ADVANCED WARNING SYSTEMS

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ADVANCED WARNING SYSTEMS

Organizational History of Advanced Warning Systems

Advanced Warning Systems is the worldwide marketer of the IGRIS Total Scanning Solution. IGRIS Scanners are non-invasive, fast, and easy to use. Their objective is to provide revolutionary, non-invasive scanning solutions, which can be tailored to maritime, vehicle, air cargo, and pedestrian applications, leading to a safer world. Work on the IGRIS technology began in the 1970s and the senior staff shares over 200 years of experience.

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Comparison With Other Products

The IGRIS technology is compared to 10 other technologies in the chart at the end of this section. The comparison is based on three criteria: (i) what the device can detect, (ii) its 3-dimensional scanning ability and (iii) its cost.

These criteria were chosen because of the nature of the problem in detecting, identifying and quantifying explosives. The problem in making these determinations is that there is no single, unique property of explosives that will allow them to be easily detected, identified and quantified. The U.S. Army has spent millions of dollars since World War II searching for such a property and it has not been found. Explosives do, however, have several common, unusual properties which are: (1) densities are higher than those of most common substances composed of the same elements and range from 1.2 to 1.9 gm/cc; (2) the density of hydrogen content is low ranging from 0.1 to 5%; (3) the density of Carbon is low ranging from 0 to 10% (4) the density of Nitrogen is high ranging from 10 to 40%; (5) the density of oxygen is high ranging from 30 to 65%; and (6) emission of unusual gases with detectable vapor pressures is nearly zero except for dynamite which is very high. The lack of a single, unique property to characterize explosives and the availability of several, unusual properties lead to a conclusion that the more of these unusual properties a detection system measures the higher its probability of success. To measure the elemental densities of Carbon, Hydrogen and Oxygen a detection system must also be capable of 3-dimensional scanning of a container.

The IGRIS system contains the inherent capability of being able to directly measure the amount of Carbon, Nitrogen and Oxygen present and identify conclusively the type of explosive or contraband drug. It is also inherently a 3-dimensional scanning device, which makes it possible to scan a container on a volume element by volume element basis to uncover explosives, which are surrounded by inert substances. The IGRIS system can determine within 10 or 20 seconds whether a substance exists in a container that might be an explosive and then to conclusively determine the type of explosive within 1 to 5 minutes.

Vapor detectors are able to detect only those substances, which have a high vapor pressure such as unsealed dynamite. However, plastic explosives do not have high vapor pressure, and this characteristic can be masked by hermetically sealing the explosive and removing all traces from the container. Vapor detectors do not interrogate the inside of the bag; they only measure vapor pressure on the outside of the bag. Moreover, vapor detectors do not have the ability to scan in 3 dimensions, which means they must consider the container as a unit making a small explosive in a large container harder to locate. As a final test, they are unacceptable.

Conventional X-ray scanners can only distinguish between elements of high atomic numbers (such as Iron and Mercury) and low atomic number (such as Carbon, Nitrogen and Oxygen). Therefore X-ray scanners are able to produce excellent images of guns, knives and sometimes explosive detonators in the

presence of low-Z materials. However, their ability to identify explosives is questionable, and the fundamental problem of distinguishing between explosives and common plastics that might shield or disguise explosives remains. Explosives are low-Z materials but so are other common substances such as sugar, oils, foodstuff, clothes, etc. X-ray scanners using X-rays of a single energy do not have the inherent ability to distinguish between these substances. As a matter of principle, it would therefore be necessary to consider all low-Z materials as explosives, which would mean searching all containers. Ignoring them would mean 100% error. X-ray scanners have 2-dimensional scanning capability. Three-dimensional capability is achievable only by holographic imaging, which sacrifices time and is expensive. Dual Energy X-ray have the added capability of producing good contrast for materials of low atomic density such as plastics, explosives and other organic materials. However, dual energy X-ray technology is limited to 2-dimensional scanning, the technology has not been commercialized and depends on large computer capability for comparison of images to standard samples. Backscatter X-rays can produce only a coarse 2-dimensional image of hydrogen in materials. However, explosives contain very little hydrogen and the effectiveness of X-rays can be removed by shielding.

Thermal neutron analysis is able to detect only Nitrogen. However, some explosives such as mercury fulminate do not contain Nitrogen, and Nitrogen is contained in many common things. As a result, the false alarm rate must be high for thermal neutron analysis. It is inherently incapable of 3-dimensional scanning but may produce a coarse 2-dimensioal image. Recent tests of thermal neutron analysis in airports have produced unsatisfactory results. Approximately 28,000 pounds of shielding and a large work area are required because of a radioactive source included in the unit. This radioactive source might, itself, become a target of terrorist, and the weight of the system also presents practical problems. CAT Scanners provide only a 3-dimensional image of low atomic numbers materials, and are sophisticated instruments not suited to field use. High-energy neutron and X-ray Resonance technology provides only a coarse 2-dimensional projection of Nitrogen and requires use of sophisticated particles accelerators.

Alternative technologies are not inherently capable of being as affective as the IGRIS technology. However, it is important to note that the market is not an exclusive market. Any good security system will include one of each type of explosive detector. Vapor detectors are mobile and can detect some explosives in remote locations when not well disguised. X-ray scanners are fast and excellent for identification of metallic weapons, and they can detect the presence of low-Z materials. Together, a vapor detector, conventional X-ray system and the IGRIS system would provide a comprehensive system for detecting explosives and contraband drugs.

Product or System	Elements Detected	Scanning Ability
IGRIS	N, C, O	3-dimensional
Vapor Detectors	None, only vapor pressure of dynamite	None
Conventional X-Ray Systems	None, only High Z versus Low Z materials	None
Dual Energy X-Ray Systems	H	Course 2-dimensional projection of hydrogenous materials
Back Scatter X-Ray Systems	H	Course 2-dimensional projection of hydrogenous materials
Cat Scan	None, only indications of low Z elements	2-dimensional
Thermal Neutron Analysis (TNA)	N	Poor 3-dimensional
High Energy Neutrons or X-Ray Resonance Technology	N	Coarse 2-dimensional

ADVANCED WARNING SYSTEMS

OFFERING

IGRIS DETECTION SCANNERS

ADVANCED WARNING SYSTEMS

- Worldwide marketer of the IGRIS Total Scanning Solution
- IGRIS Scanners are non-invasive, fast, and easy to use.
- Objective: To provide revolutionary, non-invasive scanning solutions which can be tailored to maritime, vehicle, air cargo, and pedestrian applications by using IGRIS technology, leading to a safer world.

THE RESULT

Inelastic

Gamma

Ray

Imaging

Spectroscopy

IGRIS

INELASTIC GAMMA RAY IMAGING

The world's most advanced detection system that provides a computerized analysis that accurately determines the atomic composition of substances.

U.S. PENTAGON CONTRACT

- Rewarded to IGRIS scientists by the U.S. Department of Defense: http://archive.defense.gov/Contracts/Contract.aspx?ContractID=4771
- No.: 283-12
- April 17, 2012

JIEDDO

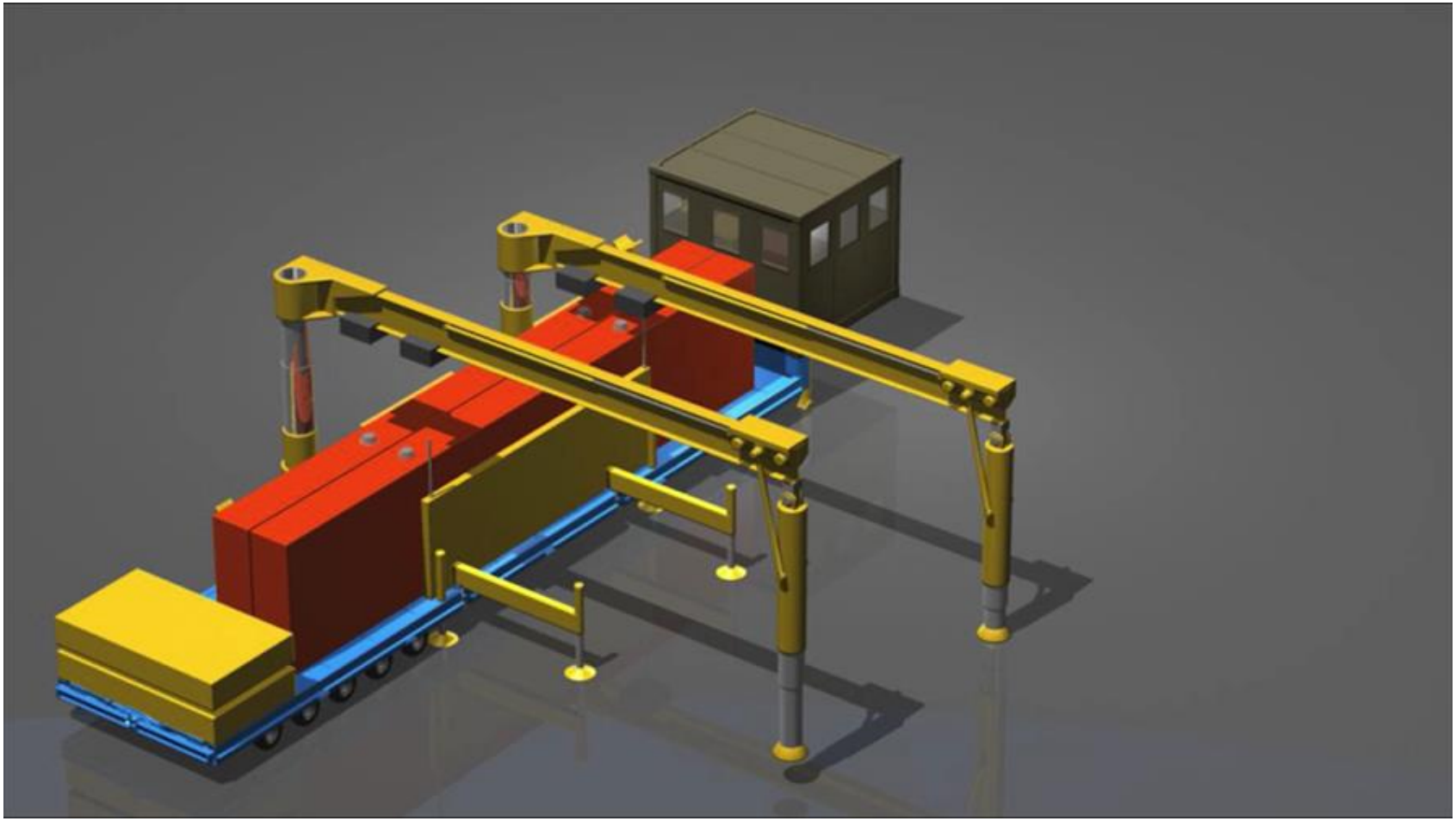
- Pentagon's JIEDDO (The Joint Improvised Explosive Device Defeat Organization) interest results in IGRIS LLC contract to build a moving vehicle detection scanner

IGRIS SCANNERS

- Mobile Cargo Scanners
- Vehicle Checkpoint Scanners
- Maritime Container Scanners
- Luggage and Parcel Scanners
- Pedestrian Scanners

*All scanners are individually developed according to specifications.

MOBILE SCANNER



SPECIFICATIONS

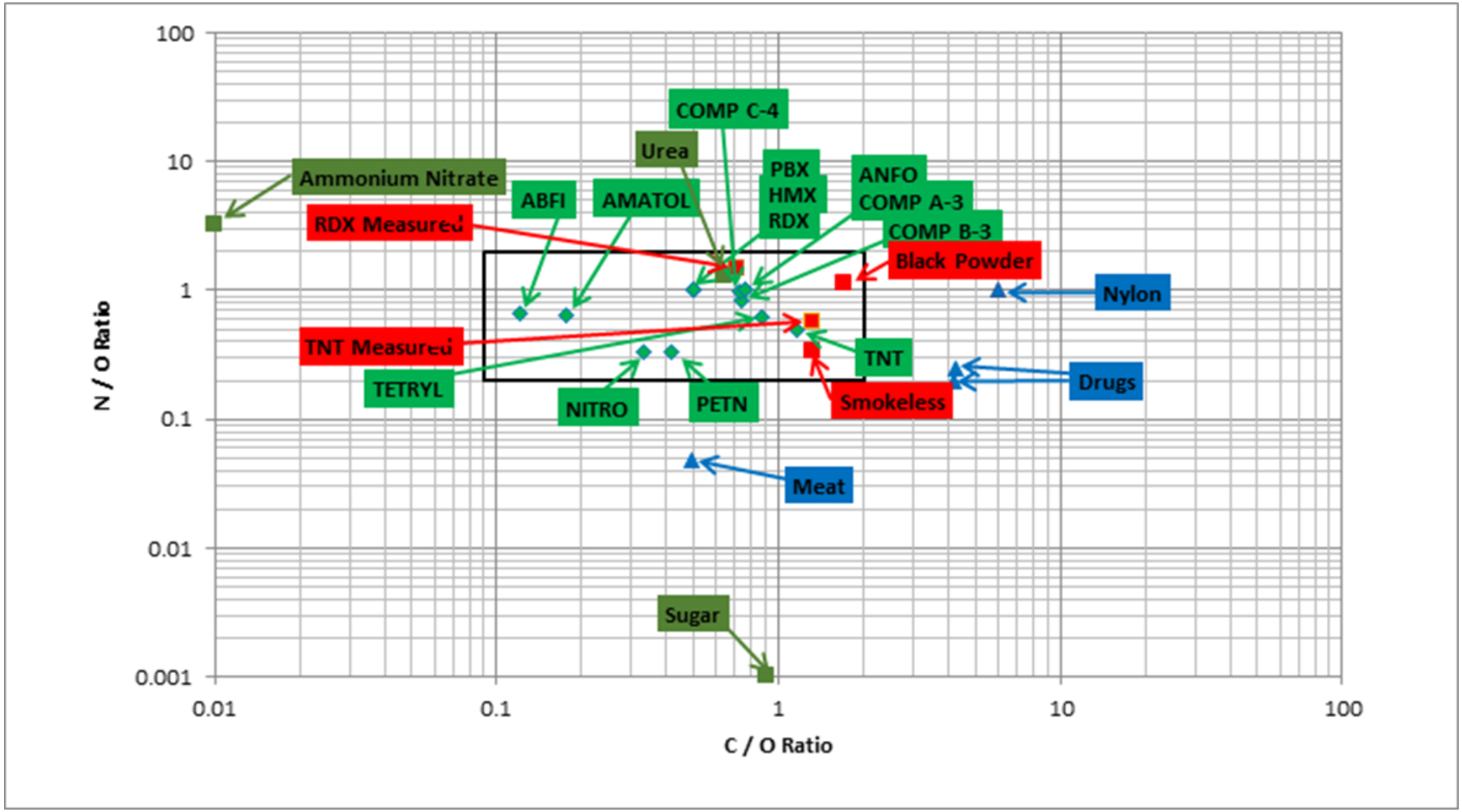
IGRIS scanning technology will scan and identify all substances of interest based on the list provided by each individual country.

- The first part of the list is normally prepared by police or national security
- The second part of the list is prepared by Customs

WHAT WILL IGRIS SCANNERS DETECT?

