Development of the X-ray security screening systems at ADANI

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6th International Conference
"Engineering of Scintillation Materials and Radiation Technologies“ (ISMART 2018)
9 to 12 October 2018

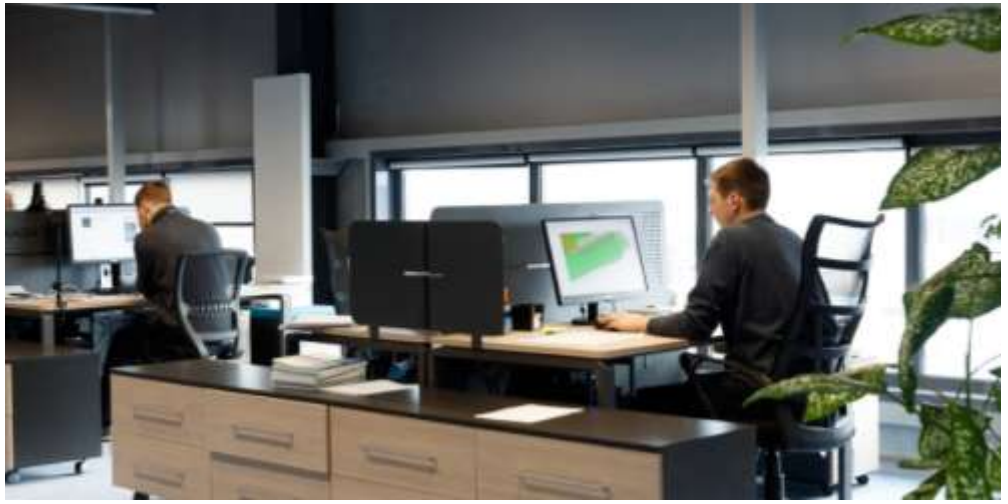
ADANI (established in 1991) is a world-class high-technology corporation with full customer-focused disruptive innovation cycle working in security, medical and safety markets

ADANI IN SHORT

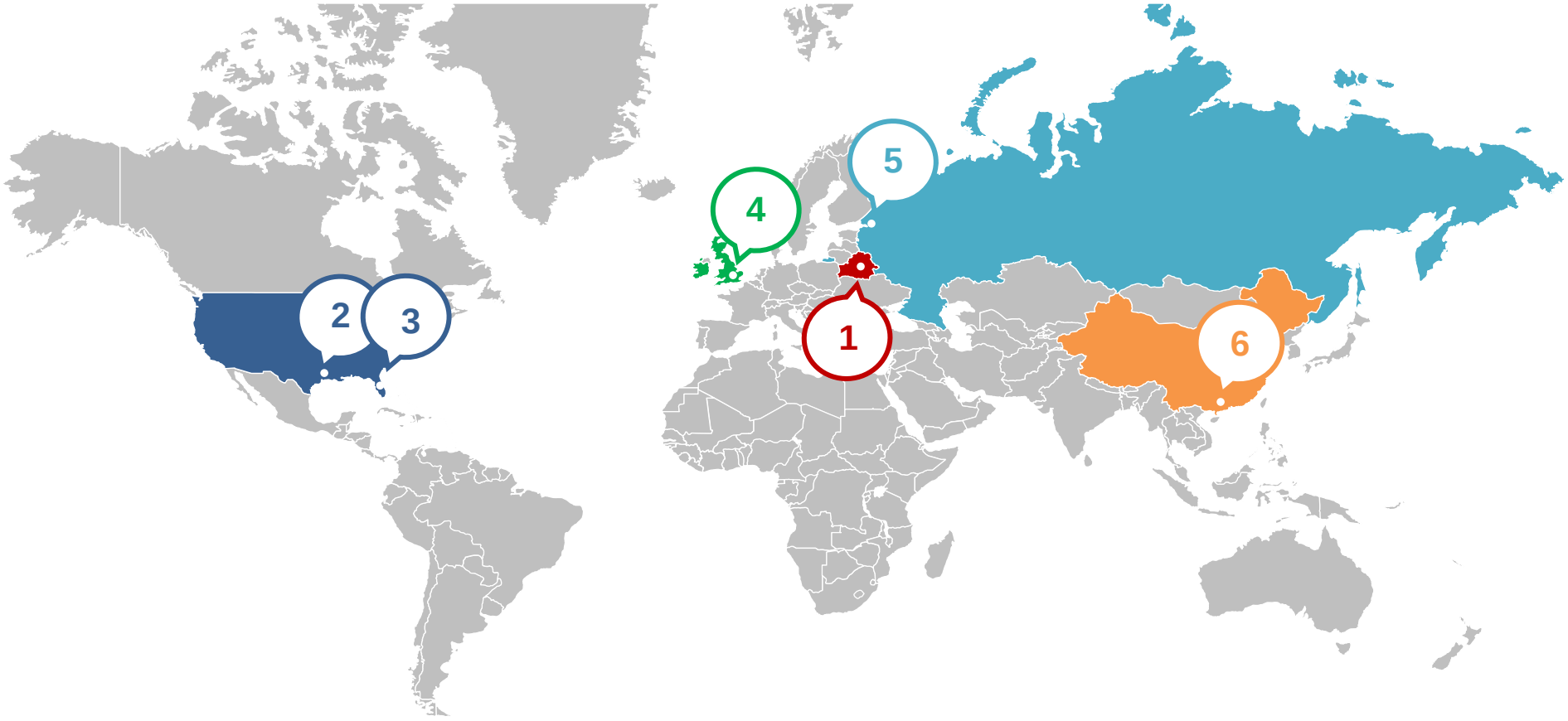
- 25 000 SQM
- Clean laboratory
- 5 X-ray shielded labs
- 100 R&D engineers
- 320 manufacturing specialists
- 600+ employees
- 60+ patents

