TUDOR TECH ITALY

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AIRPORT & SEAPORT SECURITY

HOMELAND PROTECTION

BORDER SECURITY

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Flagship patent : **Tudor Tech AERIA DV** Video Presentation Link

- The only aircraft scanner in the world
- Grand Prix of the 41th International Exhibition of Inventions of Geneva 2013

The Grand Prix of the 41st International Exhibition of Inventions of Geneva 2013

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Tudor Tech Aeria DV

TUDOR Tech AERIA DV Dual View scanning solution bring s finally the technology support in the Preventive Security Measures, as recommended by ICAO Annex 17 expanding the Measures Relating to Aircraft Security close to 100 confidence in security screening, to ensure and guarantee that civil airplanes, as main vector of air transportation, are secured and safe to fly.

IATA | Strategic Partner

Capable to detect sub millimeter objects and eventual mechanical or structural anomalies of the aircraft!

Dual View imaging system top view and side view
Dual energy imaging system material separation

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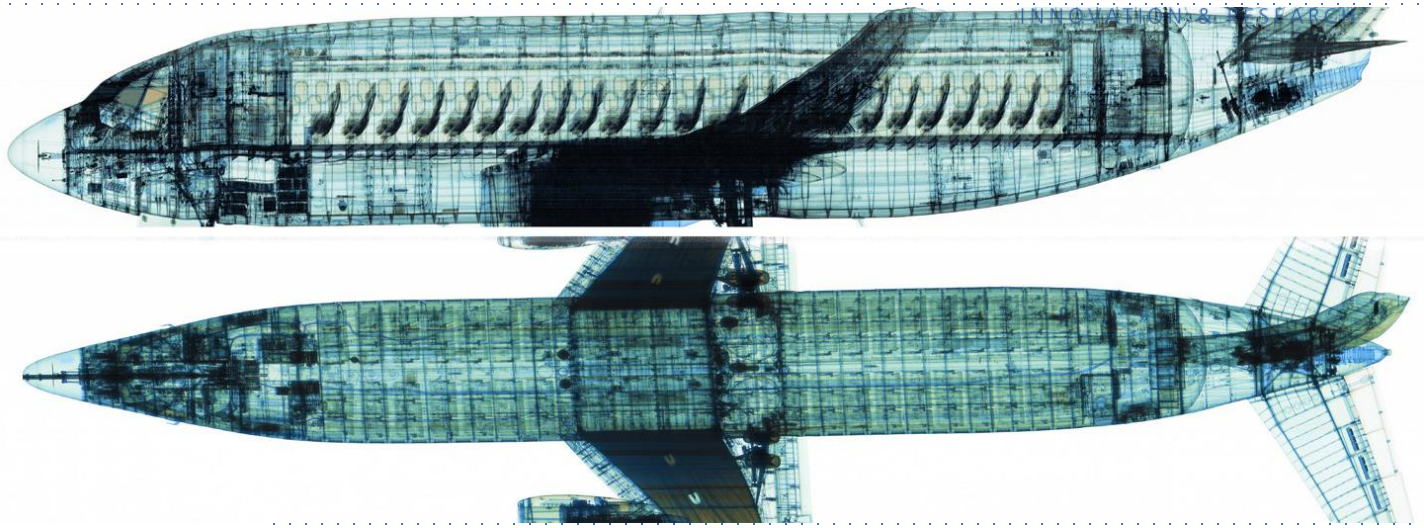
Tudor Tech Aeria DV

Performance Specifications



Imaging performances

Steel penetration:	50mm;
Penetration in Aluminum (Al):	230 mm;
Wire resolution:	0.5 mm (AWG 24);
Contrast sensitivity:	4%;
Material discrimination capability:	Three classes: organic, inorganic, metals;
TIP (Threat Image Projection):	Optional.

Operating performances

Size of the scanned aircraft:	from small business aircrafts until short to medium range aircrafts like A-320 or B-737;
Triangle Scanning Frames:	- maximum size of Top View frame: 10,3 m (w) and 14,2 m (h) - maximum size of Side View frame 49,4 m (w) by 7,8 m (h); Other scanning frames dimensions by request;
Scan mode:	Aircraft tugged through the scanning frame;
Throughput:	3 short to medium range aircrafts / hour 6 small business aircrafts /hour;
Deployment/stowing time:	Less than 30 minutes;
Operating personnel:	One process operator and one image analysis operator;
Remote operation:	Yes, by wireless LAN connection or broadband INTERNET connection (optional);
Anti-collision protection:	Yes;
Special Features:	Data integration in an higher level Command and Control Centre (optional);
Continuous Operation:	24 / 7 / 365.

Safety

The dose at the limit of the Exclusion Area:	less than 1 mSv/year, according to IAEA, GSR3;
The dose inside the Command and Control Center (CCC):	less than 1 mSv/year, according to IAEA, GSR3;
The dose on scanned aircraft:	less than 10 µSv/scan;
Megapixel Video Surveillance Subsystem:	Yes (standard);
Personal Radiation Monitor:	Yes (standard);
Optic and Acoustic Warning Signals during Scanning:	Yes (standard);
Automatic Protection of the Exclusion Area:	Yes (standard).

Environment

Operation Temperature range:	-15°C ÷ +45°C standard
Extended temperature range:	available by request
Storage Temperature Range:	-25°C ÷ +60°C standard
Relative Humidity:	Max. 98% non-condensing

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Tudor Tech Aeria DV

The key advantages of TUDOR TECH AERIA DV system

> Optimized for entire aircraft screening: the vertical and horizontal scanning frames will deliver clear dual-view radiographies of the fuselage and wings, generating high resolution images with unparalleled details, offering to the end users an essential tool for security applications;

> Complete scan of the aircraft fuselage in a single pass through the screening frame and, depending on the aircraft size, complete wings scan with additional passes;

> Unparalleled tool for fast clearing of aircrafts under bomb threat;

Operational concept

a. Main components:

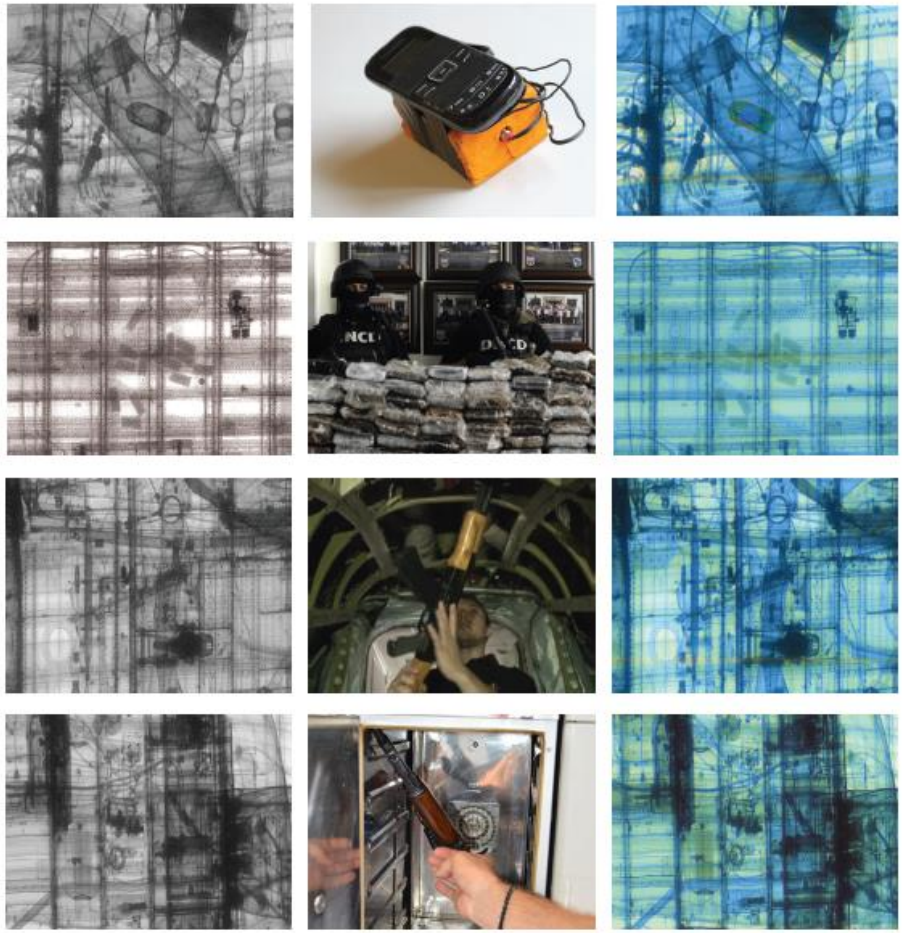
1. Mobile scanning unit – integrating the top view X-ray generators and the side view detector boom;
2. Second X-ray generator for the side view
2. Portable remote operation console;
2. Detector modules with crossing ramps for the top view;
3. Aircraft tug mobile unit;
4. Safety and security systems - portable Automatic Protection of the Exclusion Area (APEA) system, video surveillance system.

b. Configurations and operating sequences:

1. Transport configuration - the mobile scanning unit is loaded with all the components of ROBOSCAN AERIA DV ready to be driven to the scanning destination.
2. Scanning configuration - the components are unloaded from the mobile unit and deployed in designated positions according to the deployment sequence.