- Explosives; both liquids and solids
- Contraband
- Import/export items such as soybean meal, corn, wine and spirits, meat, and dairy products

DETECTION OF EXPLOSIVES

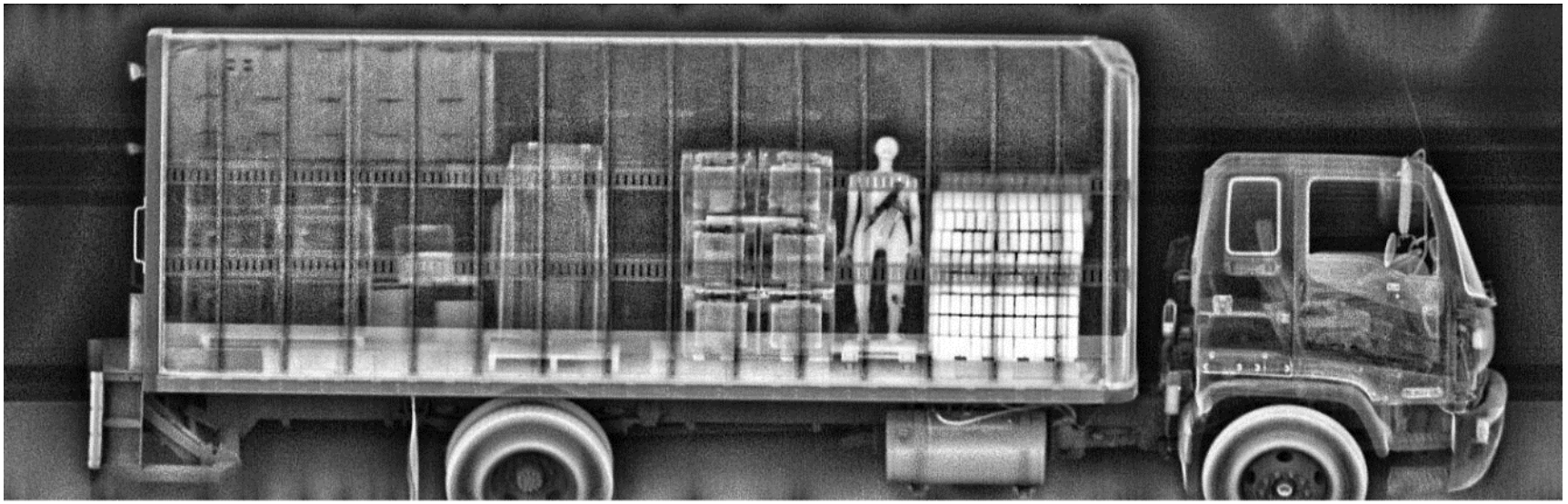


WHY IS IGRIS NEEDED?

- IGRIS is the only system to detect explosives, contraband, and items of interest to Customs with a high degree of accuracy in less than 4 seconds.

X-RAY SCANS

- Interpretation required
- Does not produce 3D images
- Used to detect dense weapons and arms
- Cannot analyze carbon, oxygen, and nitrogen ratios



This X-Ray rendering is the type of image produced by a fixed site cargo X-Ray scanner and requires approximately 2-3 minutes to scan and must be interpreted by a technician who decides if further inspection is required.

X-RAY VERSUS IGRIS

- X-ray requires 2.5 to 3 minutes to scan; **IGRIS scans of less than 4 seconds have a high degree of accuracy**

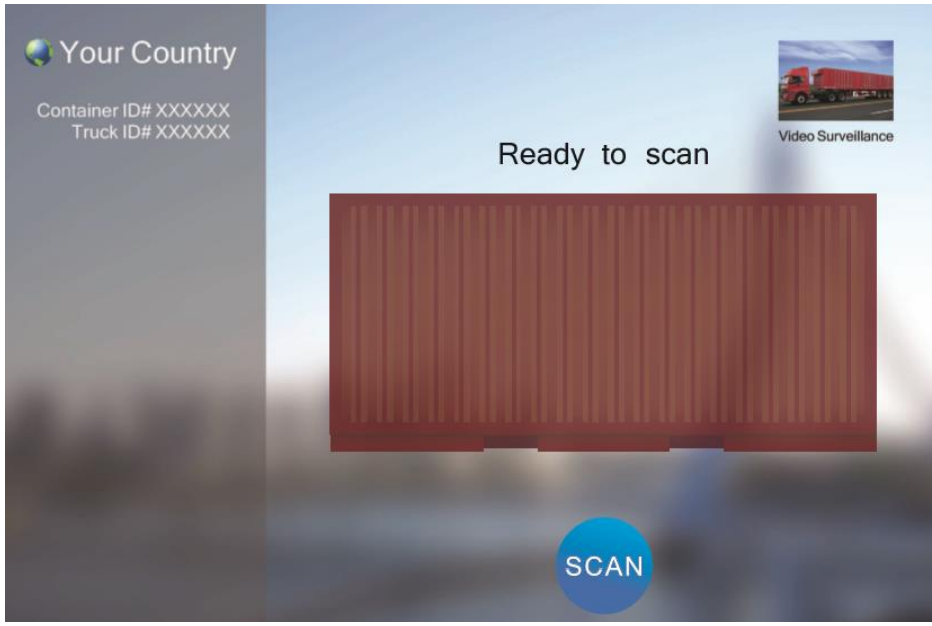
- X-ray requires interpretation which can lead to human interpretation error; **IGRIS identification is based totally upon computer analysis.**

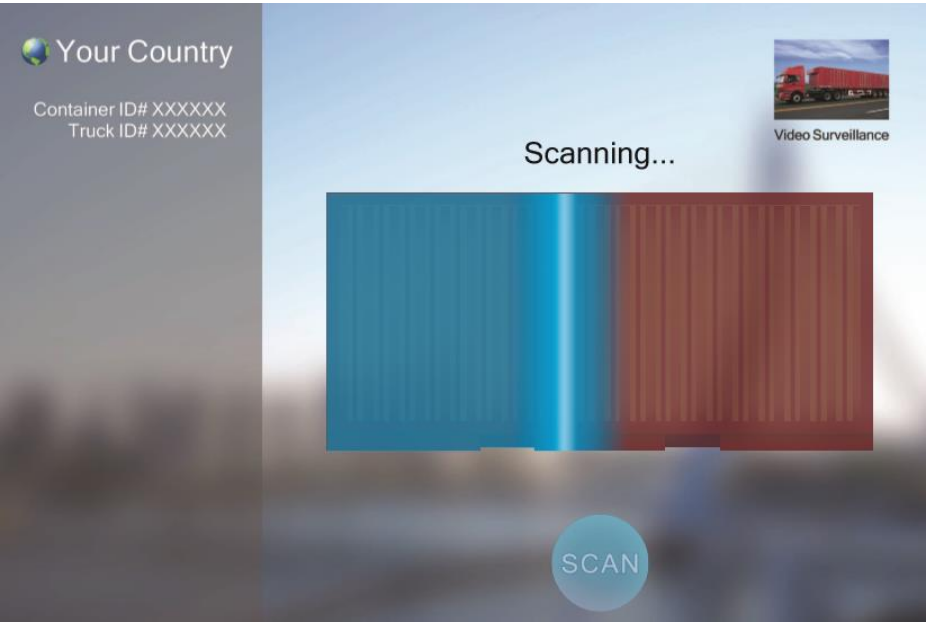
X-RAY VERSUS IGRIS

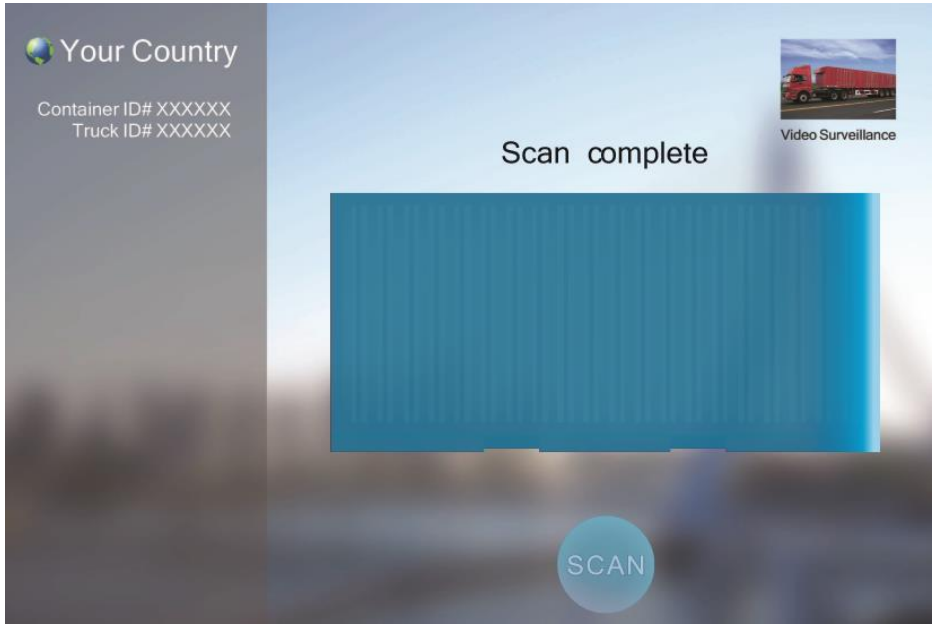
- X-ray requires skilled labor to interpret images; IGRIS' computer analysis allows operators to be unskilled labor.
- IGRIS requires no radiation shielding and is safe to the operator and public.

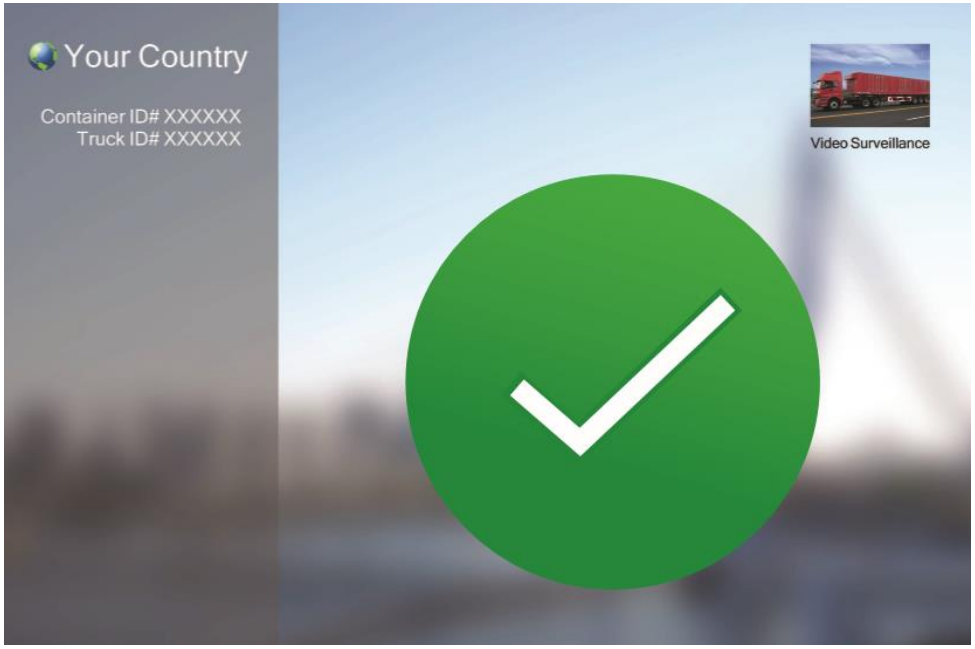
The IGRIS Maritime Scanner


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Not in position...
1 METER


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Ready to scan
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Scanning...
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Scan complete
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance

Your Country

Container ID# XXXXXX
Truck ID# XXXXXX

REPORTED CARGO

65m³ Aluminum

ACTUAL CARGO

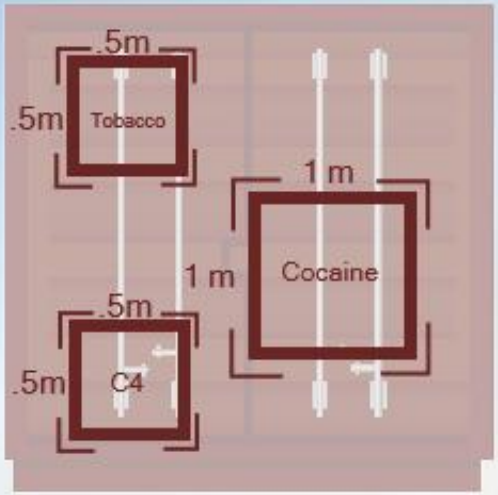
1m³ C4 Explosives

ACTUAL CARGO

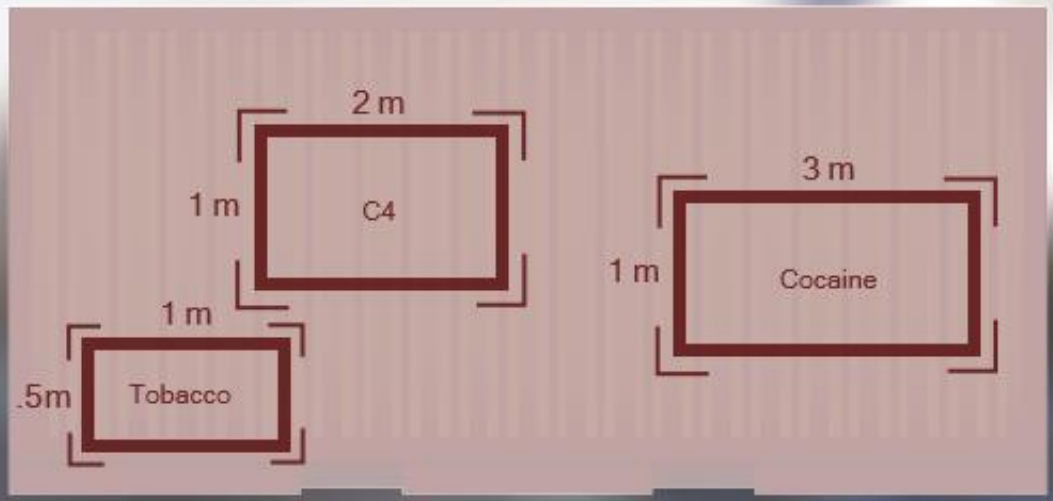
3m³ Cocaine

ACTUAL CARGO

.25m³ Tobacco



Video Surveillance



HOW CAN IGRIS HELP?

IGRIS technology eliminates possible corruption in the scanning procedure because a computer does the interpretation as opposed to the operator, as in the case of an X-ray scanner. Furthermore, if the object being scanned produces a failing result, a copy of the results is sent to the appropriate department. The IGRIS system enhances the security of the country and increases revenue from Customs by providing them with a reliable tool to put an end to the evasion of duties.

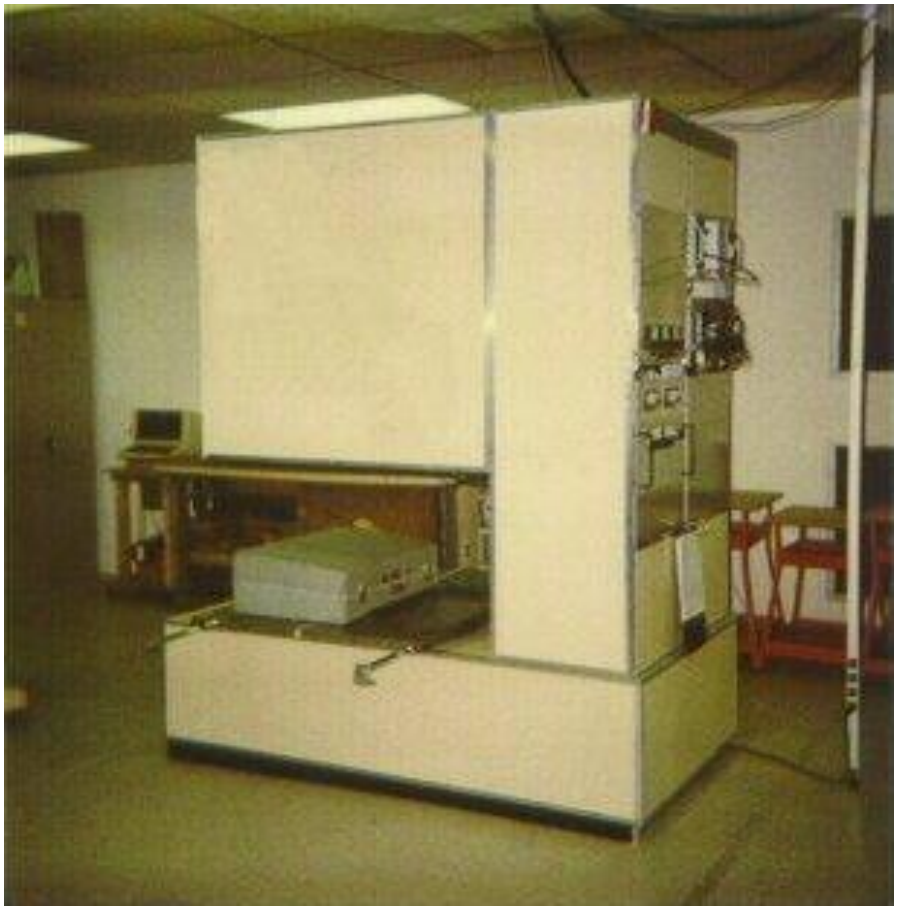
IGRIS LLC

MILITARY AND COMMERCIAL SCANNERS FOR EXPLOSIVES AND CONTRABAND SUBSTANCES

BACKGROUND & EXPERIENCE

- First work 1970s
- Relevant Senior Staff Experience > 200 years
- Technical Reviews >60
- National Laboratory Reviews 4