COMPLETE CYCLE MANUFACTURING

HI-TECH INNOVATIONS CENTER



ADANI INTERNATIONAL SALES AND MARKETING OFFICES



- 1. Minsk, Belarus
  Head office
- 2. Houston, USA
- 3. Miami, USA
- 4. London, UK
- 5. St. Petersburg, Russia
- 6. Shenzhen, China

STRATEGY 2020

VISION

By the year 2020 to become one of the top 100 world-class hi-tech innovation corporations.

MISSION

To create an unrivalled business environment that induces synergy in a generation of breakthrough and disruptive innovations ensuring security and safety of life and health of the people

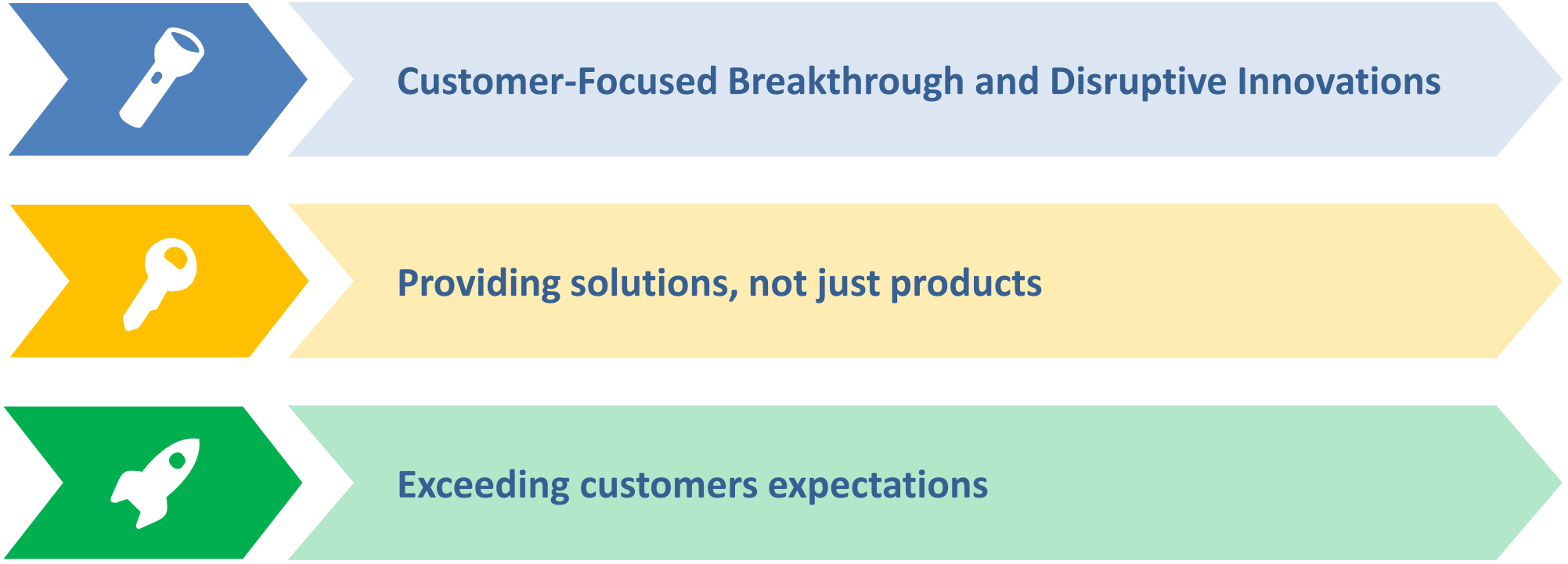
Vladimir Linev

General Director & CEO

STRATEGY 2020

"Customers don't just want products,
they want solutions for their perceived needs"

David J. Teece



ADANI PRODUCTS

SECURITY X-RAY SOLUTIONS	MEDICAL X-RAY SOLUTIONS	BENCHTOP ANALYTICAL EQUIPMENT	NONDESTRUCTIVE X-RAY SOLUTIONS