Weapons (behind 12 mm of steel plates) and other suspect items concealed within aircraft fuselage

X-ray standard view: | Dual-Energy X-ray material discrimination view:



Tudor Tech Aeria DVM (Military)

Video Presentation Link

The availability and safety of military aircrafts are critical issues, sometimes impossible to be managed in short time in the theaters of operations. **Tudor Tech Aeria DVM** solves this problem, offering to its user the unique solution to scan in minutes the fuselage and wings as complete inspection and assessment of damages of an helicopter or airplane after combat missions.

Derived from the award winning **Tudor Tech AERIA Technology Platform**, the system allows operators to obtain simultaneously a top view and a side view of the radiographed aircraft, in order to detect the destructive effects of bullets or any other objects penetrating the body of the flying equipment.

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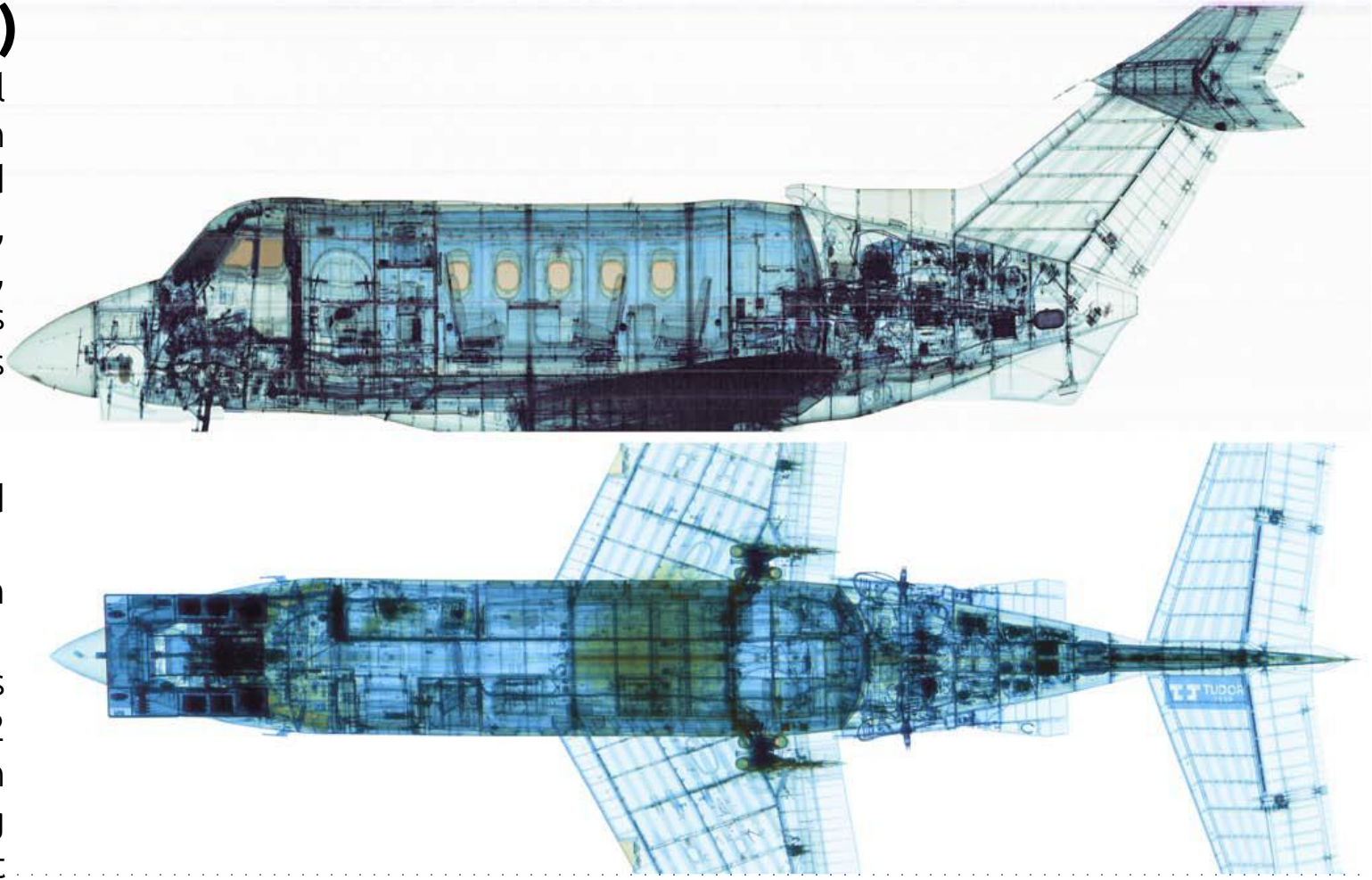
Tudor Tech Aeria DVM (Military)

The dual view imaging system combined with dual energy material discrimination capability can reveal, down to millimeters size resolution, all kind of damages of critical parts like electric wires, pipes, tubes, commands, electronic boards, hydraulic/pneumatic components, damages generated by bullets or any other foreign objects penetrating the body of the aircraft.

The dual view imaging system allows a fast and accurate diagnosis of the integrity of the aircraft regardless the direction, orientation and position of the bullets and their trajectory.
The system is assembled on a military spec chassis and can be deployed in less than 30 minutes by a 2 member crew team, being capable to operate even in the theater of operations. The whole scanning process is remotely controlled with minimal impact for routine operations on the airfield premises, with no human exposure to ionizing radiations.



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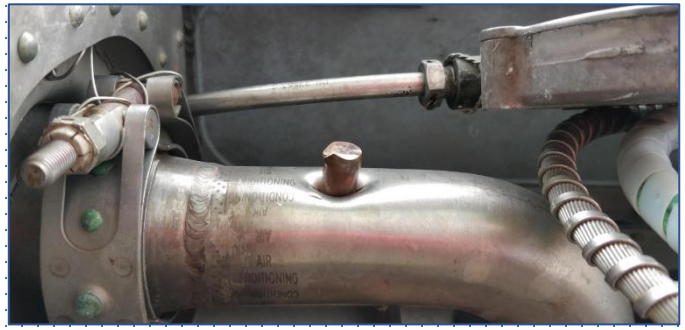
Tudor Tech Aeria DVM (Military)

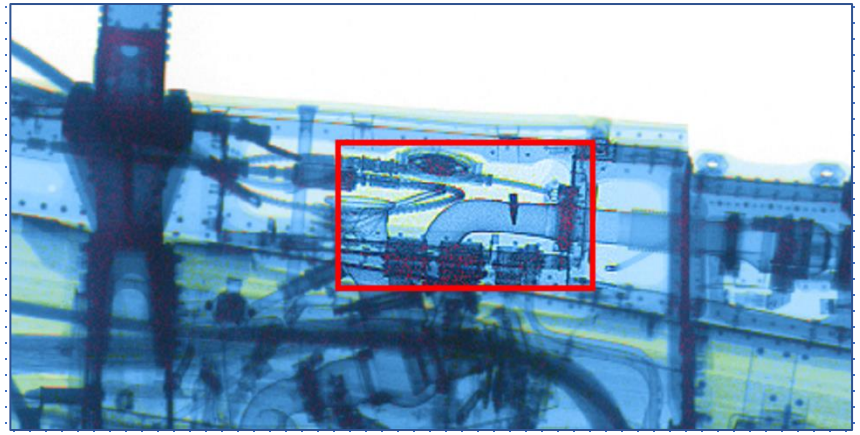
Examples of bullets' impact:

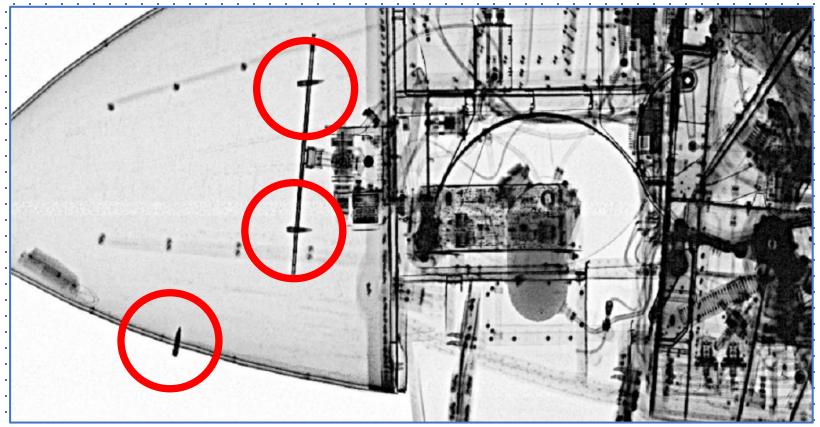
X-ray standard view

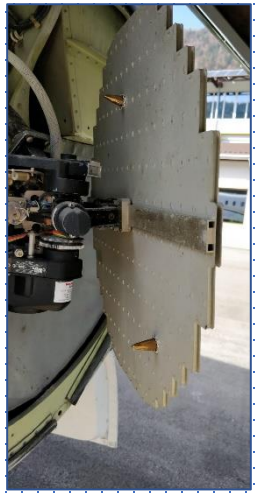
Bullet Picture

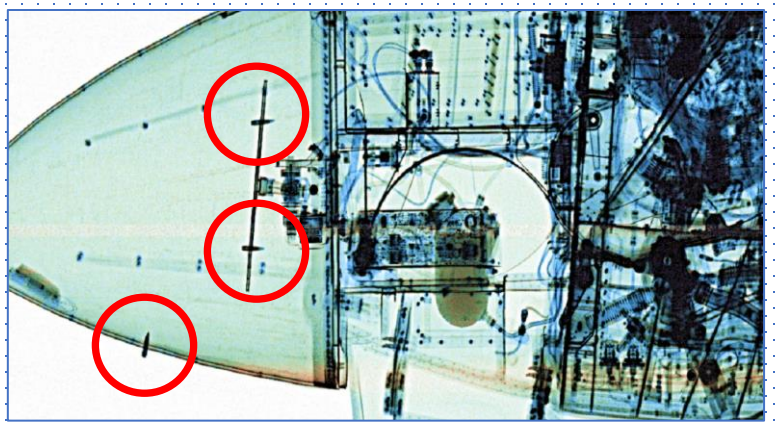


Material Discrimination View





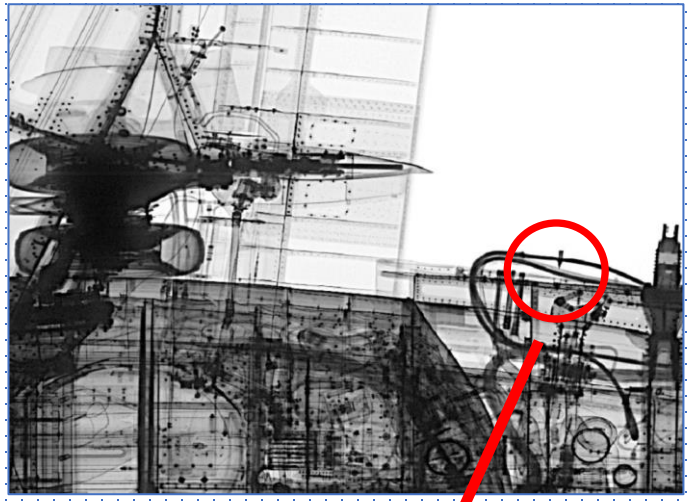


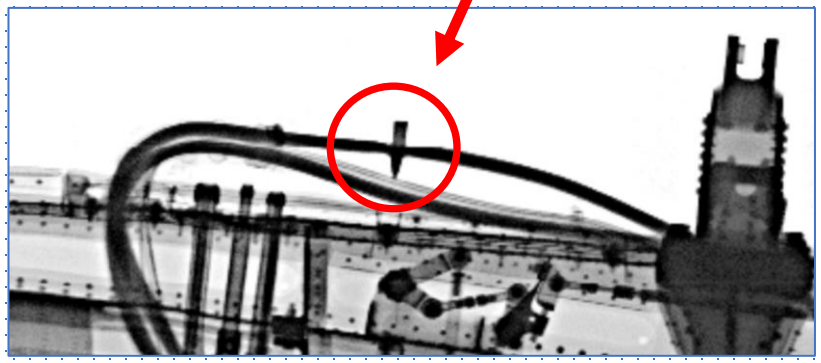


Tudor Tech Aeria DVM (Military)

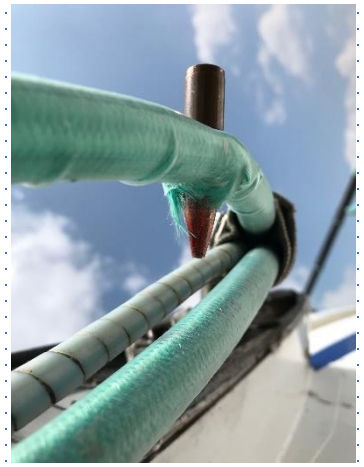
Examples of bullets' impact:

X-ray standard view

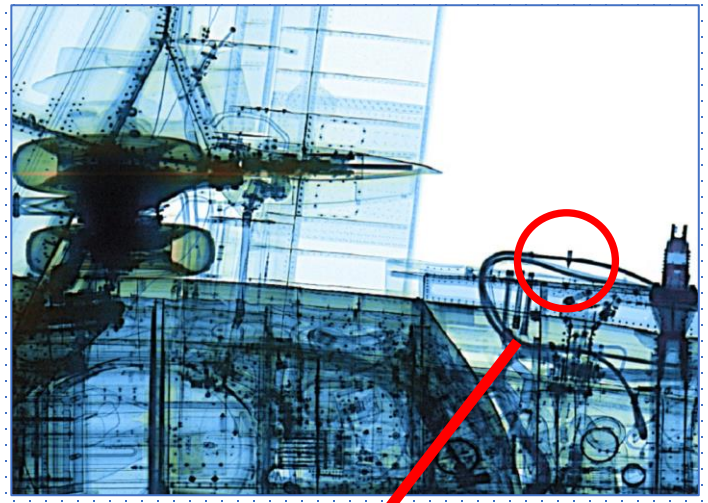


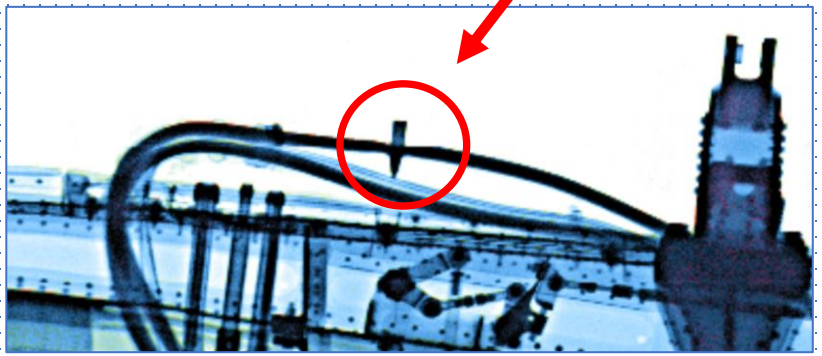


Bullet Picture



Material Discrimination View

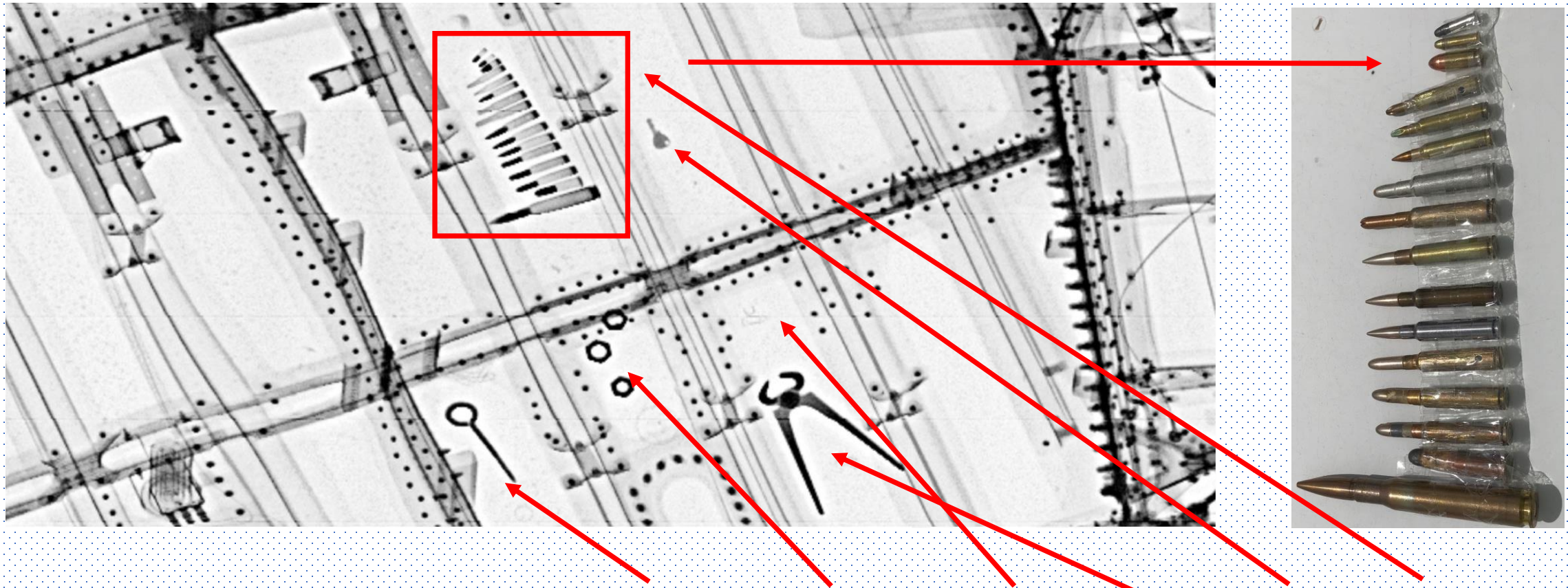




Detailed view (Zoom)

Tudor Tech Aeria DVM (Military)

Maintenance, Repair and Operations Inspection Scan:



Detecting forgotten, lost or loosen objects: securing pin, fixing nuts, paper clips, pliers tool, small key, bullets