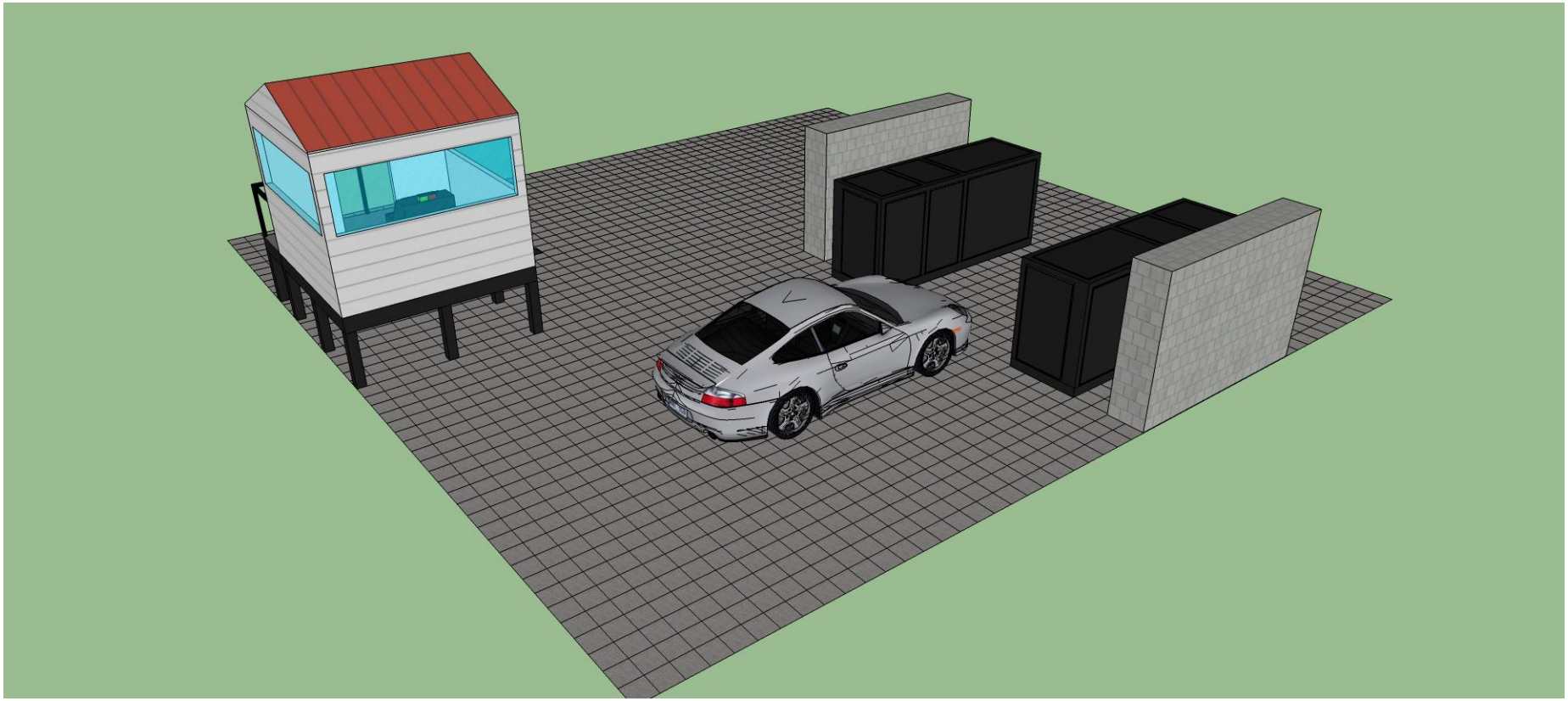
FIRST DEMONSTRATION UNIT



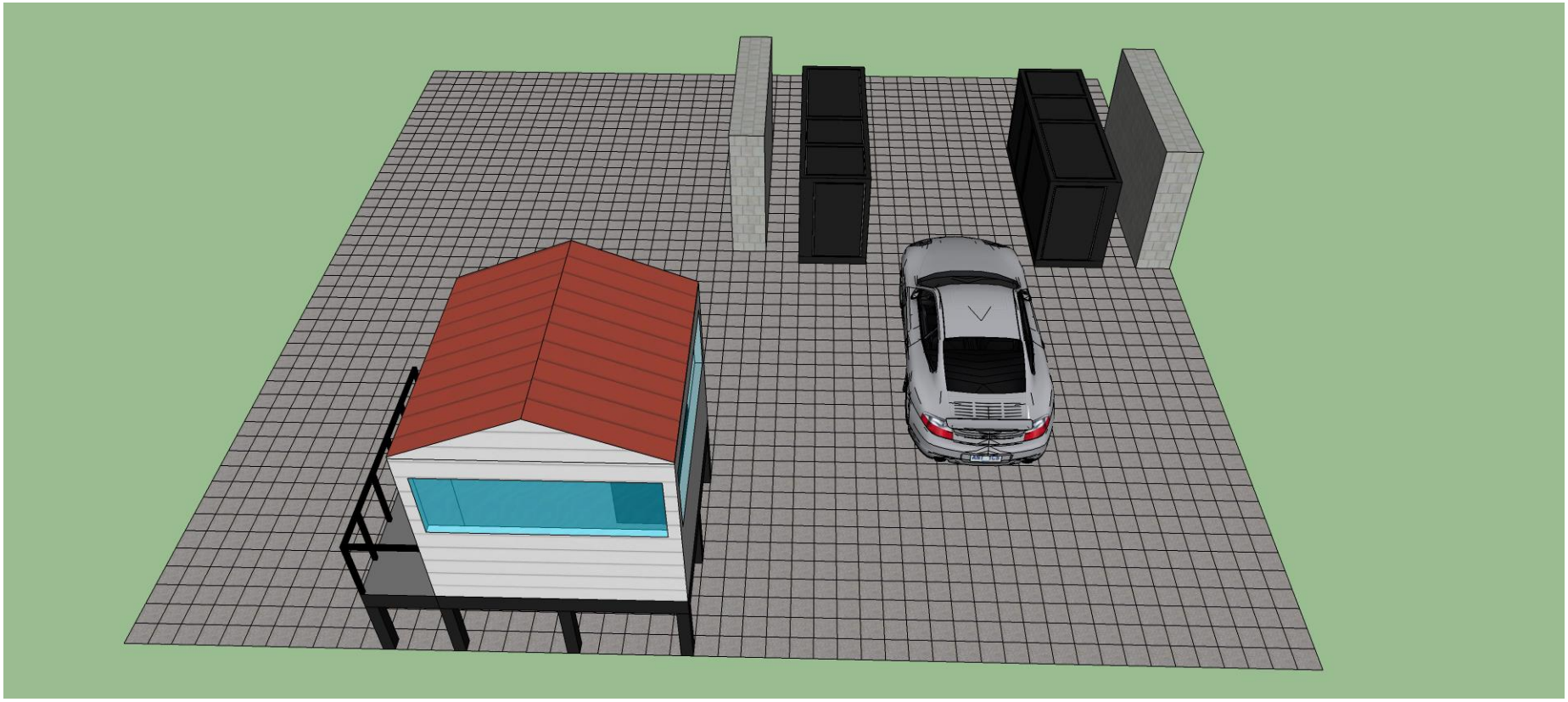
Current Project
IGRIS Moving Vehicle Interrogation System

US ARMY RESEARCH LAB
JOINT IMPROVISED EXPLOSIVE DEVICE DEFEAT ORG
CONTRACT NO. W911QX-12-D-0003

MVIS System Layout (side view)



MVIS System Layout (back view)



Single Array
Internal Layout--Back View

SCANNING ACCURACY

Speed MPH	Confidence Level Confirmation of Explosives*	Confidence Level Confirmation of Inert Object**
5	99.99%	99.99%
10	99.99%	99.99%
15	99.99%	99.99%
20	99.73%	99.99%
25	99.73%	99.99%
30	95.4%	99.7%
35	68.3%	99.7%
40	68.3%	95.4%
45	68.3%	68.3%

* 20 KG of Unshielded RDX in standard automobile trunk
** 20 KG of Smoked Ham (Substance dependent)

RADIATION DOSAGE

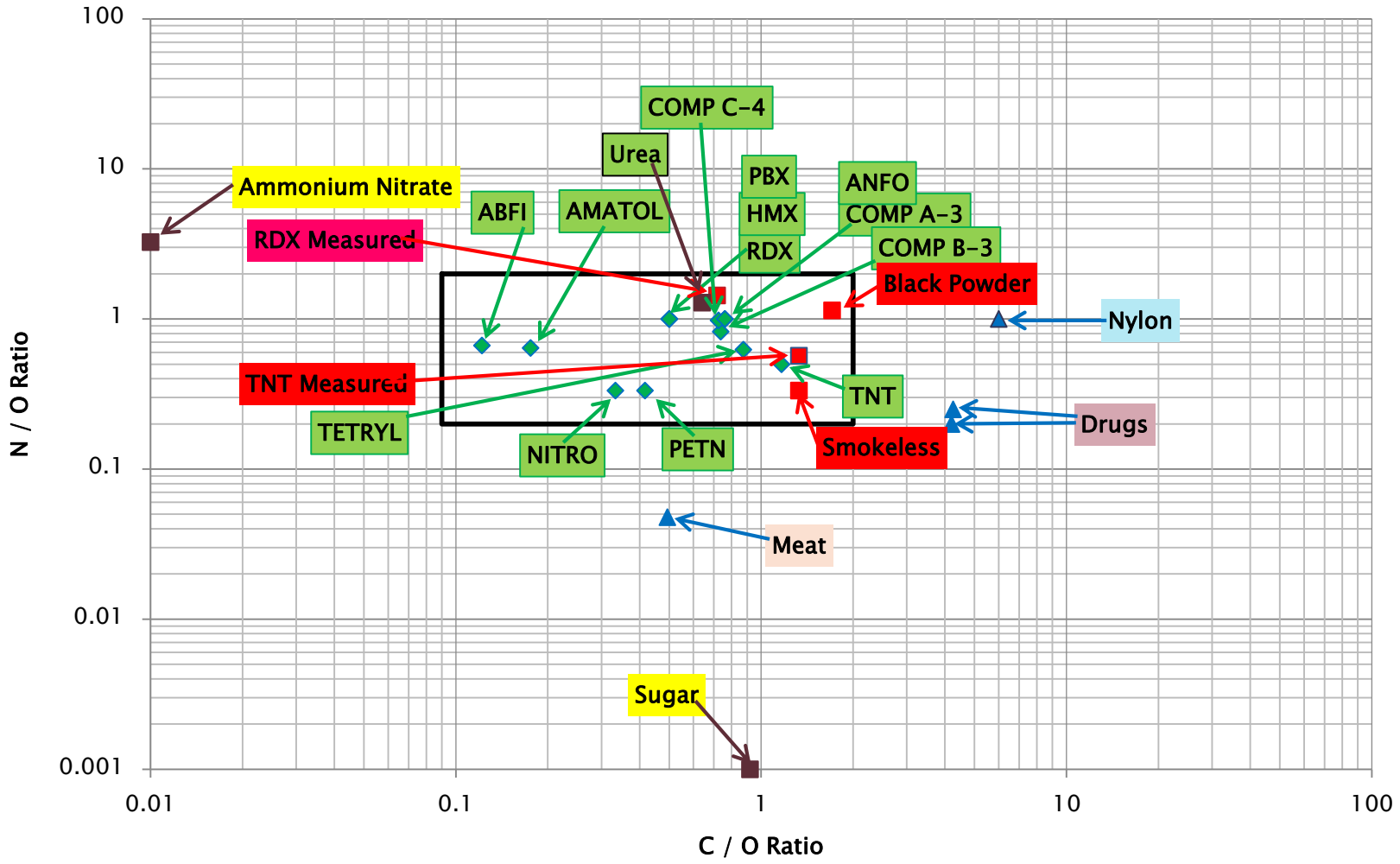
Speed MPH	Left Array Dose µ*rem*	Right Array Dose µ*rem*	Total Dose µ*rem*
10	22	1.7	23.8
15	15	1.1	15.9
20	11	0.9	11.9
25	9	0.7	9.5
30	7	0.6	7.9

Source	Dose Limit
10 CFR 20.1601	100 millirem (mrem)/year
10 CFR 20.1601	2 mrem/hour
Draft ANSI (10/29/2009)	25 microrem (***µrem)***/scan

PERFORMANCE OF IGRIS SCANNER

- Four Questions answered for each scan
  - Is it contraband?
  - What kind of contraband is it?
  - How much contraband is present?
  - Where is it located?

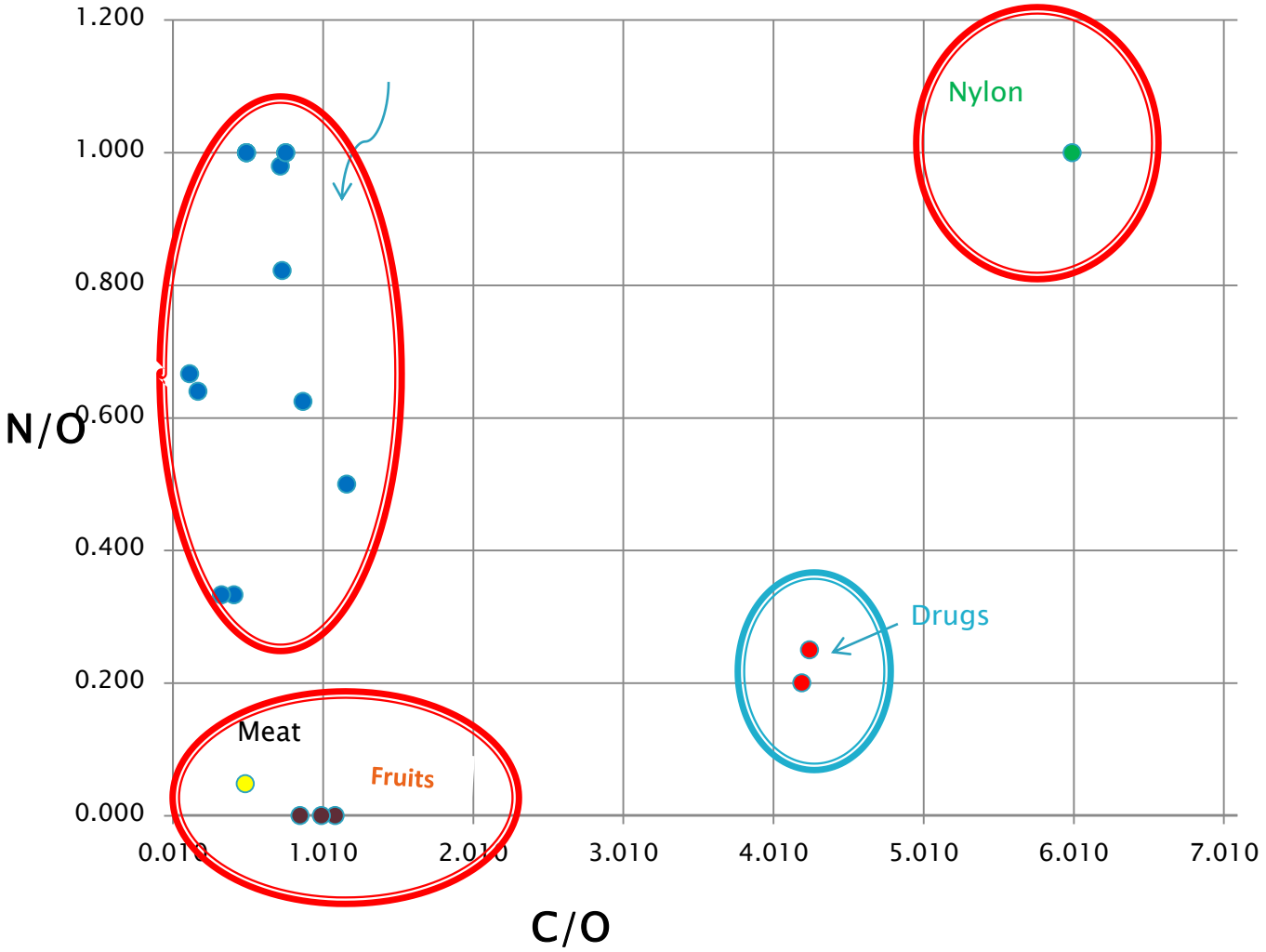
How do we identify contraband?