• Full Body X-ray Security Screening Systems • Parcel, Baggage and Cargo X-ray inspection systems • Preventive Detection and Antiterrorist Systems • Cargo and Vehicle X-ray Inspection	• Low Dose Digital Mammography HD • Radiography and Fluoroscopy • Digital Chest Radiography • Multislice CT scanners • Mobile Healthcare Units • X-ray Superficial Therapy • Artificial intelligence algorithm for image post-processing	• ADANI EPR (ESR) Spectrometer • Gamma-ray Spectrometer (Radiometer) • POWDIX 600 benchtop powder diffractometer	• FlOWD 8020 X-ray flaw detector • Food X-ray Inspection Systems • Electronics and PCB X-ray Inspection • Cabinet X-ray Inspection Systems • Industrial X-ray NDT Solutions • Art Radiography Systems


SECURITY
SOLUTIONS

PEOPLE SCREENING

Full body smart personal inspection technology. Drug detection software.

BAGGAGE INSPECTION

All tunnel sizes: 50x30, 60x45, 60x80
100x100, 175x65, 175x180

VEHCLES INSPECTION

Light and passenger vehicles inspection.
Cargo and trucks inspection.

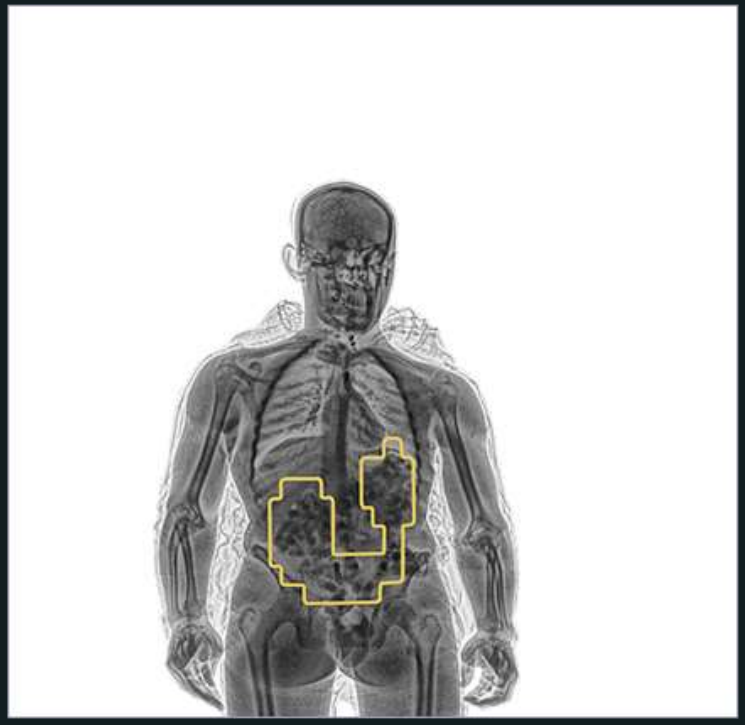
People X-ray Screening

CONPASS full body scanner is a unique X-ray imaging technology for people security screening.