TUDOR TECH ITALY

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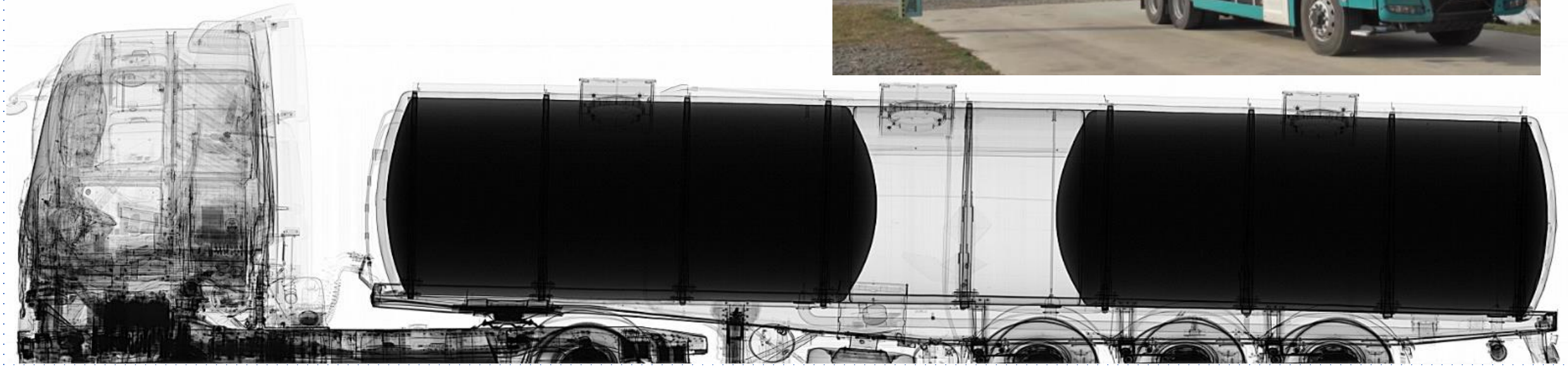
Tudor Tech ML64

Video Presentation Link

TUDOR Tech ML 64 is a mobile high energy LINAC X-ray screening solution for trucks and containers non intrusive inspection in border crossing points, seaports, airports access points, military bases or any other high security areas. The scanner provides the radiographic image of the scanned object (goods loaded in container or truck) by using a dual high energy linear accelerator (with material discrimination). It can be used as a mobile scanner for image performances optimization, or as fix scanner for throughput optimization. In mobile mode is fully robotic without any human presence inside the scanning area.



TUDOR TECH ITALY

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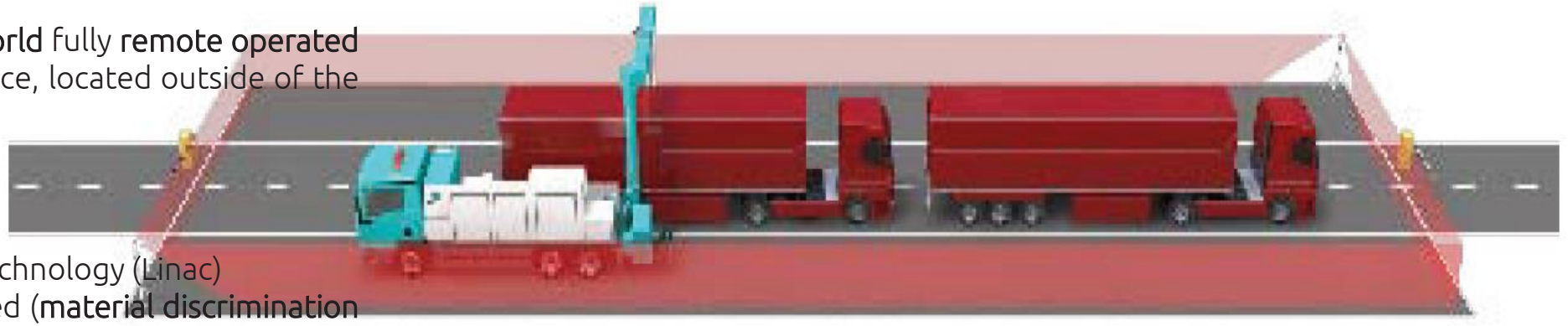
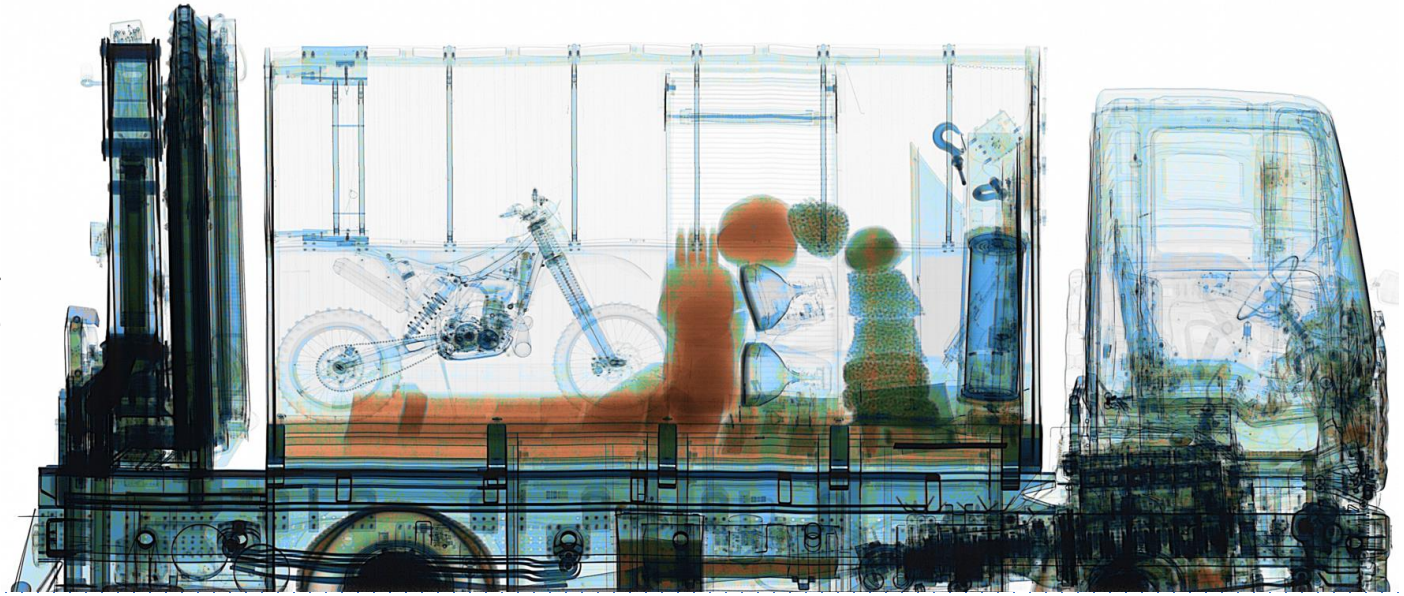
Tudor Tech ML64

The **only Linac mobile scanner in the world** fully **remote operated** by a single operator from a safe distance, located outside of the Radiological Exclusion Area.



<u>Specifications:</u>

- - **Linear accelerator** state of the art technology (Linac)
- - 4/6 MeV high energy X-ray, interlaced (**material discrimination view**)
- - Mobile
- - Steel penetration: **min 320mm** (up to **max 345mm**, depending on Radiological Requirements) acc. to ANSI N42.46-2008
- - High Contrast Sensitivity : **< 1%**
- - Wire resolution: **< 1.2mm**
- - Scanning modes: mobile - one target (**One by One**), mobile - multiple targets in a row (**Sequential**) and stationary (**Drive Through**)
- - Throughput : 30 to 180 trucks/containers/hour acc. to the length of each scanned targets, scanning mode and Radiological Requirements