Box – IGRIS Interrogated Ratios

Diamond – Stoichiometric Explosive Ratios

Triangle– Postulated Inert Ratios

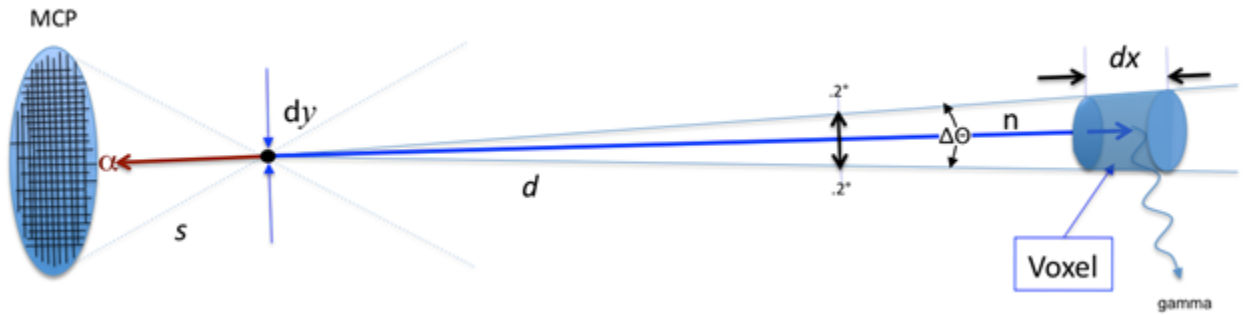

1.200
1.000
0.800
0.600
0.400
0.200
0.000
N/O
0.010
1.010
2.010
3.010
4.010
5.010
6.010
7.010
C/O
Nylon
Drugs
Meat
Fruits

IDENTIFICATION

EXPLOSIVE	C	N	O	H	C/O	N/O
RDX	3	6	6	6	0.500	1.000
PETN	5	4	12	8	0.417	0.333
NITRO	3	3	9	5	0.333	0.333
HMX	4	8	8	8	0.500	1.000
TNT	7	3	6	5	1.167	0.500
TETRYL	7	5	8	5	0.875	0.625
AMATOL	0.62	2.26	3.53	4.44	0.176	0.640
ABFI	0.365	2	3	4.713	0.122	0.667
COMP A-3	1.87	2.46	2.46	3.74	0.760	1.000
COMP B-3	6.851	7.65	9.3	8.75	0.737	0.823
COMP C-4	1.82	2.46	2.51	3.54	0.725	0.980
PBX	3	6	6	6	0.500	1.000
ANFO	1.87	2.46	2.46	3.74	0.760	1.000

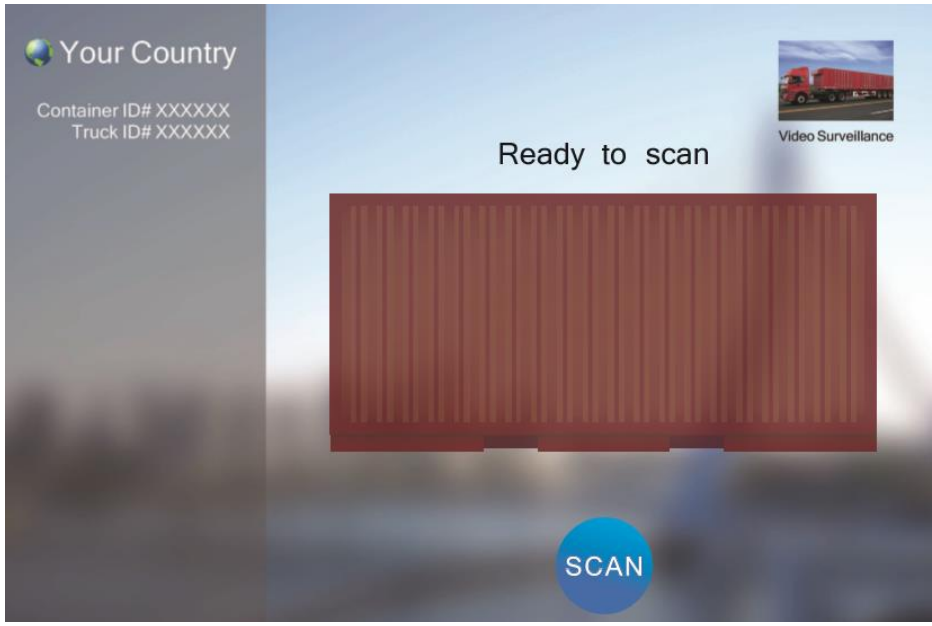
Where is it located?

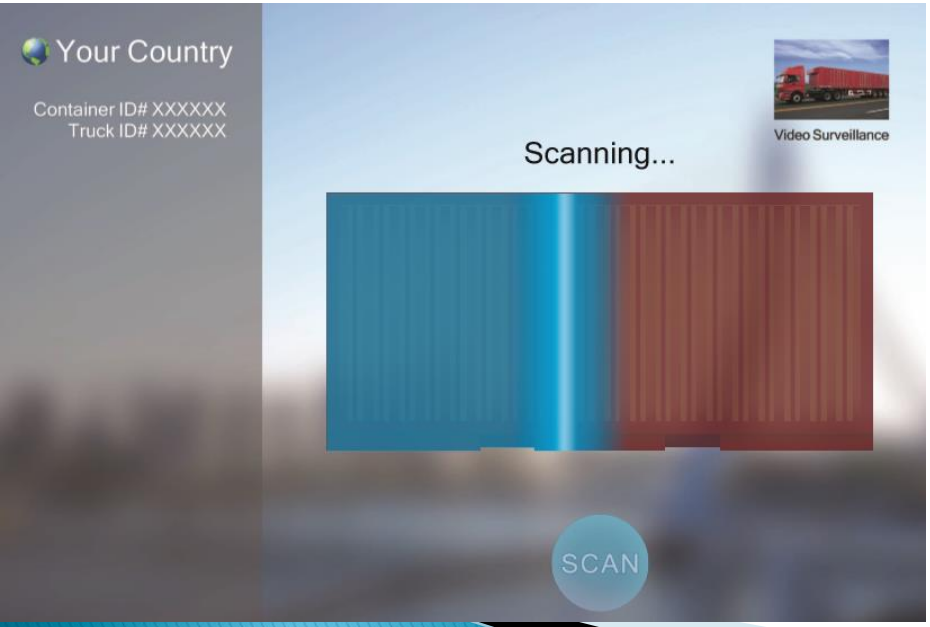
Associated Particle Time of Flight Technique

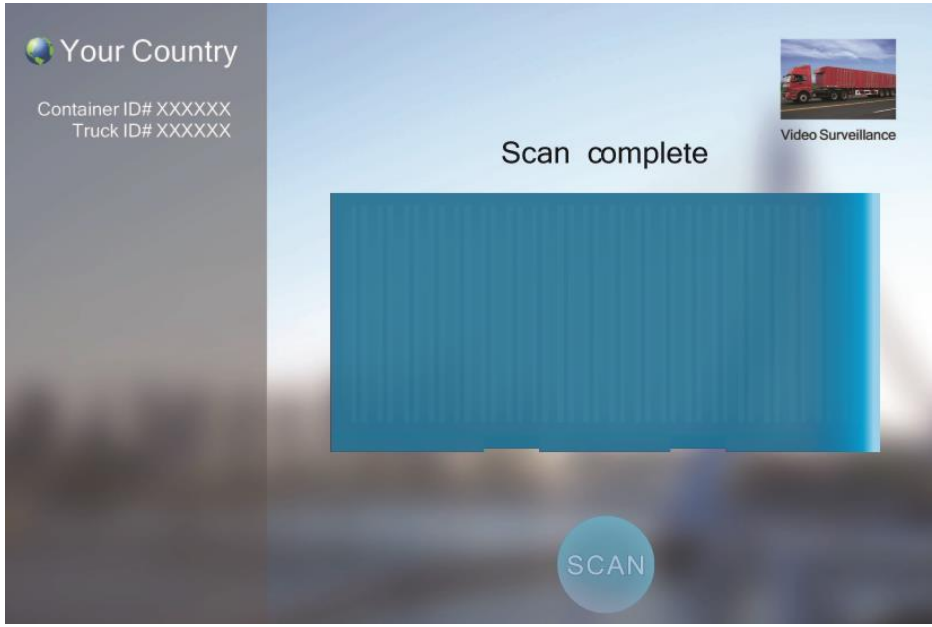


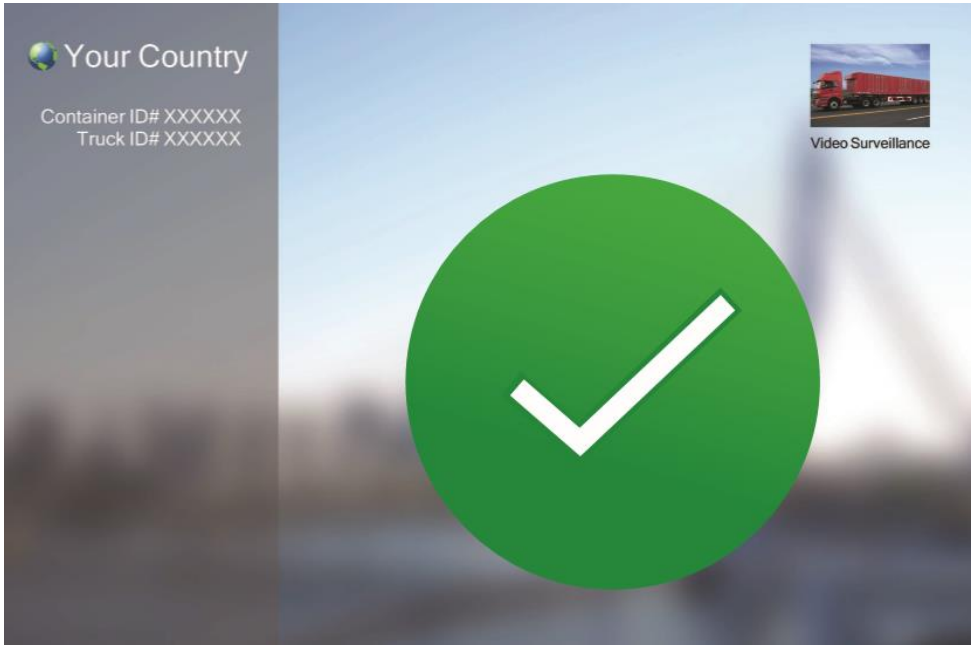
How long does it take?
How accurate is identification?


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Not in position...
1 METER


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Ready to scan
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Scanning...
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Scan complete
SCAN


Your Country
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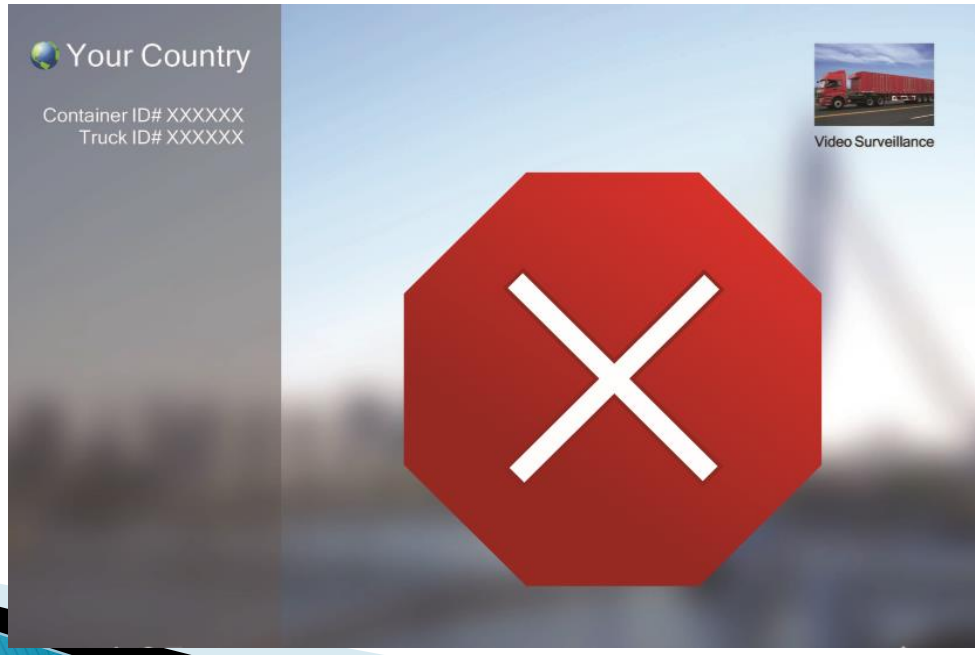
Truck ID# XXXXXX
Video Surveillance


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance

Your Country

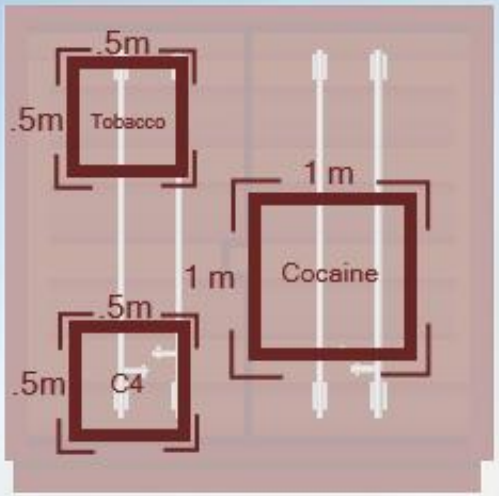
Container ID# XXXXXX
Truck ID# XXXXXX

REPORTED CARGO
65m³ Aluminum

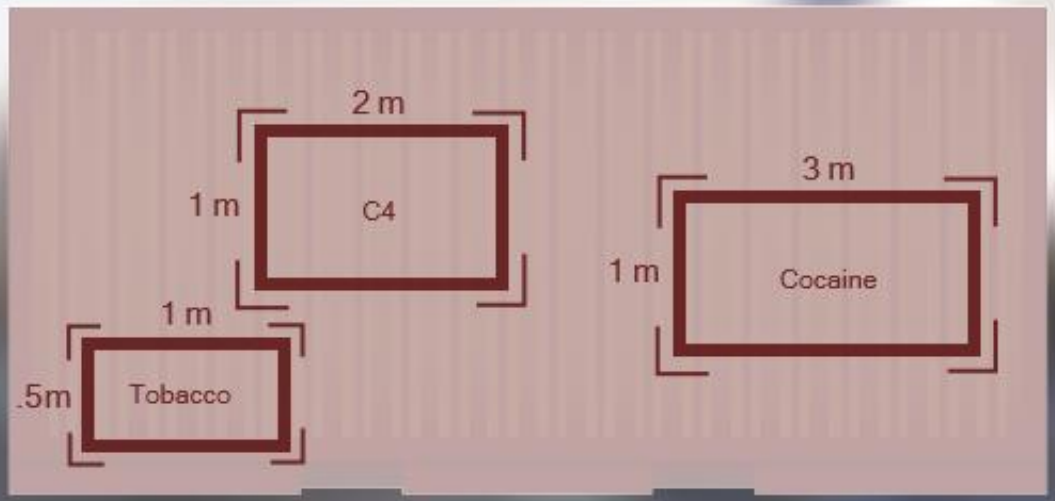
ACTUAL CARGO
1m³ C4 Explosives

ACTUAL CARGO
3m³ Cocaine

ACTUAL CARGO
.25m³ Tobacco



Video Surveillance



IGRIS LABORATORY

USA

QUESTIONS

Altair

ProductDesign

Overview of Capabilities

Jeffrey Hopkins

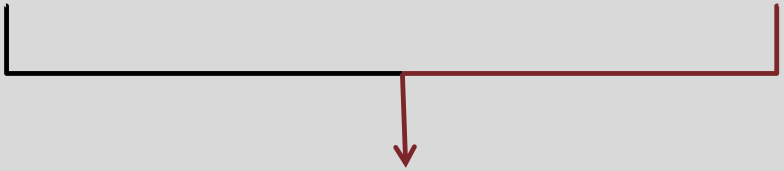
The Team

Altair

Advanced Warning Systems (AWS)