CONPASS has been created to detect concealed weapons, explosives or other contraband for checkpoint inspection at airports, prisons, border crossings and government buildings or wherever high security is required.

People X-ray Screening

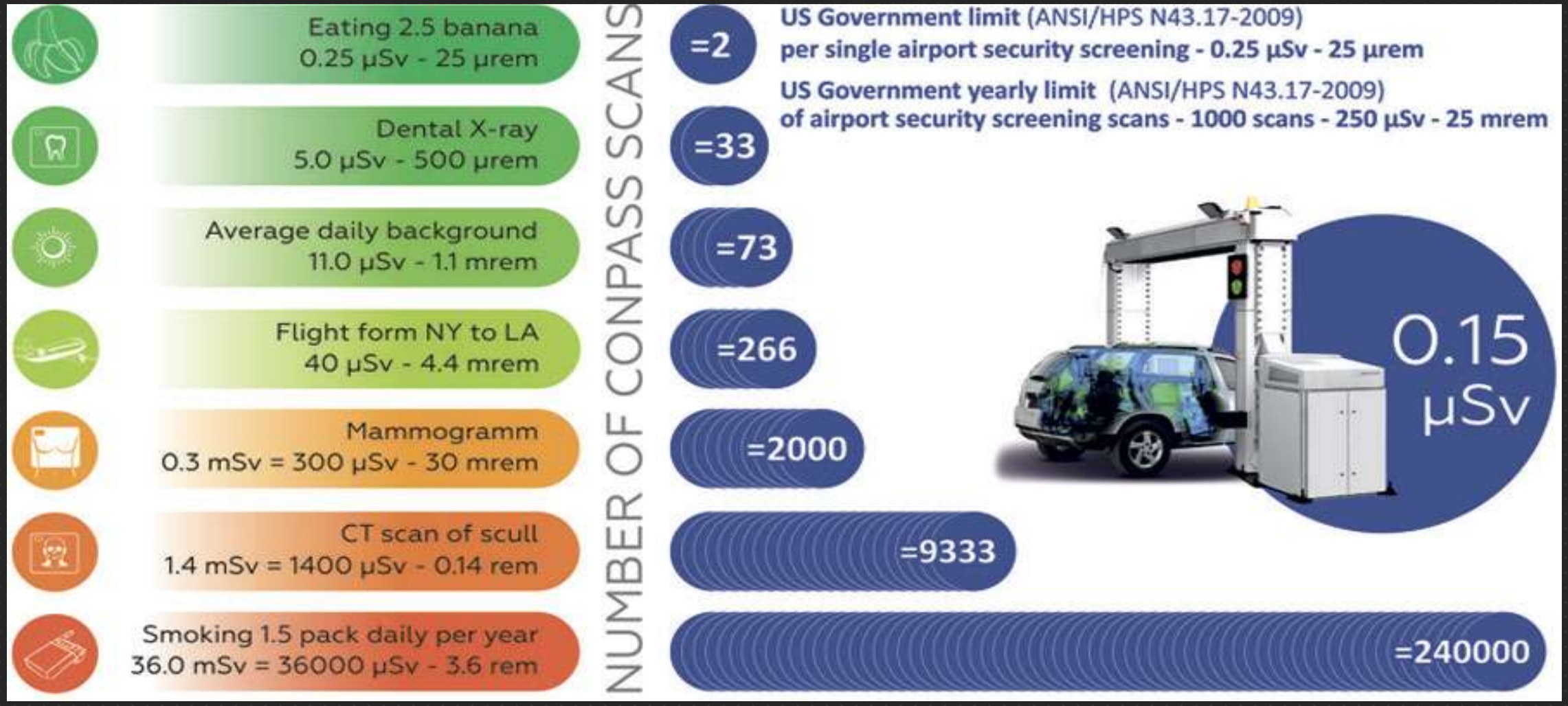
X-ray dose per inspection	0,25 µSv - typically, Fully adjustable 0,1 - 4,5 µSv (depends on X-Ray generator type)
Digital X-ray Detector	832/1408 pixel L-shaped array [Full Body], 448/704 pixel linear array [Torso]
Preset Scanning Modes	3 independently configurable modes
Wire detectability	32 AWG (American Wire Gauge) typical / 38 optional (0,202/0,101 mm)
Image manipulation features	Zoom, b/w reverse, edge enhance, color overlay, auto filters, brightness/contrast
Penetration at steel	34 mm [1.34'']



CONPASS DV (Dual View) security X-ray inspection system offers an optional high resolution image of the torso.