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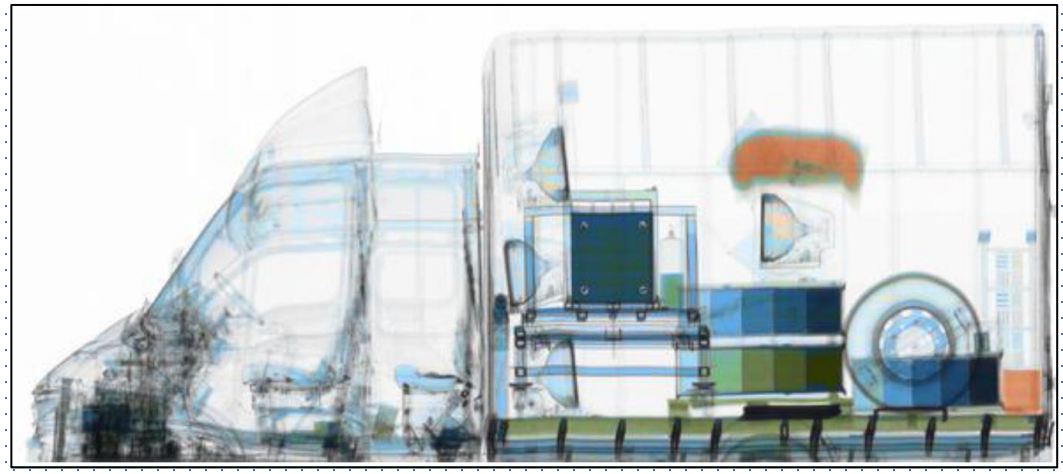
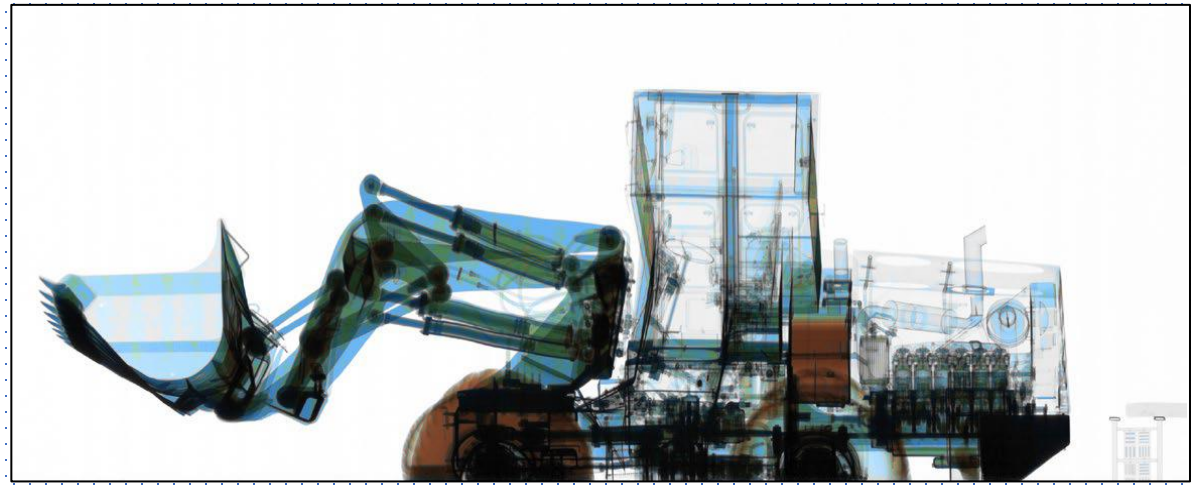
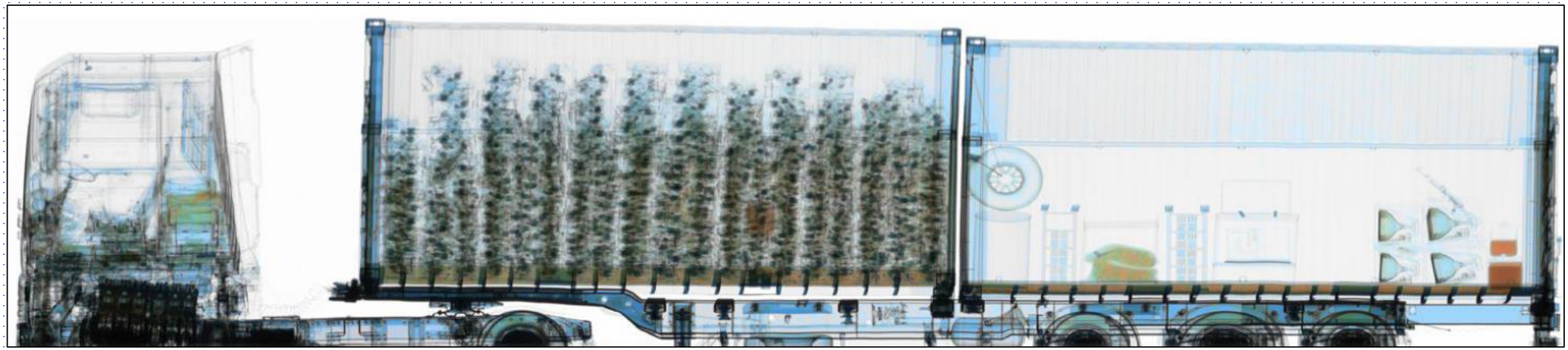
Tudor Tech ML64 - Radiographies







Tudor Tech PL64

Tudor Tech PL 64 is a **high throughput, high energy** LINAC X-ray screening solution, cost effective and optimized solution for container and trucks non intrusive **drive through** fast inspection in border crossing points, seaports, access points in military bases or any other high security areas.

The main advantage is the high flexibility of the solution meeting all customer requirements, in terms of performance, reliability and cost operation.

Tudor Tech PL 64 was designed to provide **high radiographic image quality** and unparalleled high throughput of up to **200 trucks/containers per hour**, avoiding traffic jam at the control site entrance.

TUDOR TECH PL64

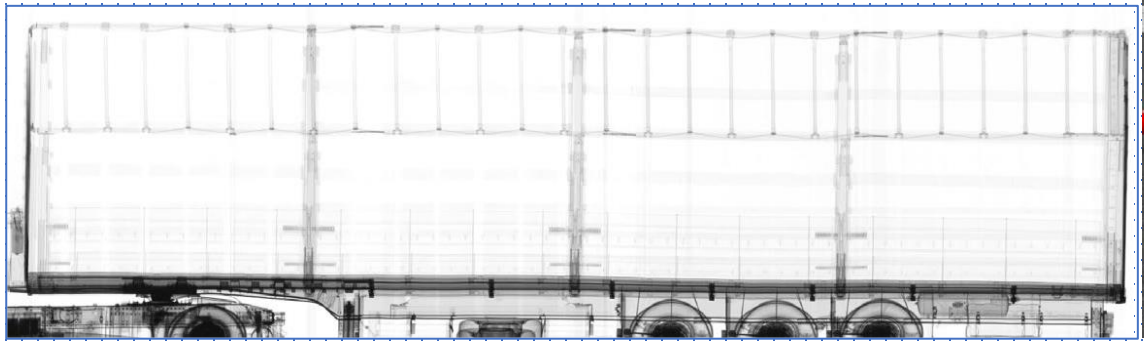
FIX X RAY IMAGING SYSTEM FOR TRUCKS AND CONTAINERS

Tudor Tech PL64

In **Drive Through** (Portal) scanning mode, the inspected vehicles are driven by their drivers through the scanner.

In this case, the requirement is to exclude the driver cabin from scanning and to scan just the cargo. **Or** (depending on local regulations) to scan just the cabin of the target with **low dose-low energy** X-ray and, after the end of the cabin is detected (by a dedicated detection subsystem), to automatically switch the X-ray beam to **high energy** in order to scan just the **cargo**.

The cabin detection subsystem is composed from different safe sensors, which are enabling the high energy X-ray exposure just *after* the cabin (and driver) of the inspected vehicle have passed through the portal.



Tudor Tech GL64

Tudor Tech GL64 scanning system is based on Tudor Tech's award-winning screening technology and comes with impressive image analysis capabilities that ensure the highest productivity for cargo inspection applications without compromising the safety and security of the operators.

Being a LINAC based, high energy X-ray screening technology, the system specifications are:

- Energy: **4/6 MeV**, Linac generated, interlaced X-ray (providing material discrimination capabilities)
- Steel penetration: **up to 350 mm**
- Wire resolution in air: **1.2 mm**
- Contrast sensitivity: **<1%**
- Spatial resolution (horizontal): **4 mm**
- Spatial resolution (vertical): **3 mm**
- Material separation: **4 classes** (organic, inorganic, metals, heavy metals)

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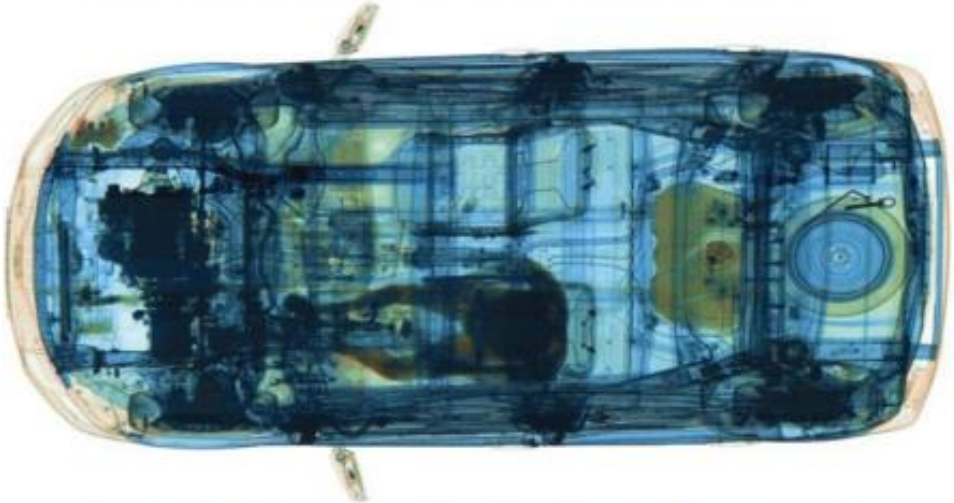
Tudor Tech OCV [Video Presentation Link]

TUDOR Tech OCV is a safe and cost effective scanner that achieves top imaging performance with an extremely low radiation dose for the vehicle occupants equivalent to the dose received during only 1 minute flying at 10 000 m altitude.

Developed with a constant focus on high performance and reliability, it can scan up to 400 vehicles per hour in search for contraband or threats such as weapons, improvised explosive devices, cash money, hidden persons, dirty bombs, etc.