IGRIS
Nuclear Design/Build

Altair ProductDesign
Mechanical Design/Build



The Container Scanner

Overview

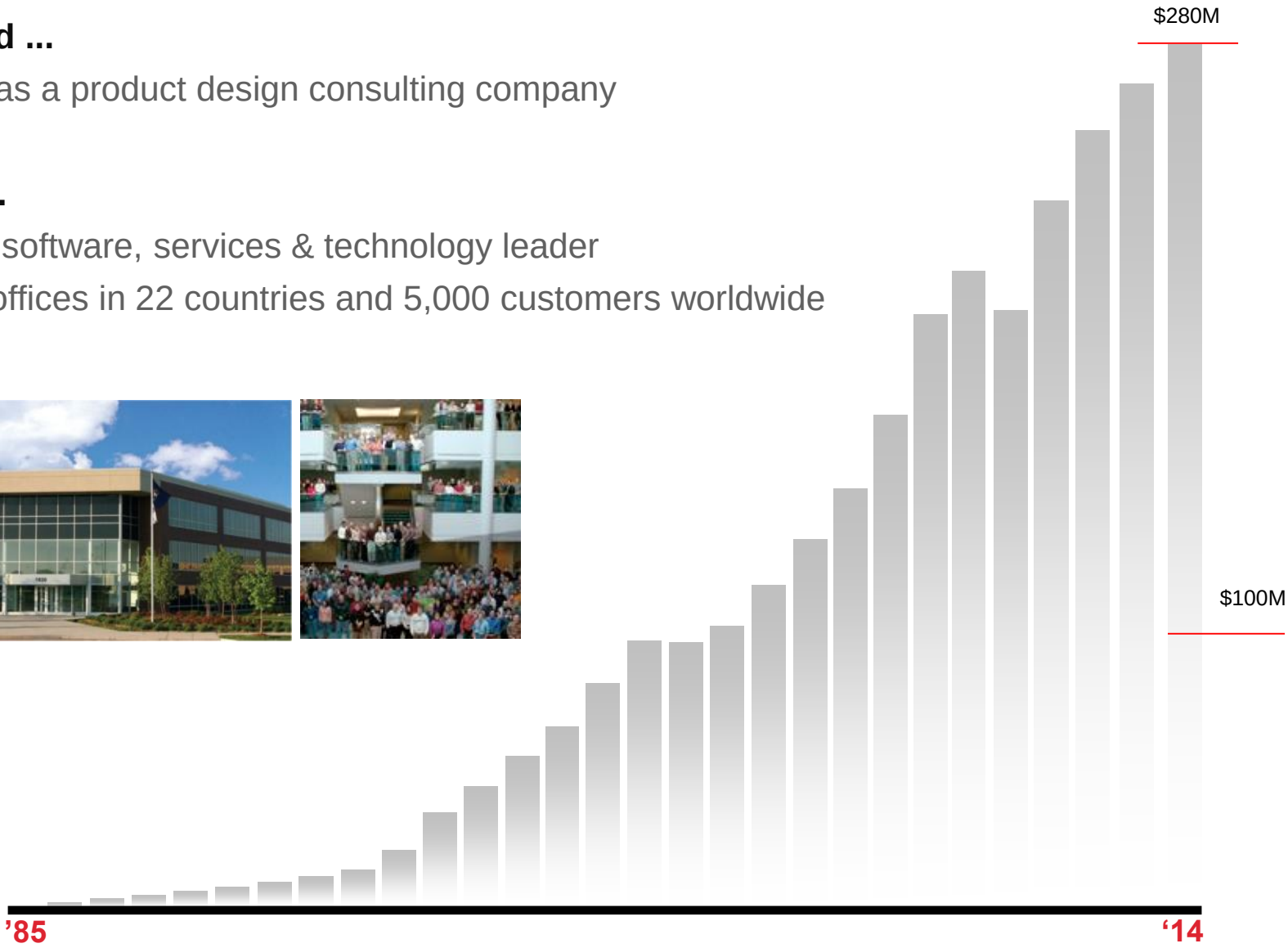
Founded ...

In 1985 as a product design consulting company

Today ...

A global software, services & technology leader

with 59 offices in 22 countries and 5,000 customers worldwide



Innovation Intelligence®

Altair

30

Years of Innovation

59

Offices in 22 Countries

2300

Employees Worldwide

Customers

Altair

Automotive

Aerospace

Heavy Equipment

Government

Life/Earth Sciences

Consumer Goods

Energy

5,000 customers worldwide

Altair's Divisions and Companies

Altair

HyperWorks®

Engineering Simulation
and Optimization Software

ProductDesign Solutions

Product Innovation and
Development Consulting

solidThinking®

Simulation-driven Industrial
and Concept Design Software

Enterprise Solutions

Cloud-based Business and Engineering
Analytics Software and Consulting

PBS Works™

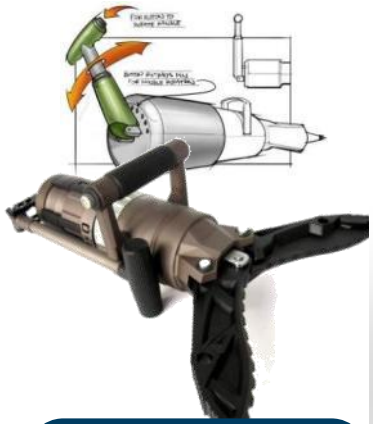
High Performance Computing
Software and Consulting

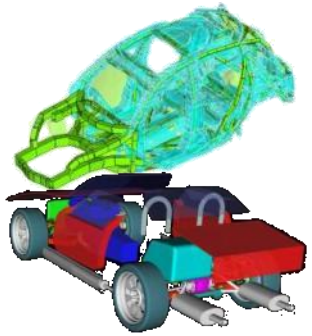
Staffing Solutions

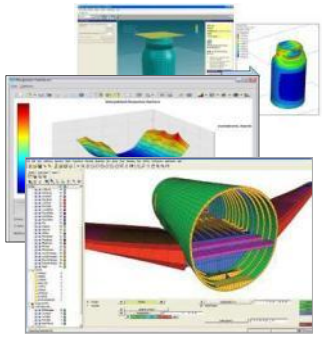
Technical Staffing and
On-premise Consulting

Scope

Concept → Reality







Design Research

- Competitive Benchmarking
- Immersive Research
- Ideation
- Concept Creation
- Requirement Development

Design Engineering

- Product Definition
- Design Development and Release
- FMEA
- Evidence to Support Production Release
- Current Model Support

Simulation-Driven Design

- Optimization and Robust Design
- Structural Analysis
- Multi-Body Dynamics
- Manufacturing Process Simulation
- Computational Fluid Dynamics

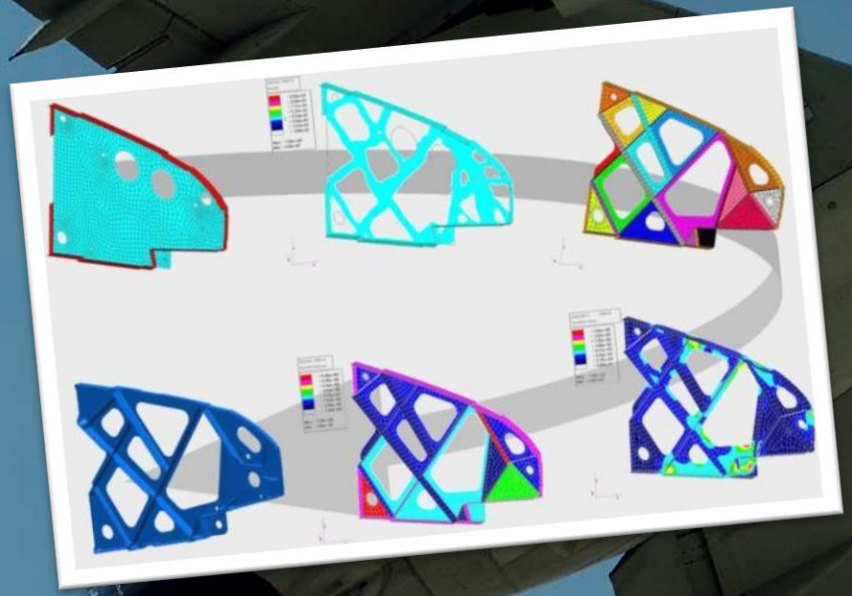
Program Management

- Project Schedule
- Project Budget
- Tracking Bill of Materials
- Cross-functional Management
- Supplier Management

Verification and Testing

- Physical-to-Virtual Correlation
- Prototype Development
- Vehicle/Chassis Development
- Focused Laboratory Testing

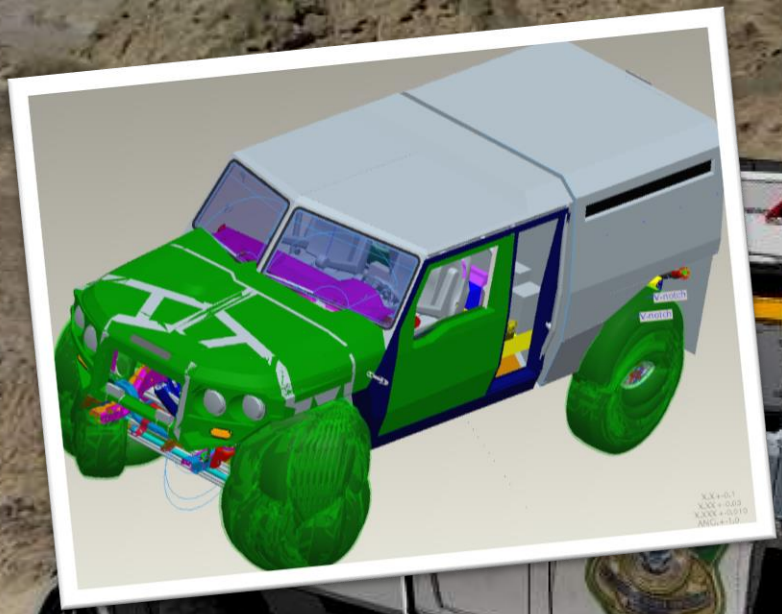
Reducing Aircraft Weight



Weight is a crucial consideration for the aerospace industry. Using our unique optimization design process and accompanying technology, Altair ProductDesign successfully reduced the weight of the A380's wing ribs by **500kg** per aircraft, saving both manufacturing cost and increasing fuel efficiency.

client: **Airbus**
project: **Weight reduction**

Off-Road Vehicle Development

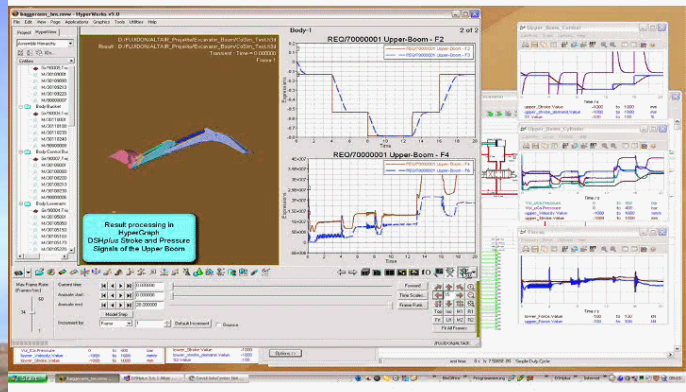


BAE wanted to produce a high mobility, high durability vehicle for Border Patrol, SWAT and First Responders that fills the gap between available commercial and military trucks. Altair ProductDesign was selected to perform target setting, concept studies, system benchmarking, design engineering, ride/handling development & prototype build of the new vehicle.

client: **BAE Systems**
project: **Vehicle development**

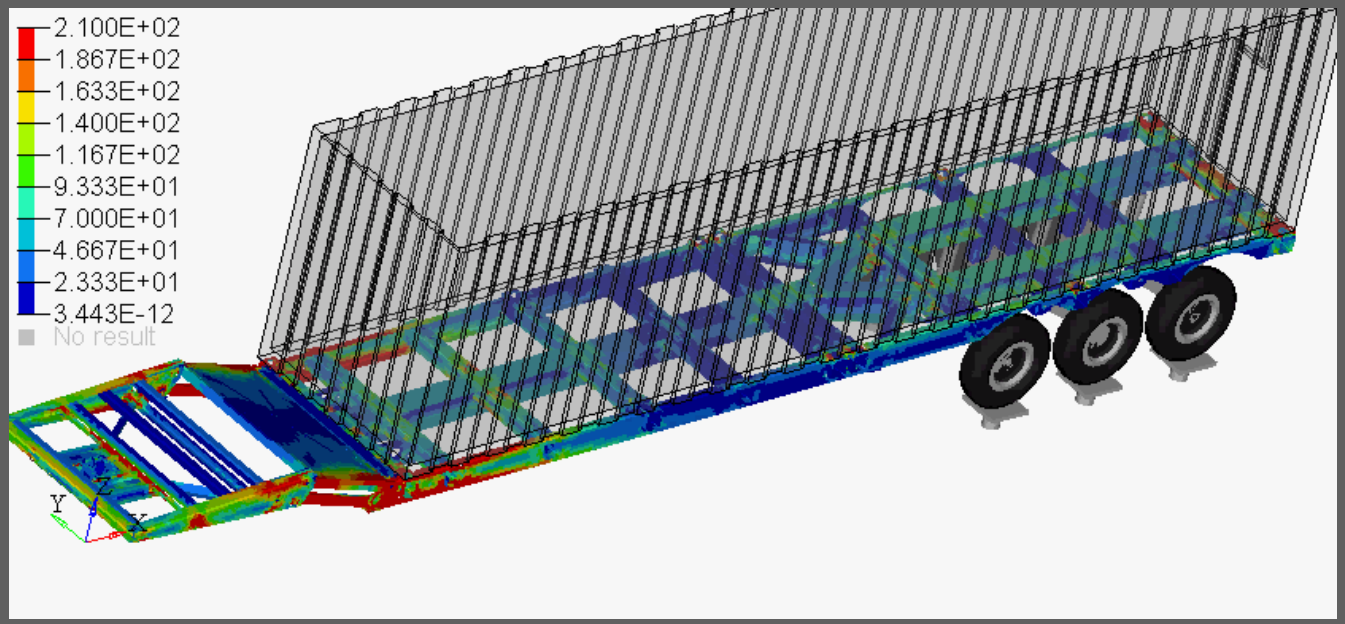
Mars Vehicle Development

Heavy Equipment/Military



Trailer Development

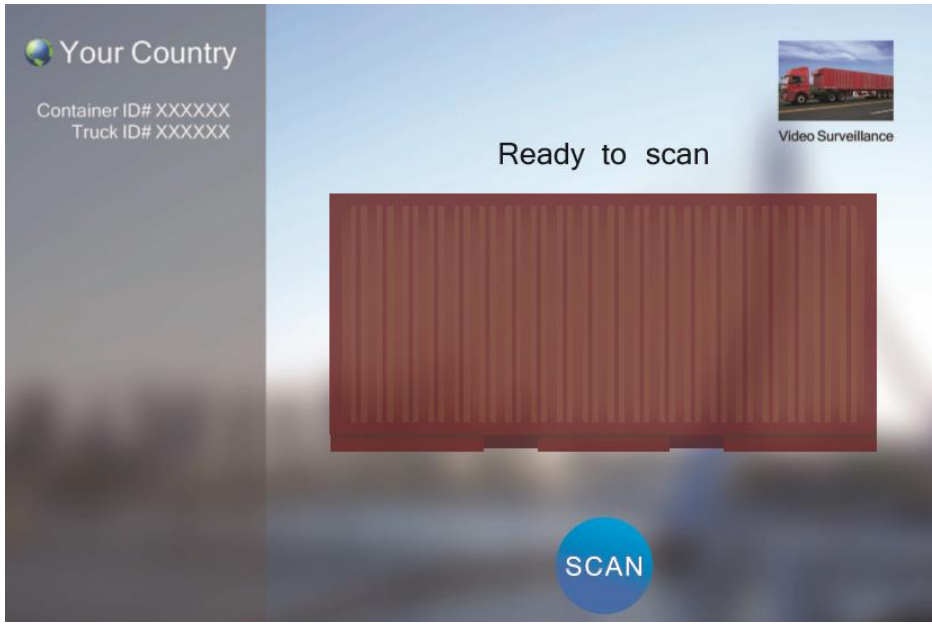
Von Mises Stress
2G Curb Hop at GVW, 2nd Iteration of Frame Structure