X-Ray Security Screening System Business Unit

Security without compromising safety:

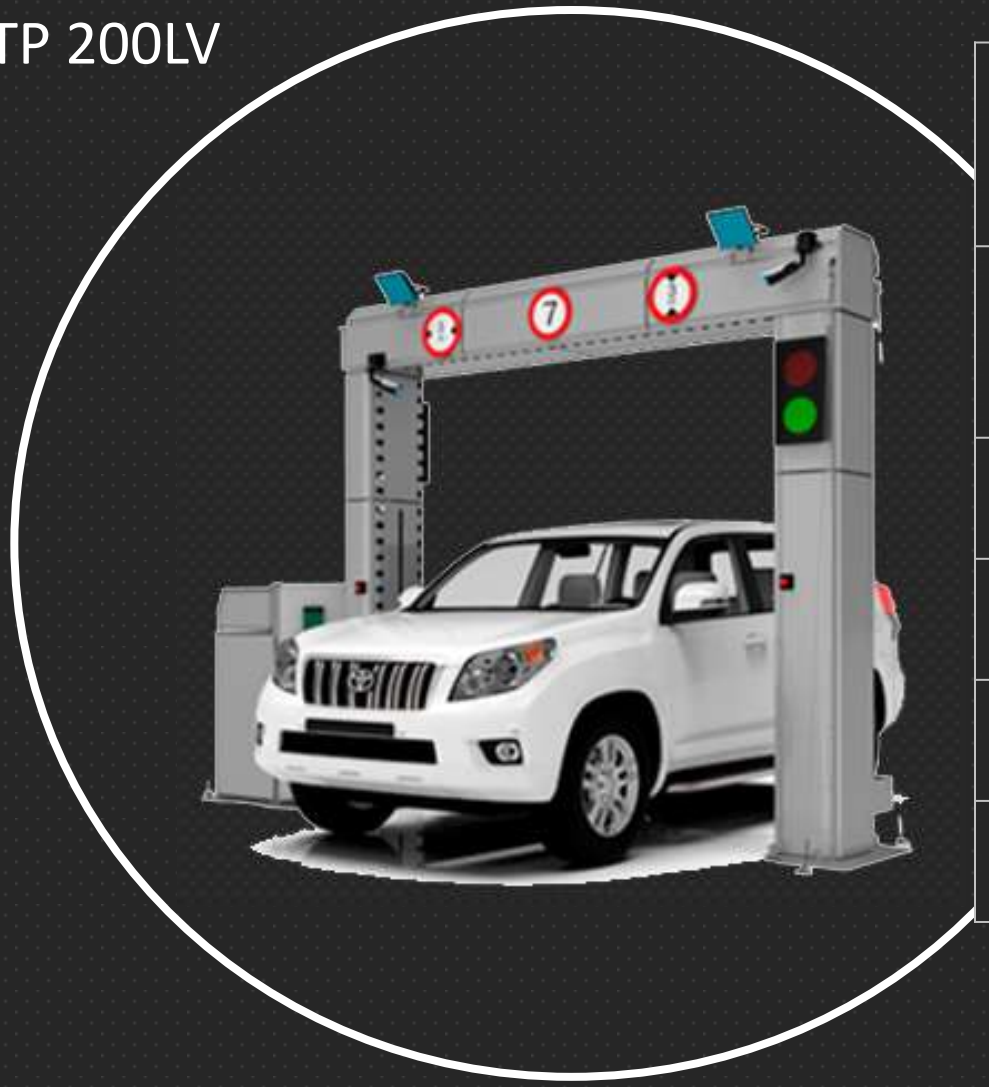


Cargo and Vehicle X-ray Inspection

Drive-Through Portal (DTP) X-ray systems are high-energy scanners designed for non-intrusive inspection of vehicles, cargo, containers and goods in various inspection sites.