TUDOR TECH OCV

X-RAY SCANNER FOR OCCUPIED CARS AND VANS



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Tudor Tech OCV

TECHNICAL DATA

GENERAL SPECIFICATIONS

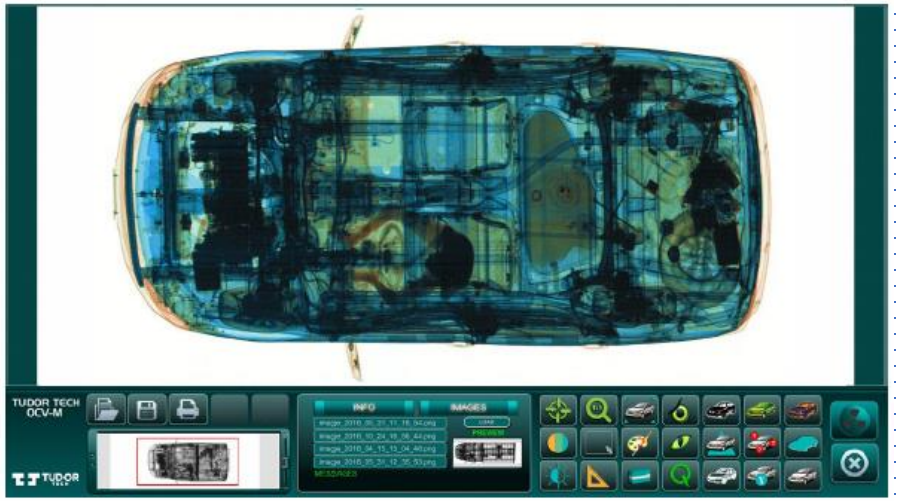
Scanning tunnel:	3.20 m width; 3.75 m height
Portal dimensions:	4.50 m width x 5 m height
Exclusion Area:	max. 10 m width x 10 m length; it can be reduced depending on the required throughput

IMAGING SPECIFICATIONS

X-ray generator:	300 kV
X-ray beam orientation:	Vertically downward
Steel penetration:	60 mm
Wire resolution:	0.5 mm (AWG 26)
Spatial resolution:	2 mm
Material discrimination:	Three material classes (Organic/Inorganic/Metal)

OPERATIONAL

Throughput:	400 vehicles/h
Scanning speed range:	5 - 15 km/h
Personal required:	1 operator for process control and image analysis. The operator is located outside of the Exclusion Area, inside the Command and Control Center (CCC).
Operator workstation:	Two display, Full-HD professional monitors (one monitor for image analysis and one for CCTV surveillance) One touch-screen monitor for the software control application Multiple image analysis workstations (optional)
Operating Software:	In-house developed ergonomic software interface Low-fatigue design of the graphic user interface Touchscreen operation (optional) Automatic archiving of scan data in user defined database Proprietary image processing filters High quality images of the vehicle and the held objects Possibility to change scanning directions: YES (optional)



Additional info:	Video camera and LPR camera for recording and saving the vehicle's type, model, plate no. and vehicle's entry time Negative filtering technology. Warning alarms for the non penetration areas

HEALTH & SAFETY

Radiation safety:	Compliant to IAEA, WHO and EU guidelines Compliant to ANSI N43.17
The dose at the limit of the Exclusion Area:	less than 1 mSv/year, according to IAEA, GSR3.
The dose inside the CCC:	less than 1 mSv/year, according to IAEA, GSR3
The dose for vehicle's occupants:	100 nSv / scan

Optic and Acoustic Warning Signals during scanning

ENVIRONMENTAL SPECIFICATIONS

Operating temperature: -20 to +55 °C; extreme temperature kits available
Humidity: 0% to 100%

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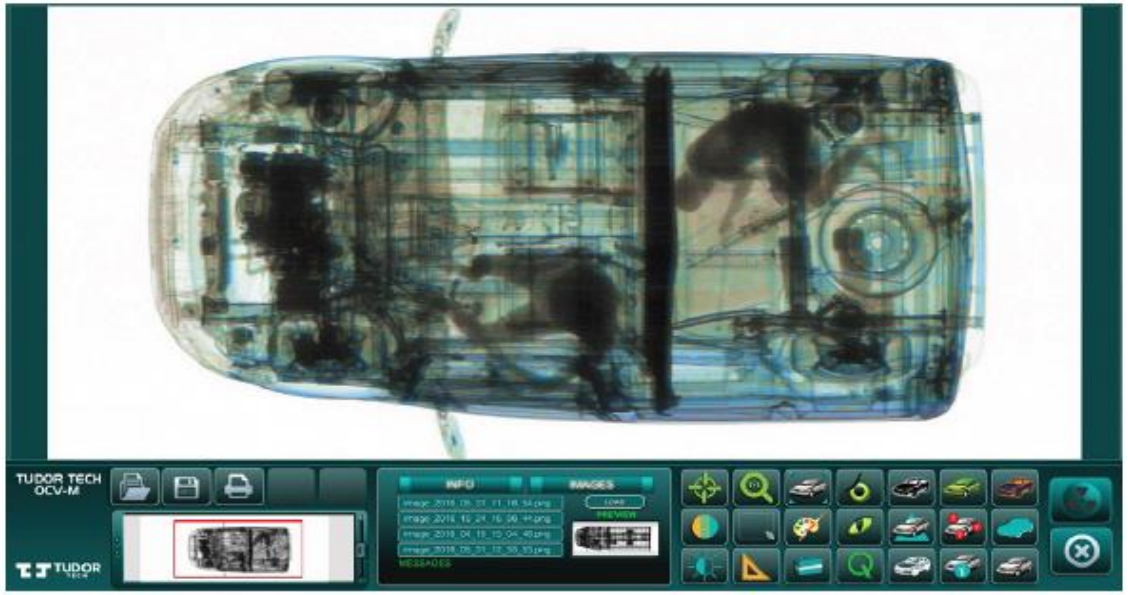
Tudor Tech OCV-M [Video Presentation Link]

TUDOR Tech OCV-M uses transmission imaging, a top-down oriented X-ray generator and optimized geometry in order to provide high-resolution images of vehicles driving through the virtual scanning frame. The dimensions of the scanning frame are adjustable and ensure that any vehicle dimension is scanned with the highest efficiency and the best possible image is provided to the operator which is locate inside the remote Command and Control Center (CCC).

The dual-energy imaging provides organic / inorganic material separation for fast identification of threats such as explosives or other IED components. It also gives the operator an important tool to identify other dangerous items such as weapons or contraband.



TUDOR TECH OCV-M

X-RAY SCANNER FOR OCCUPIED CARS, VANS AND LIGHT TRUCKS

Tudor Tech OCV-M

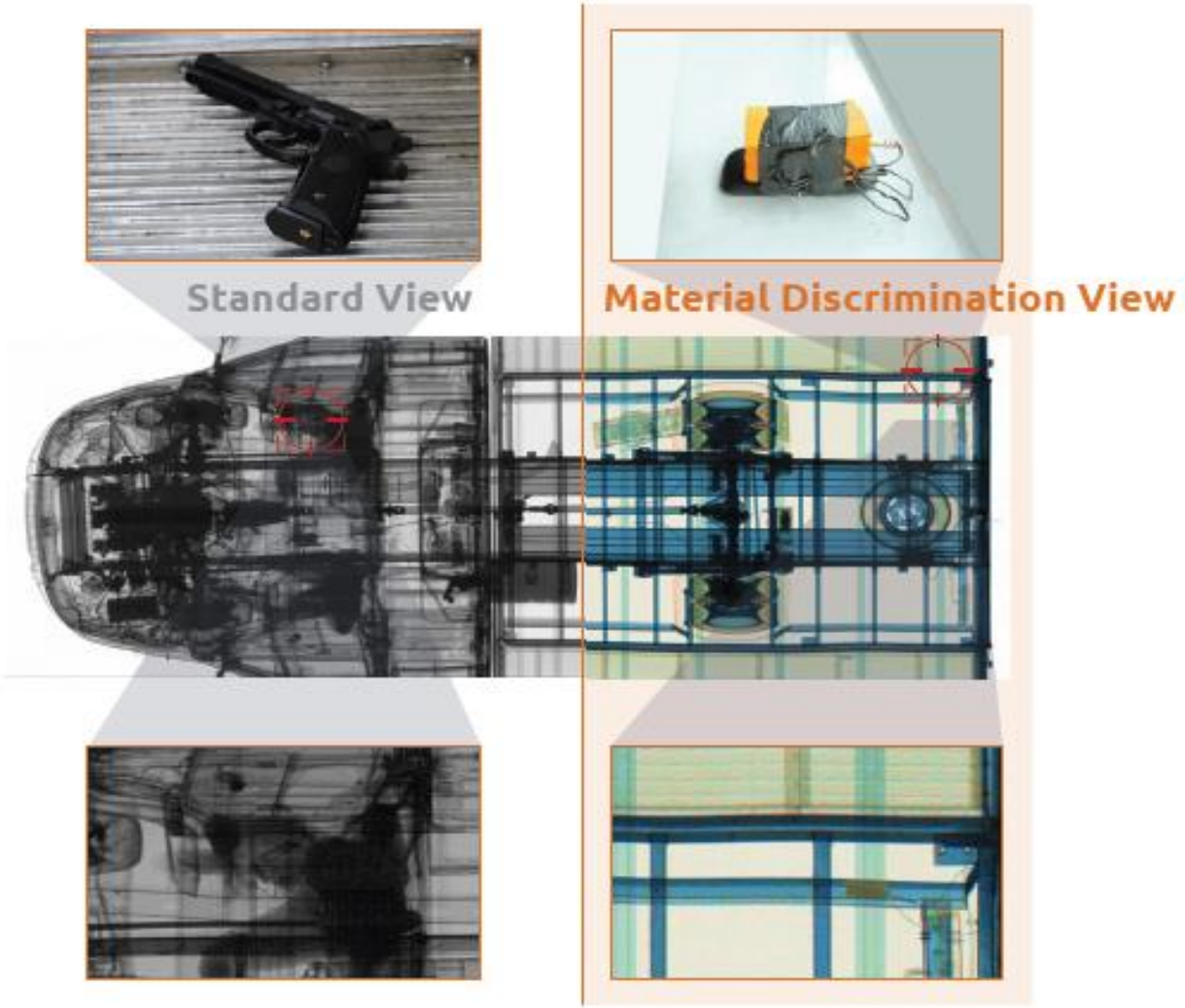
Functionality and operation

TUDOR Tech OCV-M is the perfect choice for any temporary security applications due to its extreme mobility and achieves very high throughput thanks to its advanced imaging technology and traffic management system. The traffic management subsystem identifies vehicles through automated license plate recognition (LPR).