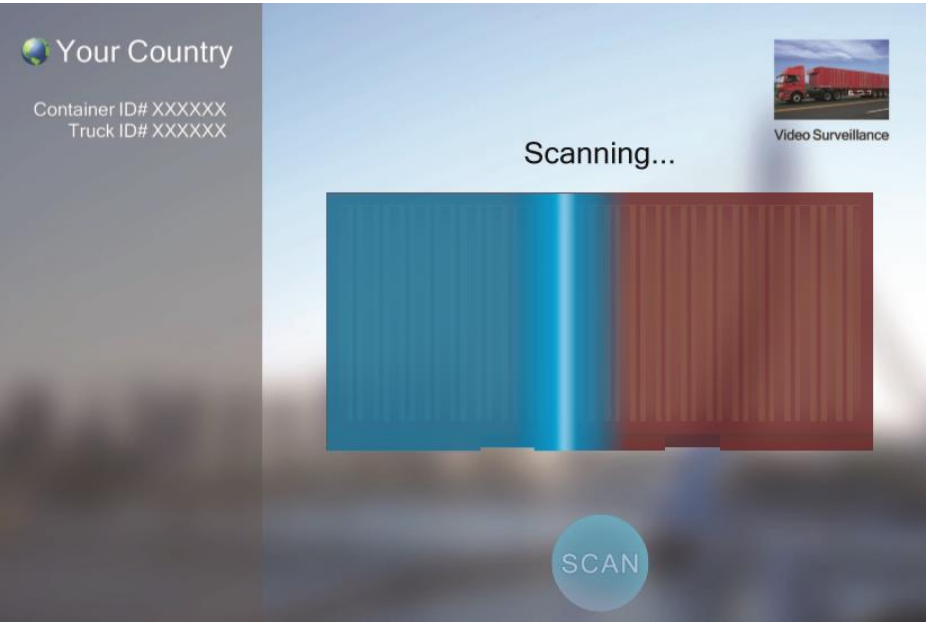


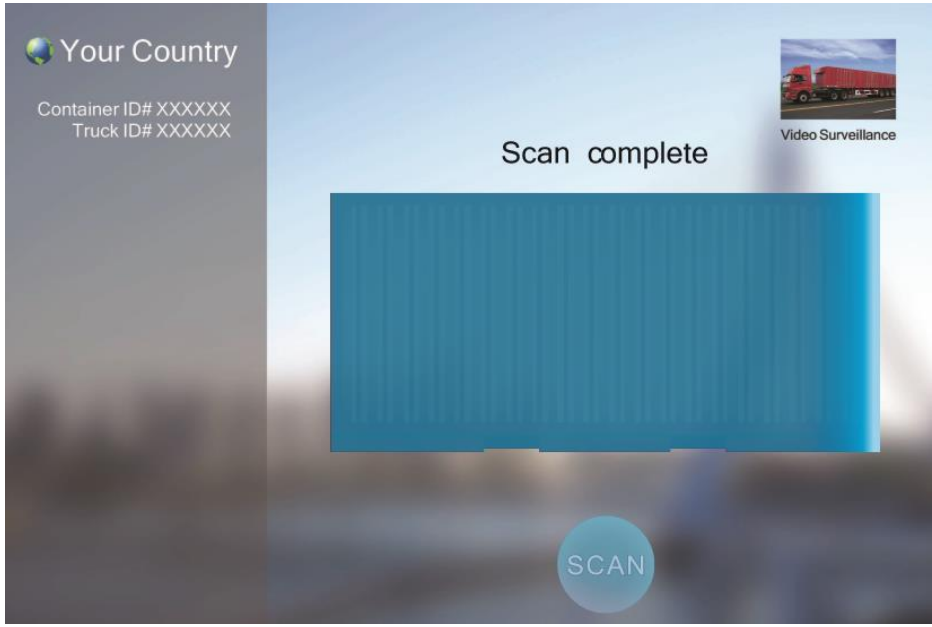
The IGRIS Maritime Scanner

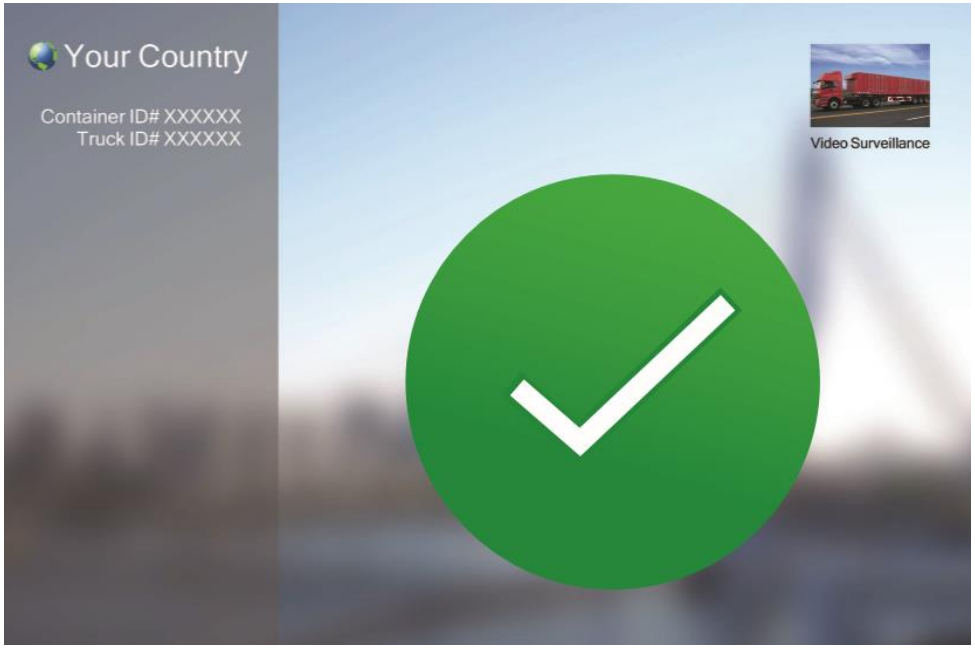
Altair


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Not in position...
1 METER


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Ready to scan
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Scanning...
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance
Scan complete
SCAN