Cargo and Vehicle X-ray Inspection

DTP 200LV



Maximum size of the scanned objects (LxWxH)	≤ 8 m x 2.5 m x 2.8 m [≤ 26.25' x 8.20' x 9.19']
Dimension of inspection tunnel (WxH)	3.0 m x 3.0 m [9.84' x 9.84']
Scanning speed	5 ± 15 km/h [3 - 6 mph]
Throughput	Up to 120 vehicles per hour
Steel penetration	25 mm [0.98"]
Wire resolution	Ø 0.8 mm (20 AWG)

Cargo and Vehicle X-ray Inspection

DTP 7500LV

Maximum size of the scanned objects (LxWxH)	25 m x 3.0 m x 4.4 m [82.0' x 9.84' x 14.4']
Dimension of inspection tunnel (WxH)	3.5 m x 4.65 m [11.48' x 15.26']
Scanning speed	5 ± 10 km/h [3 - 6 mph]
Throughput	Up to 90 vehicles per hour
Steel penetration	320 mm [12.6"]
Wire resolution	Ø 2.0 mm (12 AWG)
Maximum dose to the driver	with scanning of cabin < 0.4 µSv/scan at 5 km/h without scanning of cabin 0.05 µSv/scan at 5 km/h

Cargo and Vehicle X-ray Inspection

DTP 7500LVR – RELOCATABLE VEHICLE X-RAY INSPECTION SYSTEM

Maximum size of the scanned objects (LxWxH)	25 m x 3.0 m x 4.4 m [82.0' x 9.84' x 14.4']
Dimension of inspection tunnel (WxH)	3.98 m x 4.5 m [13.06' x 14.76']
Scanning speed	5 ± 10 km/h [3 - 6 mph]
Throughput	Up to 100 vehicles per hour
Steel penetration	320 mm [12.6"]
Wire resolution	Ø 2.0 mm (12 AWG)
Maximum dose to the driver	with scanning of cabin < 0.4 µSv/scan at 5 km/h without scanning of cabin 0.05 µSv/scan at 5 km/h

Cargo and Vehicle X-ray Inspection

DTP 6000LVM - MOBILE X-RAY INSPECTION SYSTEM FOR VAN, VEHICLE AND CARGO

Maximum size of the scanned objects (LxWxH)	25 m x 3.0 m x 4.6 m [82.0' x 9.84' x 15.1']
Dimension of inspection tunnel (WxH)	3.5 m x 4.8 m [11.48' x 15.7']
Scanning speed	Drive-throught mode 5-10 km/h Drive-by mode 8/12/24 m/min
Throughput	Up to 40 containers per hour
Steel penetration	320 mm [12.6"]
Dose for a vehicle driver if the driver's cab is not scanned	At most 0.05 µSv for one scanning procedure
Dose for scanning object	<0.6 µSv/scan

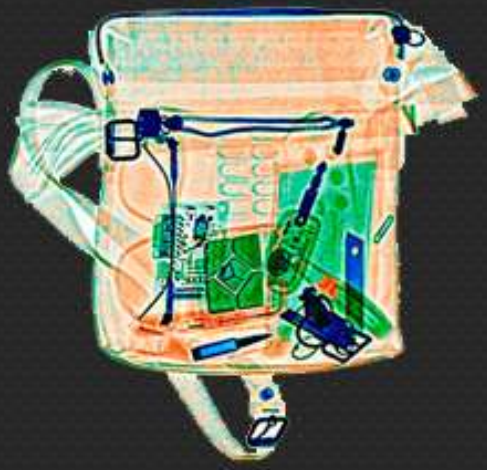
Parcel, Baggage and Small Cargo X-ray Inspection

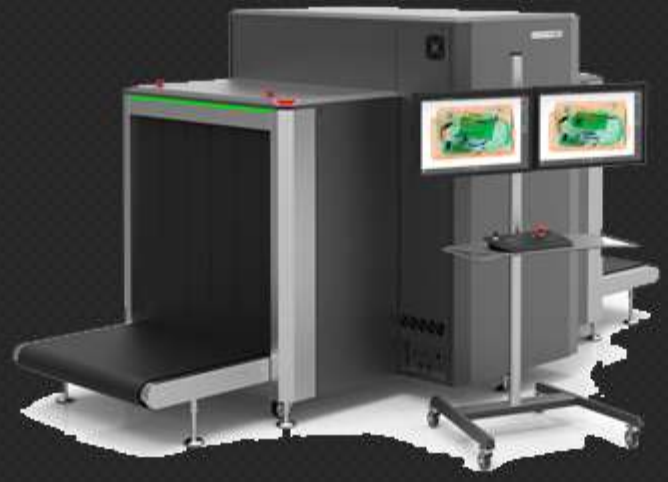
Dual energy X-ray inspection allows operators to detect weapons, explosives (including plastic explosives), drugs, fuses and dangerous objects that can represent a safety hazard.

