among operators from different security companies.

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## >> Next part: CT Image analysis, training- content and components

### Read all three parts of this paper

The content of this paper is built around three main pillars deep diving into the operator training perspective when transitioning towards CT. At first, the organization around training programs is looked at, setting the context and requirements for a CT training program. Then, focus is on the content of training and the actual transition of moving from 2D to 3D image analysis. At last, a perspective on the continuous monitoring and enhancement of operator performance is discussed.



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