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance


Your Country
Container ID# XXXXXX
Truck ID# XXXXXX
Video Surveillance

Your Country

Container ID# XXXXXX
Truck ID# XXXXXX

REPORTED CARGO

65m³ Aluminum

ACTUAL CARGO

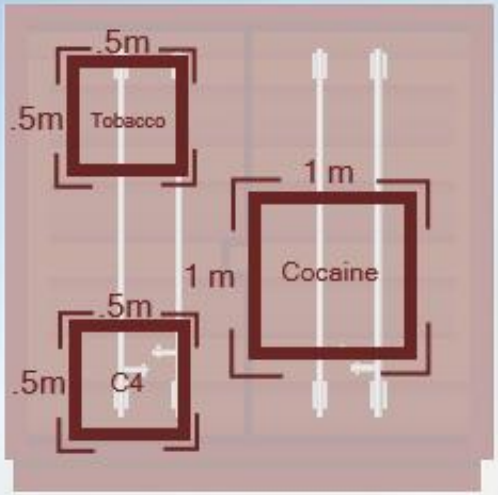
1m³ C4 Explosives

ACTUAL CARGO

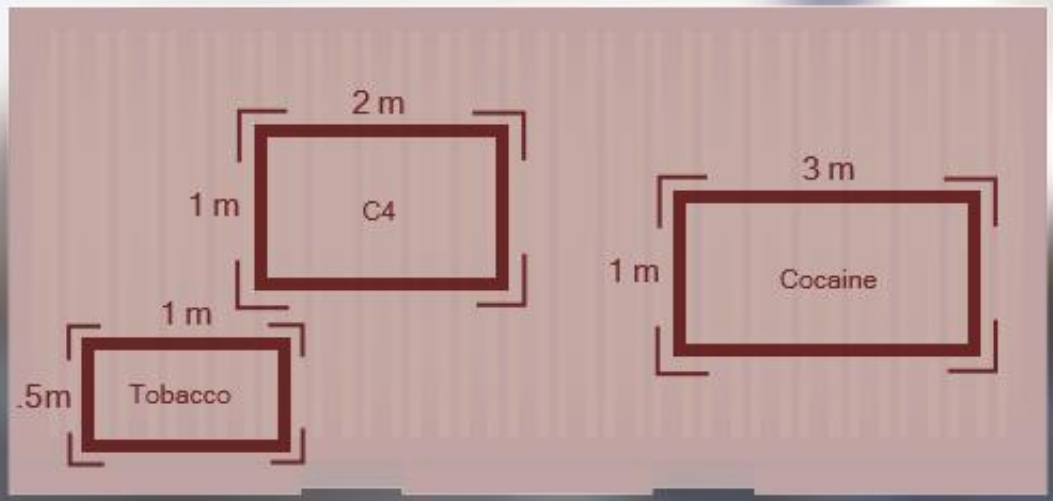
3m³ Cocaine

ACTUAL CARGO

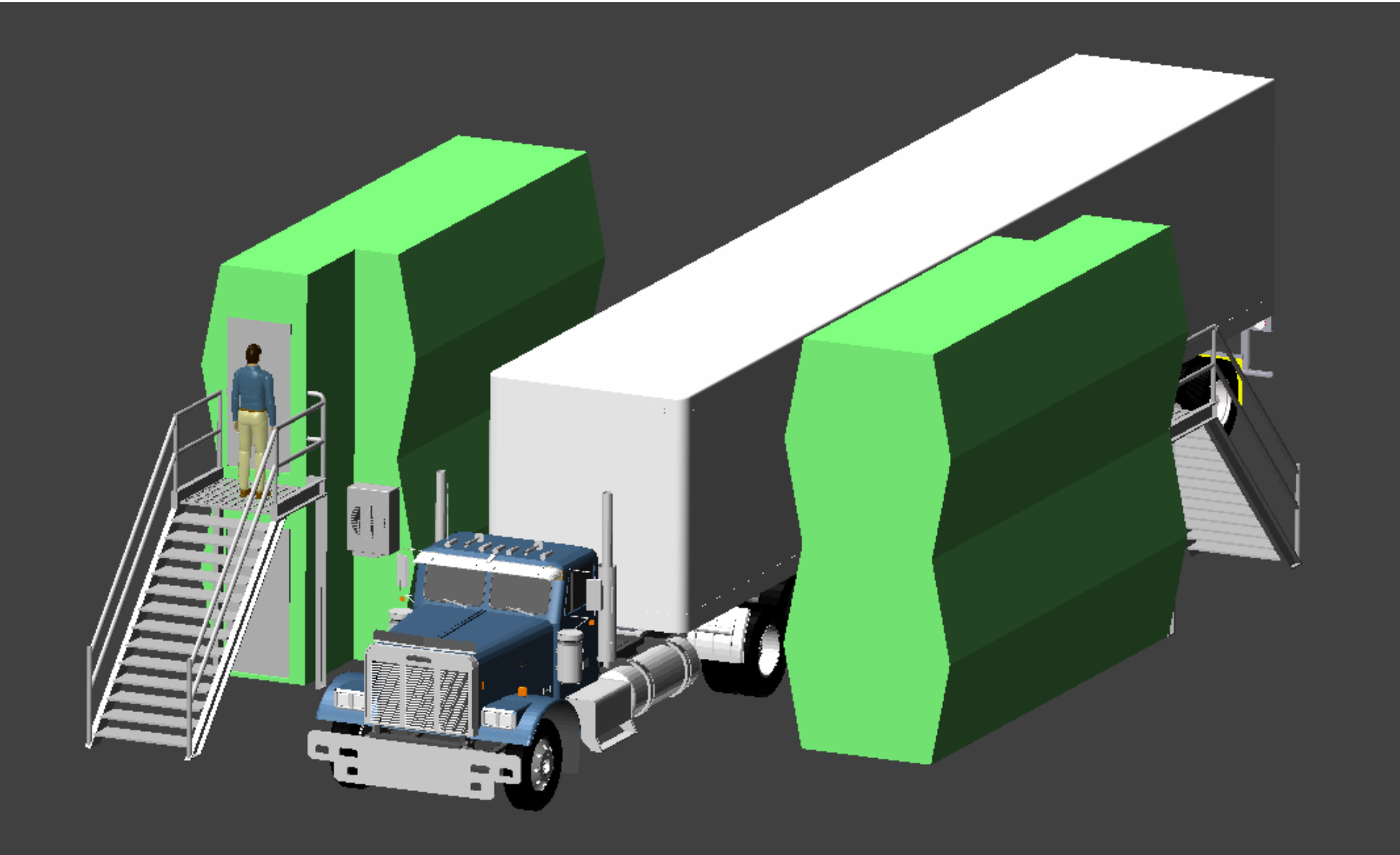
.25m³ Tobacco



Video Surveillance

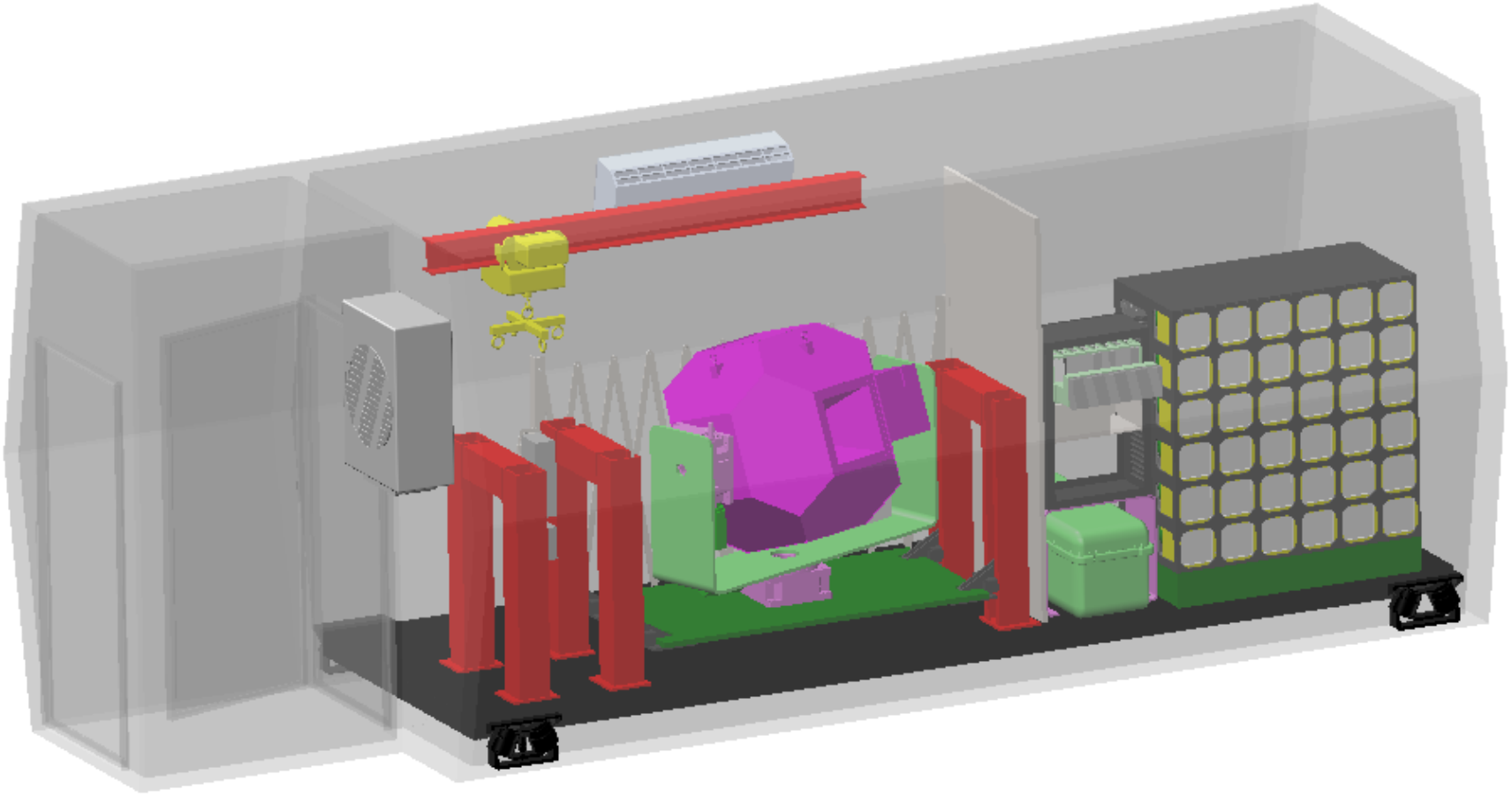


Designed for Easy Operation and Service



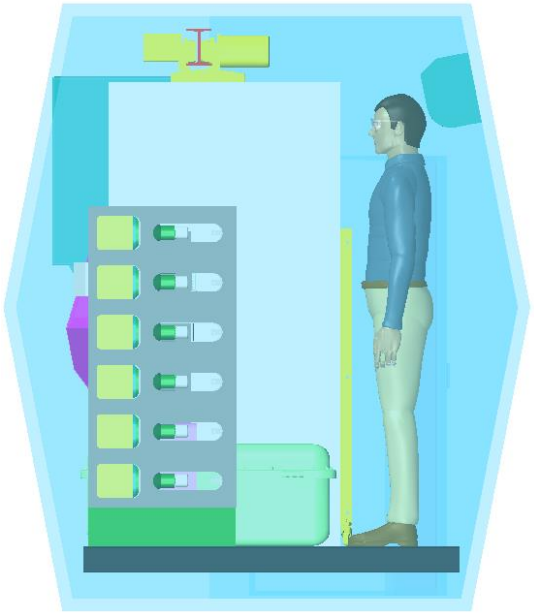
Inside the Scanner

Altair



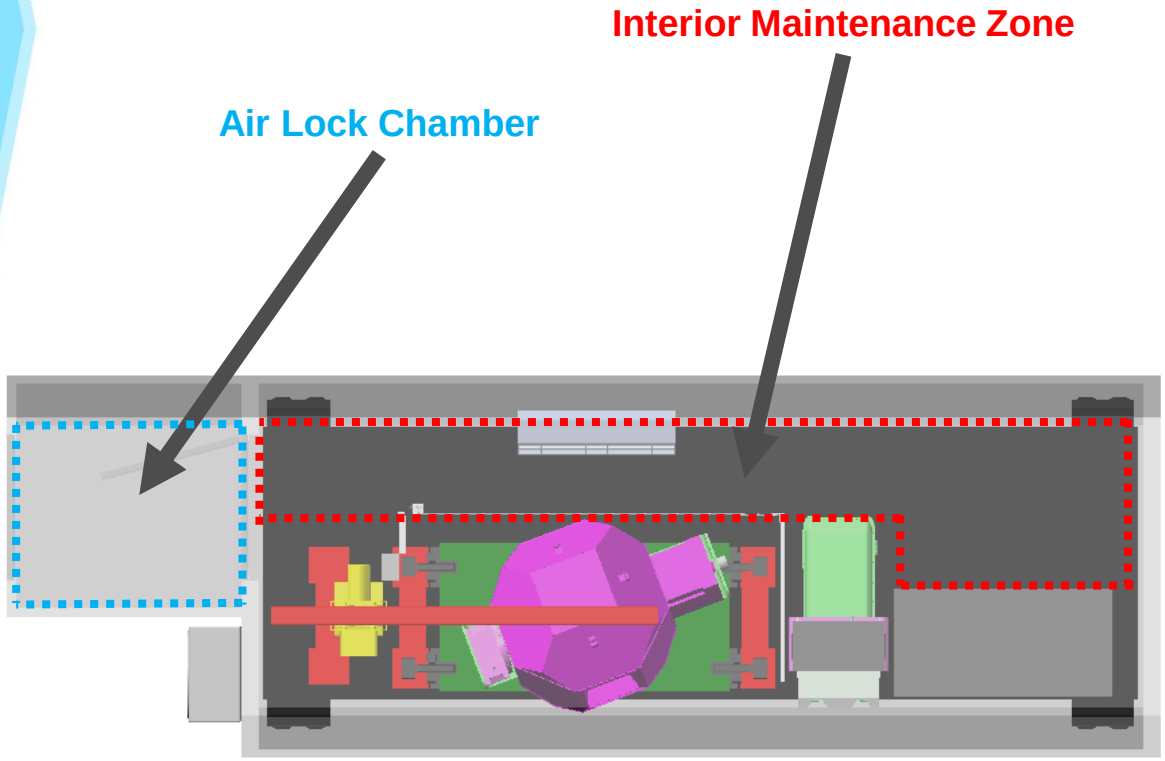
Interior Access for Maintenance Personnel

Altair



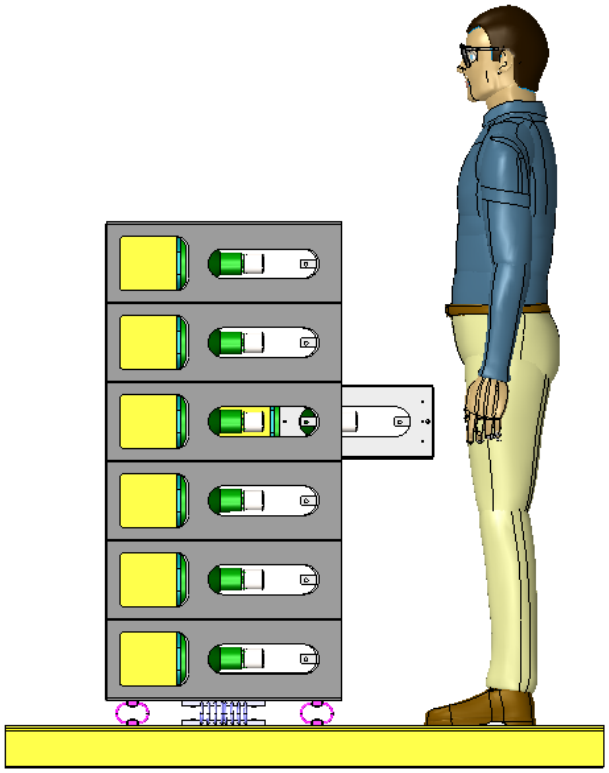
Side View

Most service can be carried out by local staff

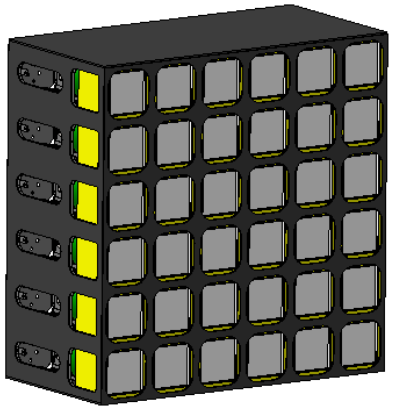


Top View

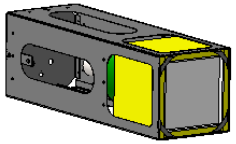
Sodium Iodide Crystal Maintenance



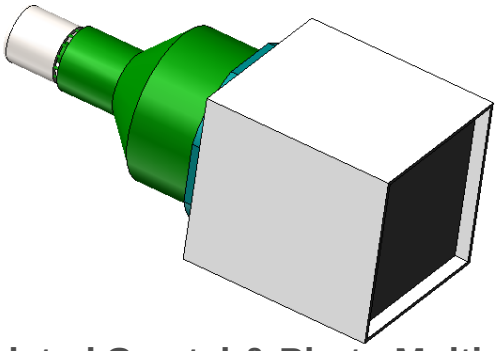
Slide out Access of
Replaceable Cartridge



36 Crystal Array



Crystal & Photo Multiplier
In Replaceable Cartridge

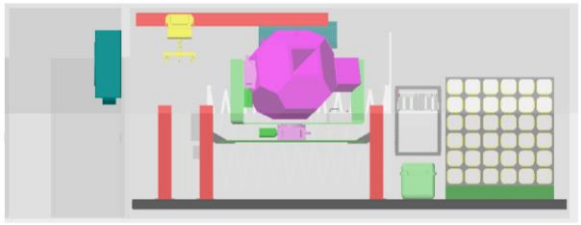


Isolated Crystal & Photo Multiplier
(never handled independently)

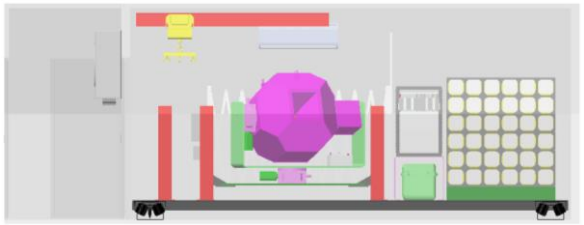
Automated Adjustment for Calibration of Neutron Beam