Parcel, Baggage and Small Cargo X-ray Inspection

Wide range of products:

Tunnel dimensions Width Height	 from 532 to 1750 mm from 332 to 1850 mm
Weight	from 160 to 3000 kg



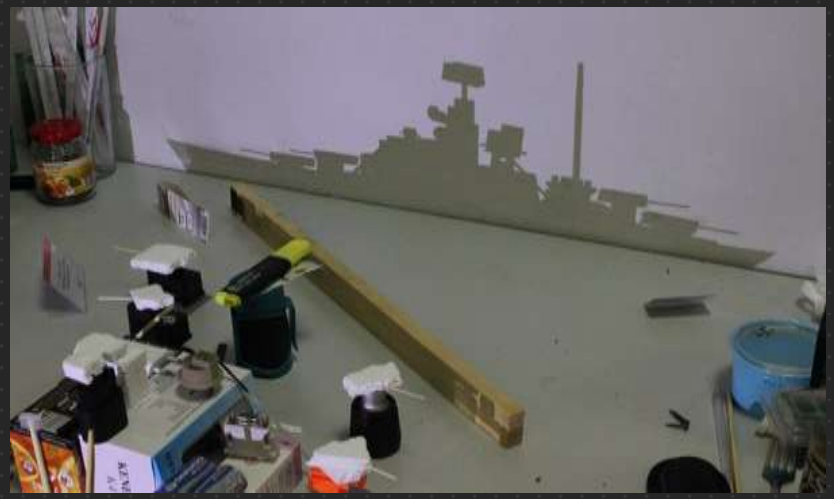


Parcel, Baggage and Small Cargo X-ray Inspection

Unique customer-focused solutions

Inherent Components – scintillators

- A single energy monochrome shadow image isn't informative enough in many cases.
- Recognition of objects by materials (metal, non-metal, and organics) requires a dual – energy X-ray sources and detectors with two lines of scintillators for different energies.



The most wide applied scintillators in X-ray security systems are: CsI(Tl), Gd_2O_2S:Tb(Eu) (GOS screen or ceramic GOS) and $CdWO_4$.

Scintillator	Short name	Density, g/cm^3	Light yield, photons/keV
CsI:Tl	CsI	4,51	66
Gd_2O_2S:Tb(Eu)	GOS	7,34	59(73) ~ ⟨66⟩
$Y_3Al_5O_{12}$:Ce	YAG	4,57	17
$CdWO_4$	CWO	7,90	28

Inherent Components – detectors

ADANI develops own detectors for high and low energy applications as well as X-ray generators for various applications.

A use of own components have several advantages:

- independence from importation failures;
- cost reduction;
- fast implementation of the newest materials and techniques into our products.

Innovations are in a high priority at ADANI and we are constantly looking for new ideas in field of X-ray detection and generation and welcomes proposals on the new scintillation materials and other technique in X-ray domain!

Detectors for Cargo and Vehicle X-ray Inspection

Lightweight (700 g) high performance detectors for X-ray applications in an energy region from 450 keV to 15 MeV.

1	Number of pixels	32
2	Scintillation element size (pitch x width x height x length), mm	4,6x3,8x7x30
3	Upper energy level for ionizing radiation quanta, MeV, not less than	7,5
4	Maximal power consumption, W	2,4
5	Range of supply voltages, V	9-15
6	Transmission coefficient, steps; pC	7; 2,5-17,5
7	Maximal frequency for 64 modules scanning, Hz	400
8	Integration time, µs	50
9	Dynamic range depending on the transmission coefficient, bit	13.8-16.5

Detectors – comprehensive test program

Pamir-300 X-ray generator test bench

Vibration test bench

Detectors in a climatic chamber (high and low temperature and humidity tests)

ADANI contact information

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ADANI

Thank you!