The proprietary ultra-slim detector unit can handle even the most extreme weights and is derived from TUDOR Tech's unique aircraft scanning systems.

Further integration possibilities are available such as automatic interrogation of law enforcement databases – this allows the operator to have real-time extensive information about the vehicle: owner, registration date and place, registered color etc.

Based on the information provided by the system, the operator can check quickly if the presented information is in accordance with the reality and has an important tool that can help identify a potential threat such as fake license plates or a stolen vehicle that is often used for terrorist or criminal activities.



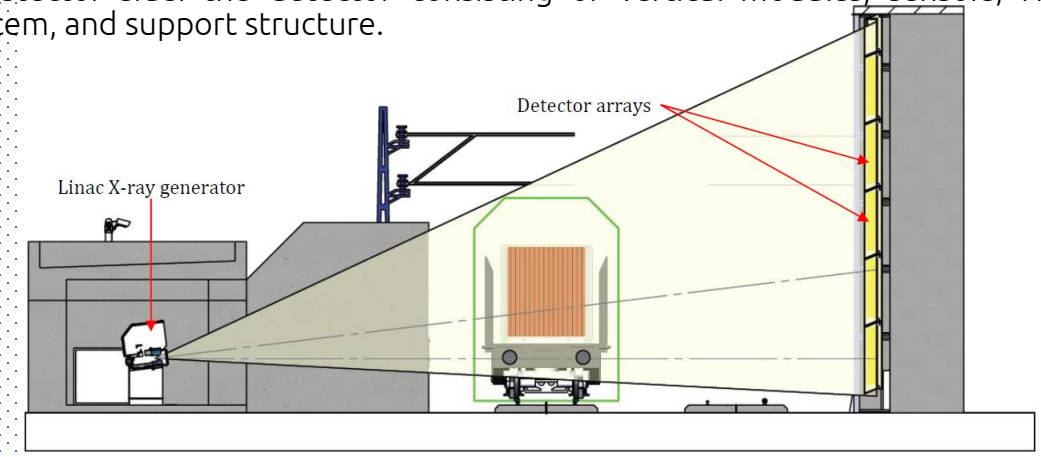
Tudor Tech TL (Linac Train Scanner)

Tudor Tech TL is a X-ray inspection system installed on a platform next to the railway with single/multiple tracks, used for identifying the illegal traffic of threats and goods (drugs, forbidden chemicals and contraband – cigarettes, fuel, alcohol) at border checkpoints/customs and other strategic areas.

The Tudor Tech Train Scanning system is equipped with state of the art technology, interlaced dual energy Linac, and high performance imaging detector system, designed to provide a high penetration and high resolution radiographic image, thereby allowing discrimination of materials by using high energy photons and dedicated proprietary processing algorithms.

The structure and geometry consists of:

- Linac side: Linac building that holds the linear accelerator, modulator, Linac chiller, collimator, sensors, structural supports and automation cabinet.
- Detector side: the detector consisting of vertical modules, sensors, HVAC system, and support structure.



Command and Control Center (CCC)

The Command and Control Center (CCC) is the location from where a scanner is operated.

The CCC mainly consists in:

- Operating workstation with 3 FHD monitors, running proprietary and dedicated software
- Operator console for the scanner
- NAS (Network Attached Storage)
- UPS (Uninterruptible Power Supply) for the IT equipment in the CCC
- Multifunctional printer (to print documents and scan manifest paper)
- Public Addressing system, Intercom
- Ethernet Switch, Industrial Wireless Ethernet Access Point (for mobile scanners)
- Image Analysis workstation (if image is locally analyzed by dedicated analyst, different from the operator)

Command and Control Center (CCC)

For every type of Tudor Tech's scanning equipment, the CCC is placed **outside of the Exclusion Area**, regardless of model.

The Exclusion Area is defined as an area where access of any person (operators or bystanders) is not allowed during the scanning process, in order to prevent any accidental exposure. **Exception:** vehicle driver for Portal mode operation scanning.

The scanning equipment is placed in the Exclusion Area, and, its operation must take place within this authorized area. During the X-Ray scanning, no person may stay inside the Exclusion Area. **Exception:** vehicle driver for Portal mode operation scanning.

The radiation dose at the boundary of the Exclusion Area is below the threshold of 1 mSv/year for public exposure, set by IAEA, according to GSR3. The access to the Exclusion Area is limited by either physical means (barriers, fences, walls) or by the Automation Protection of the Exclusion Area (APEA subsystem comprised of Infrared Barriers which are automatically stopping the X-ray generation and any scanner movements when intrusion is detected).

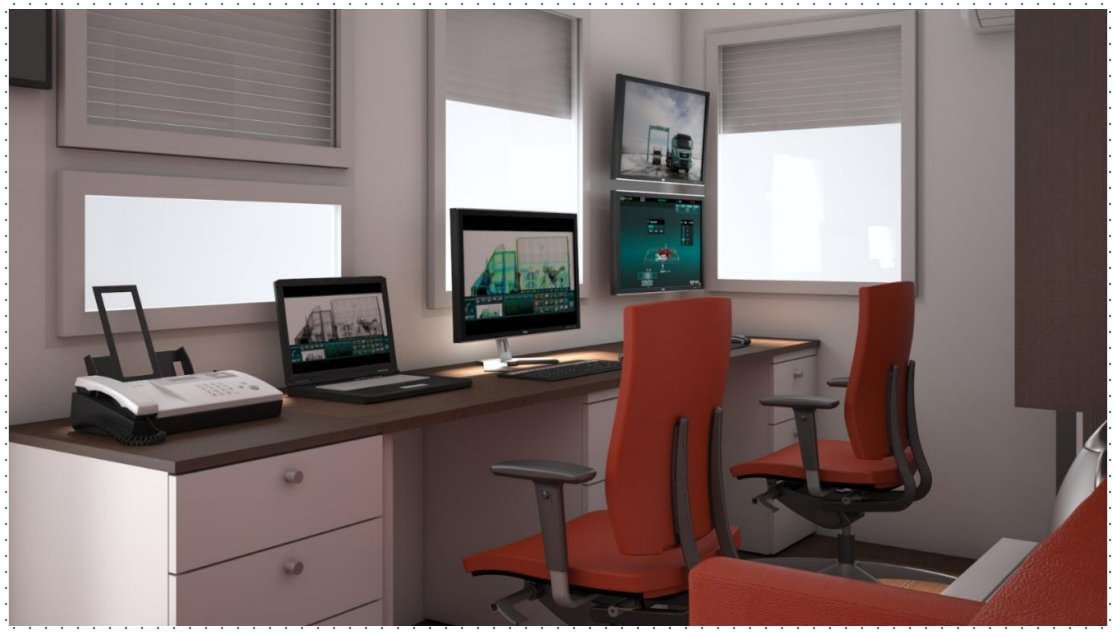
Command and Control Center (CCC)

Depending on application specific and requirements, the Command and Control Center (CCC) could be:

1. A Fixed CCC (FCCC) : arranged in a pre-existing building or office in the scanning area with direct view to the scanning site.
2. A Container CCC (CCCC) : the CCC is arranged into a container which is placed in the scanning area with direct view to the scanning site

FCCC

CCCC



Command and Control Center (CCC)

3. Mobile CCC (MCCC) : the CCC is mounted into a dedicated VAN vehicle which is placed in the scanning area with direct view to the scanning site (option for the mobile scanners).
4. A Portable CCC (PCCC) : the CCC's IT equipment is simplified and is mounted inside a rugged case (option for the mobile scanners).

MCCC

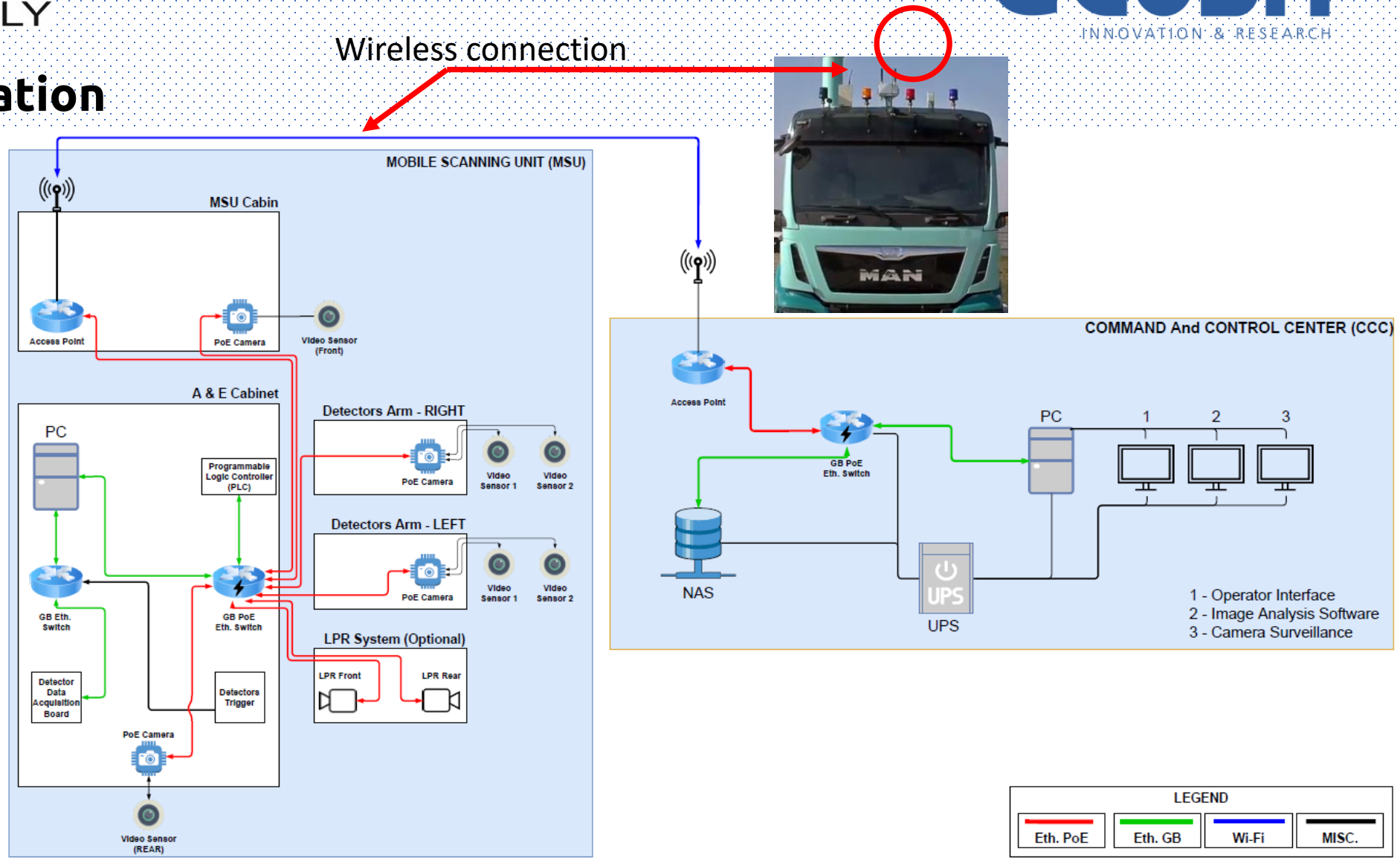
PCCC

Wireless Communication

The mobile scanners are remotely operated from outside of the Exclusion Area, from the Operator Interface software via Industrial Secured Wireless Access Points.

The MSU (Mobile Scanning Unit) is moving inside de scanning area, without being connected by wires to the CCC.

The connection between the MSU and CCC is an Ethernet connection, accomplished by means of two MOXA Outdoor, Industrial, Secured, Encrypted Wireless Access Points (one being mounted on the MSU's cabin and one being mounted on the CCC).

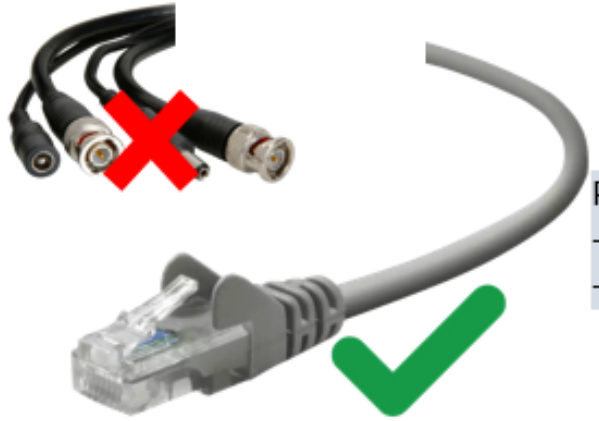


Wireless Communication

CCC communicates with the scanning equipment through industrial, encrypted Ethernet connection:
- Wireless, via secured high-speed Wi-Fi, for the mobile platform scanners;

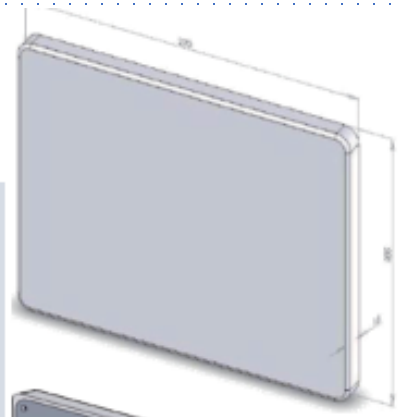
Wireless access point, with Omni-directional antennas.

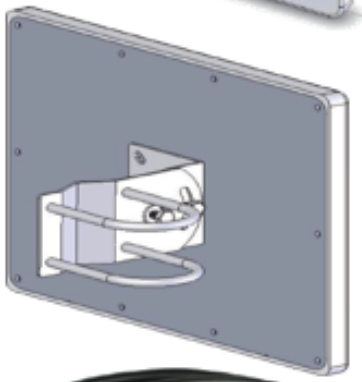
PoE Switch



Power over Ethernet:
- Faster, simpler deployment
- Decreased infrastructure costs

Wireless directional antenna, which can be mounted on poles or custom-made mounts, depending on customer specs.





Specific cables connect the AP with the directional antennas.

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Wireless Communication

In standard specification, mobile scanners integrate the MOXA Outdoor Industrial APs as described below, including omnidirectional antennas (on the MSU) and directional antennas (on the CCC).

If there is a special request from the customer to switch the specified APs to a military grade ones, there is the possibility to implement the request via CISCO Unified Wireless Network, or a specific device or producer, provided by the customer. CISCO offers approved networking solutions having military purposes.

Standard specification scanner, MOXA AP

Outdoor industrial IEEE 802.11a/b/g/n wireless AP/bridge/client

- 2x2 MIMO 802.11a/b/g/n AP/bridge/client
- Seamless roaming with Client-Based Turbo Roaming
- Wireless redundancy with AeroLink Protection
- Rugged industrial design with integrated antenna and power isolation
- IP68-rated weatherproof housing designed for outdoor applications and -40 to 75°C operating temperatures
- Avoid wireless congestion with 5 GHz DFS channel support

Turbo Roaming · 802.11 · RF Isolation · AeroLink Protection

Wi Fi CERTIFIED · c UL us LISTED · CE · FC

cisco Solution Overview

Wireless Connectivity for Defense Operations: Optimize Communications

Image Analysis

Setup no. 3 -> Remote Image Analysis Center :

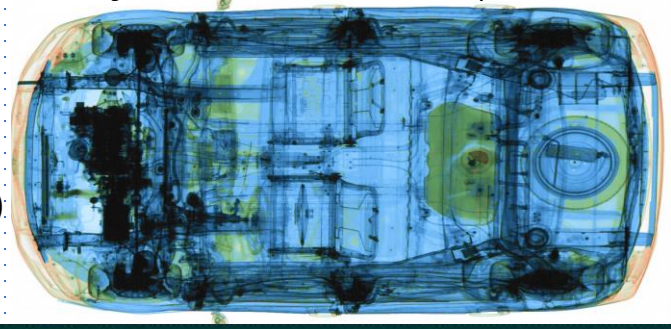
The operators handle **just the scanning process** and the radiographic images are automatically sent to a **remote location**, via secured Internet connection; where **multiple remote analysts** will analyze the radiographic images from **one or more** scanners which, usually, are coming from **different multiple scanning sites** (each scanning site with one or more - the same type or different - scanners, from our scanning products family).

Image Analysis Software Features

Image Analysis Software (IAS) : software application that displays in real time the radiographic image of the target while being scanned.

The IAS integrates a multitude of proprietary algorithms called **filters** which have the purpose of helping the image analyst by enhancing the radiographic image where needed, in order to better search for threats or contraband in the target vehicles.

Material Discrimination View filter (MDV) is present as a standard feature on all Tudor Tech's scanning systems, being a most used feature as it has the capability to detect the nature of the scanned materials by evaluation of the equivalent Z ato
with the following color map:
- Orange: organic (plastic, sugar, explosives, drugs)
- Green: Inorganic/ light metals (salt, aluminum)
- Blue: Metals (steel, copper)
- Purple: Heavy metals (lead, wolfram, available for Linac)



[More information about IAS Features here.]

OCR (Optical Character Recognition)

OCR is a feature comprising two systems : LPR (License Plate Recognition) and CCR (Container Code Recognition – *where applicable*)

Camera module with two video modules that are pre-set.

Infrared (IR) illuminator for better number acquisition

White light (WL) illuminator for 24/7 operation

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ATR (Automatic Threat Recognition)

The ATR (Automatic Threat Recognition) software allows the recognition of some suspect objects like chemical substances, drugs and explosives, weapons, which are automatically marked with a red-colored square frame.

While available, the proficiency of ATR depends on two factors:
- specific cargo properties
- training level of the Artificial Intelligence system (different customers have different interests on targeted objects; the training of the ATR software model is done in collaboration with the customer in order to obtain higher customer-specific accuracy)