Altair

Vertical Adjustment

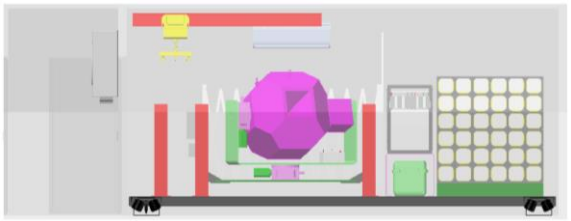


High Position

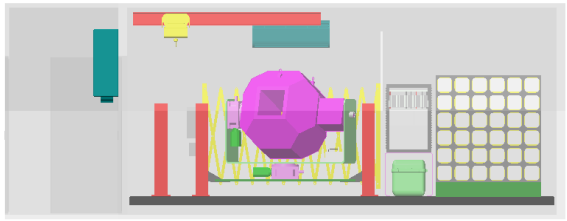


Low Position

Horizontal Adjustment

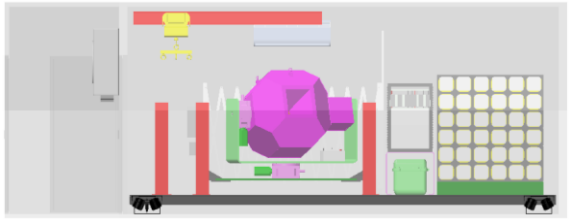


Right Position

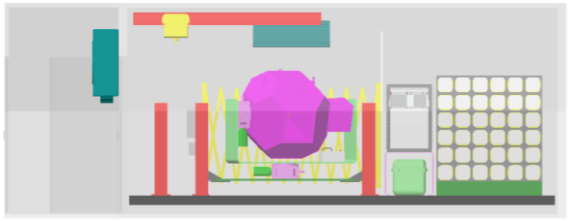


Left Position

Rotational Adjustment

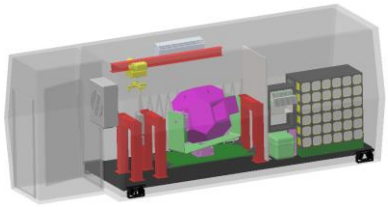


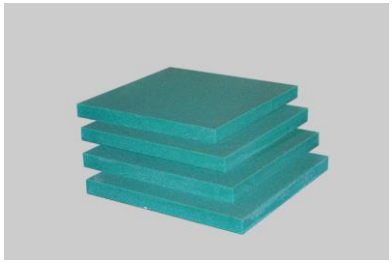
Up Position



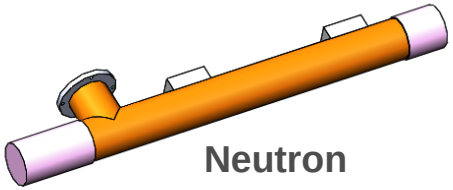
Down Position

Neutron Generator Maintenance Access





Commercially available borated polyethylene

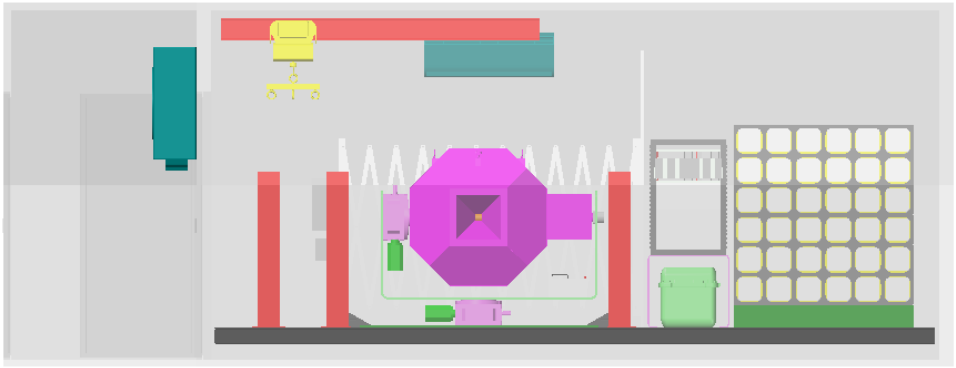


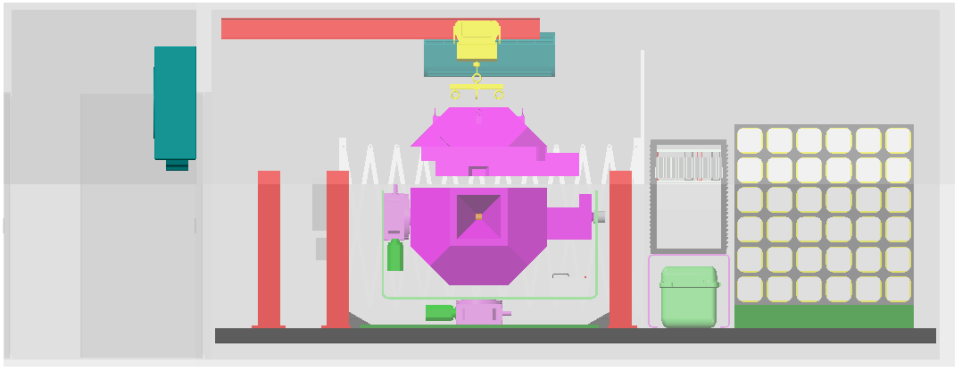
Neutron Generator

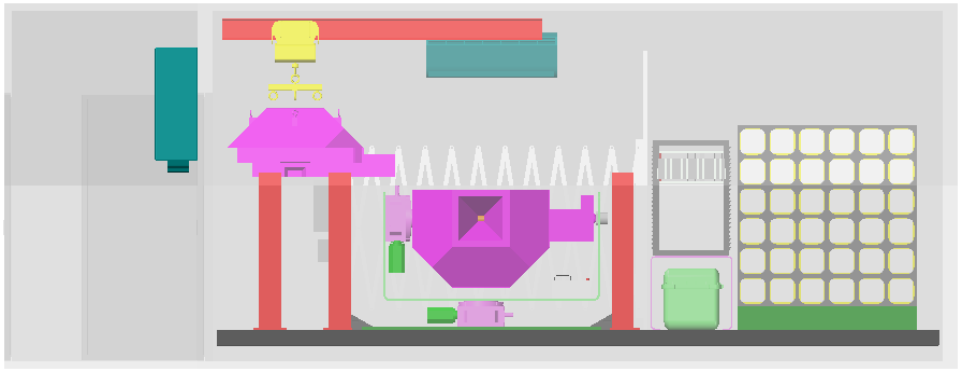
Home Position

Lift Lid

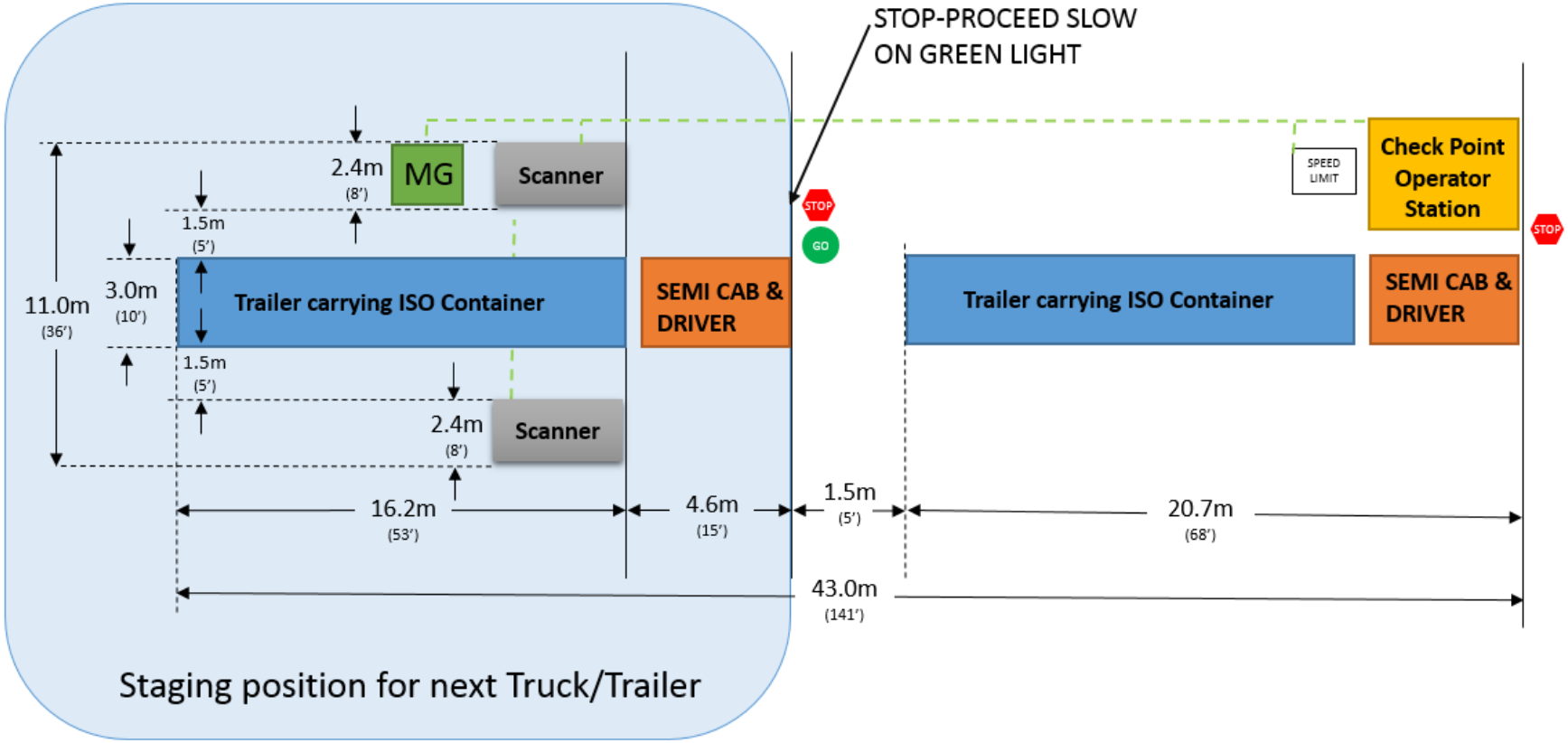
Stowed Position





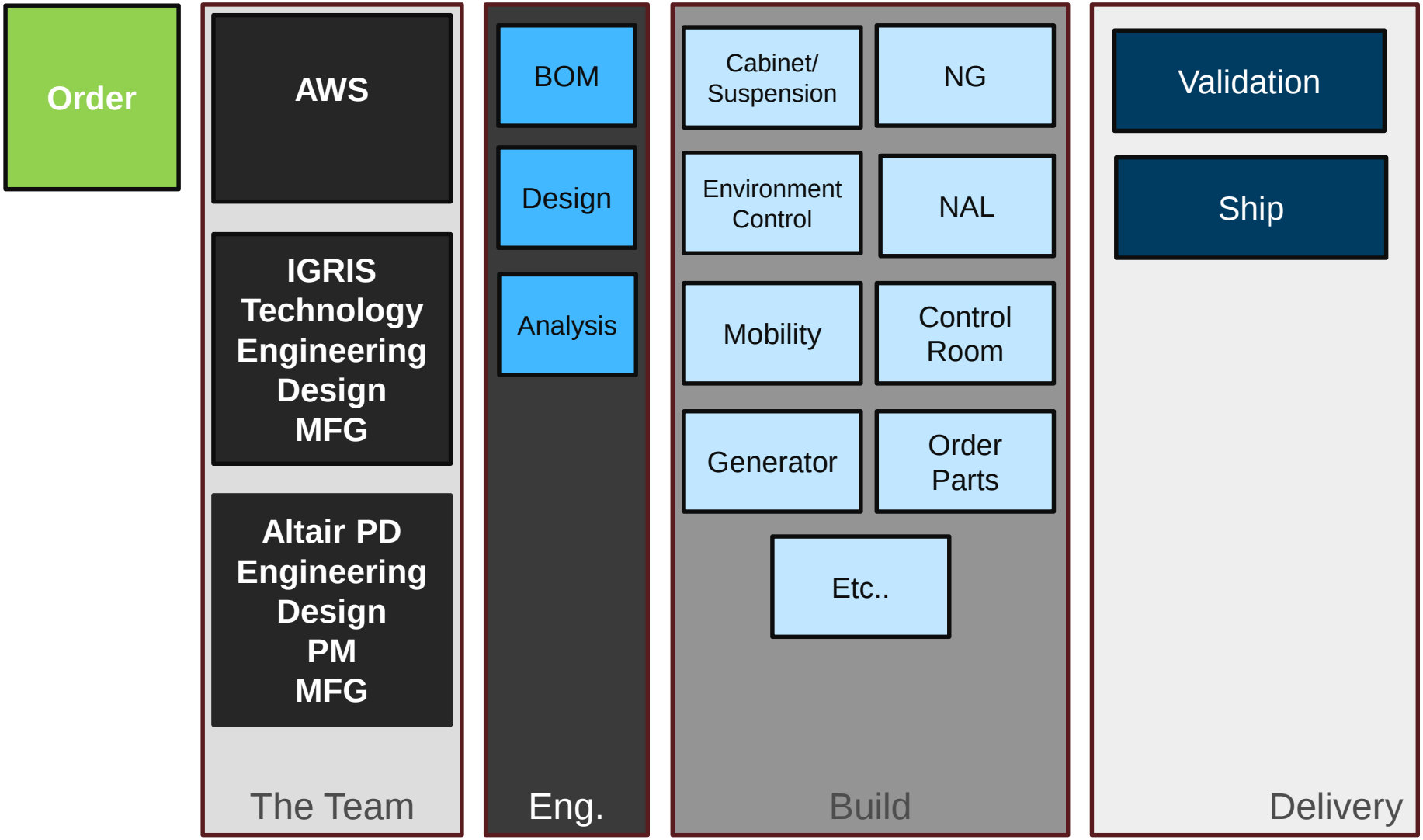


Maritime Typical Layout Specifications



The Process

Altair



“Our vision is to radically change the way organizations design products and make decisions.”

– James R. Scapa, Chairman & CEO, Altair

Q & A

ADVANCED WARNING SYSTEMS

Frequently Asked Questions

What is the technological method behind IGRIS scanners?

The Inelastic Gamma Ray Imaging System (IGRIS) combines the technology of inelastic neutron scattering with the associated particle time-of-flight spectroscopy to obtain an effective and accurate system for detection and identification of explosives and contraband drugs. In the IGRIS System, high energy neutrons are produced in a sealed tube neutron generator (STNG) with an energy of 14.1 MeV and emitted isotropically from the source. Approximately 1 million neutrons are produced each second, and the units have demonstrated an average lifetime of about 2,000 hours of operation. These high energy neutrons react with atomic nuclei of elements in the container to be assayed to produce gamma rays. Several nuclear reactions are possible, one of which is inelastic scattering with subsequent loss of neutron energy and production of gamma rays ranging in energy up to about 7 MeV. The energy and number of the gamma rays identifies the element from which it is emitted and essentially forms a "finger print" from which the element can always be identified.

The measured intensity of the inelastic gamma rays may be combined with the measured neutron output of the STNG and the known probability of inelastic neutron scattering reactions for the element to determine the density of the target atoms in the sample. Measured ratios of carbon, oxygen and nitrogen atoms (C/O, N/O and C/N) are then used to identify explosives composed of these elements. The primary purpose of the IGRIS system is to obtain density data from which these ratios may be derived.

Gamma rays produced in the sample being scanned interact with a detector assembly that provides signals to the electronic data processing module. This data is analyzed by a computer

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software program that takes account of background signals and variations in sample size and location to produce a visual indication on a video monitor for explosives or contraband drugs.

Interrogation of a sample is complicated by the many different components it may contain. Terrorists may attempt to disguise explosives by including other plastic items, food products, oils, etc. which also contain Carbon, Nitrogen and Oxygen and might be confused with explosives. For this reason, any system used to detect explosives must be able to scan the sample by volume elements that are interrogated separately. The size of these volume elements is determined by the minimum mass of explosive to be detected, approximately
0.5 kgm or 350 cc.

The IGRIS system satisfies the volume scan requirement using the associated particle time-of-flight technique. This technique allows the IGRIS system to scan a container on a volume element by volume element basis with a resolution of about 100 cubic centimeters at 1 meter. Each neutron produced is accompanied by an associated alpha particle, which moves in the opposite direction from the neutron and is detected in a 2dimensional array of alpha particle detectors behind the STNG. The gamma-ray detectors are time-gated by pulses from the alpha detector, which forms a cone of flight-time correlated neutrons through the container being analyzed. A coincidence between the signals from the alpha detector and gamma rays from the container selects only the nuclear reactions produced by neutrons in the cone and allows the IGRIS system to selectively interrogate only the volume elements of the container within the cone. The timeof-flight of the neutron and the gamma ray provides depth information so that the horizontal, vertical and depth coordinates of the reaction sites can be mapped providing a 3-dimensional image of the density of each element in the container.

The entire IGRIS system routinely exhibits high reliability in the laboratory, and on several occasions the equipment has demonstrated ruggedness in being transported to other sites for measurements. The entire unit is compact and approximately the same size as the X-ray systems

now in use to inspect airline luggage. It may be installed in a van for mobile use. Its modular construction makes for easy transport to site and assembly.

What safety measures are taken to ensure the safety of the operator and the truck-drivers?

Personnel operating the IGRIS scanners are restricted in approach to the IGRIS scanner by a distance of 1 meter. Outside this barrier, radiation levels are below those normally approved by the US government for public exposure to radiation producing equipment in 10 CFR part 20. The IGRIS scanner is engineering such that drivers and passengers in the vehicle passing through the scanner will receive less than 25 microrems per scan, which is the recently recommended limits in ANSI standard for scanning.

Is IGRIS licensed to operate?

The IGRIS laboratory has permission from the US Nuclear Regulatory Commission to possess radioactive sources, and the State of Tennessee licenses IGRIS to possess and operate equipment producing neutron radiation (see certificate below). *Each customer must satisfy similar regulations published by its own government.

ADVANCED WARNING SYSTEMS

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF RADIOLOGICAL HEALTH

Reg # 179-1839
Date Registered 07-07-2015

Control # 2

CERTIFIED REGISTRATION

Amendment 1

Pursuant to Tennessee Department of Environment and Conservation Regulations, and in reliance on statements and representations heretofore made by the registrant, a *Certified Registration* is hereby issued authorizing the registrant to use accelerator listed below for the purpose(s) and at the place(s) designated below. This *Certified Registration* is subject to all applicable rules and regulations of the Tennessee Department of Environment and Conservation and orders of the Division of Radiological Health, now or hereafter in effect and to any conditions specified below.

REGISTRANT

1. Name IGRIS, LLC
2. Address 9575 Macon Road
Cordova, TN 38016

3. *Certified Registration* No.
A-7914-F18

4. Expiration date
June 30, 2018

5. File No.
A-7914

6. A. TYPE OF EQUIPMENT AND MANUFACTURER	B. PEAK KILOVOLTAGE	C. YEAR AND MODEL	D. TYPES OF RADIATION PRODUCED	E. MAXIMUM INTENSITY PRODUCED
i. and ii. Adelphi Technology Sealed Tube Neutron Generator	i. and ii. 150 KeV	i. and ii. Model DT108AP1	i. and ii. Neutrons and Photons	i. and ii. 1 x 10 8 Neutrons/sec.
iii. Thermo MF Physics LLC, Sealed Tube Neutron Generator	iii. 150 KeV	iii. Model API 120	iii. Neutrons and Photons	iii. 1 x 10 8 Neutrons/sec.

10. Authorized Use

SEE AMENDMENT SHEETS

CONDITIONS

11. Unless otherwise specified, the authorized place of use is the registrant's address stated in item 2, above.

SEE AMENDMENT SHEETS

For the Commissioner
Tennessee Department of Environment and Conservation

Date of Issuance April 17, 2015

By: Original Signed by Johnny C.Graves
Johnny C. Graves, Licensing, Registration & Planning

ADVANCED WARNING SYSTEMS

Is IGRIS technology safe for all types of merchandise–electronics, medicines, organic materials, food products, etc.?

Yes, no radioactivity is induced in samples greater than safety levels published by the U.S. government (See chart below).

RADIATION DOSAGE

Speed MPH	Left Array Dose µrem	Right Array Dose µrem	Total Dose µrem
10	22	1.7	23.8
15	15	1.1	15.9
20	11	0.9	11.9
25	9	0.7	9.5
30	7	0.6	7.9

Source	Dose Limit
10 CFR 20.1601	100 millirem (mrem)/year
10 CFR 20.1601	2 mrem/hour
Draft ANSI (10/29/2009)	25 microrem (µrem)/scan

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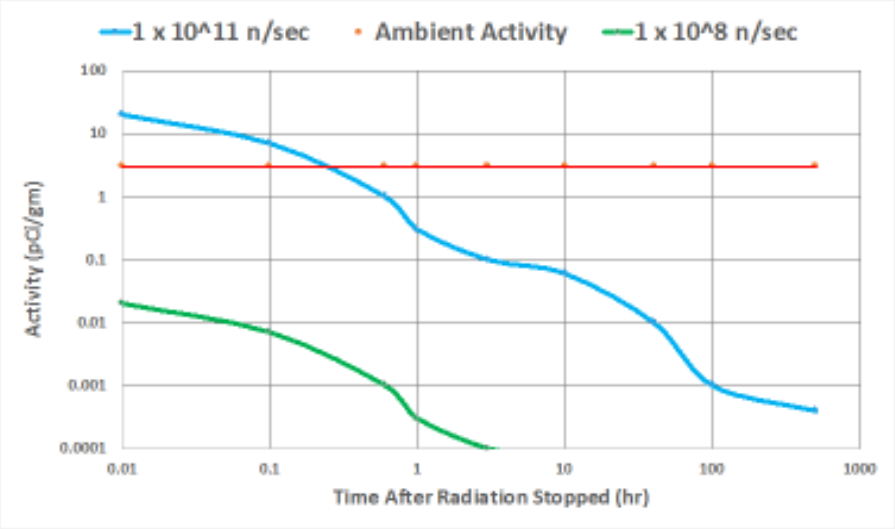
ADVANCED WARNING SYSTEMS

Has the scanner been tested on food products and other organic materials?

IGRIS has tested numerous explosives and inert substances including food, fabrics, fertilizer, building materials, etc. In all cases the scanning equipment identified the Carbon, Nitrogen, Oxygen, and Chlorine content of the sample.

INDUCED RATIOACTIVITY IN AGRICULTURAL PRODUCTS AFTER 1 MINUTE IRRADIATION WITH 14 MeV NEUTRONS



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ADVANCED WARNING SYSTEMS

Is there a full-scale operational prototype of the IGRIS scanner?

A full scale prototype of the single-array IGRIS scanner is available for demonstration.

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ADVANCED WARNING SYSTEMS

14 MeV - 1 Vehicle Checkpoint Scanner

The IGRIS Vehicle Scanning Solution (14 MeV-1) is a highly effective alternative to physical inspection of vehicles entering secure areas and is designed to scan cars, pickup trucks, and motorcycles. Within seconds, a scan can be performed on a moving vehicle or a stopped vehicle to determine with certainty whether contraband exists in virtually any quantity. This system can detect all explosive materials in both a liquid or solid state, illegal drugs, chemicals and nuclear materials, and items of interest to Customs even when they are in a camouflaged environment. It is ideal for anti-smuggling, border security, and perimeter control applications. IGRIS technology is unmatched by any other explosive and contraband detection on the market today.

Detection Capabilities

IGRIS scanning technology will scan and identify all substances of interest based on the list provided by each individual country. The first part of the list, normally prepared by police or national security, deals with security issues and generally includes items such as drugs and explosives. A list of the explosive materials that will be routinely detected by the IGRIS vehicle scanner includes: C4, Pentolite, Detasheet, Octol 75/25, Composition B, Smokeless Powder, TNT, and PBX. Virtually any other explosive or harmful compound can be detected, including nerve gas. Nuclear weapons and nuclear waste is also detected.

The second part of the list is prepared by Customs and describes the items that they would like to tax either upon import or upon export, such as coffee, tobacco, alcohol, etc. The IGRIS system enhances the security of the country and increases revenue from Customs by providing them with a reliable tool to put an end to the evasion of duties.

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ADVANCED WARNING SYSTEMS

Performance Objectives

IGRIS, or Inelastic Gamma Ray Imaging Spectroscopy, is a revolutionary computerized detection system that analyzes the atomic composition of contraband, identifying any and all organic and inorganic substances with a high degree of accuracy within seconds. Scans can be performed on a moving target or a stopped target.

Labor Requirements

One minimum wage employee with training can operate the IGRIS vehicle scanner (14 MeV-1). The operator presses a single button, which will initiate the scanning process. A "PASS" (green light) or "FAIL" (red light) reading appears to indicate whether explosive or contraband materials are present, eliminating human interpretation error when screening images. The detection light can be simultaneously linked with additional safety measures, which raise or lower exit gates to allow or restrict vehicles from further movement.

Safety

The IGRIS scanner is safe to operate both for the personnel and the public with less than 1/100th the radiation exposure of a dental X-Ray, which is well below the published ANSI standards for radiation safety. The scientists who invented this technology have been working for over 20 years with IGRIS scanners and the safety of this scanner is well documented and presents no risk.

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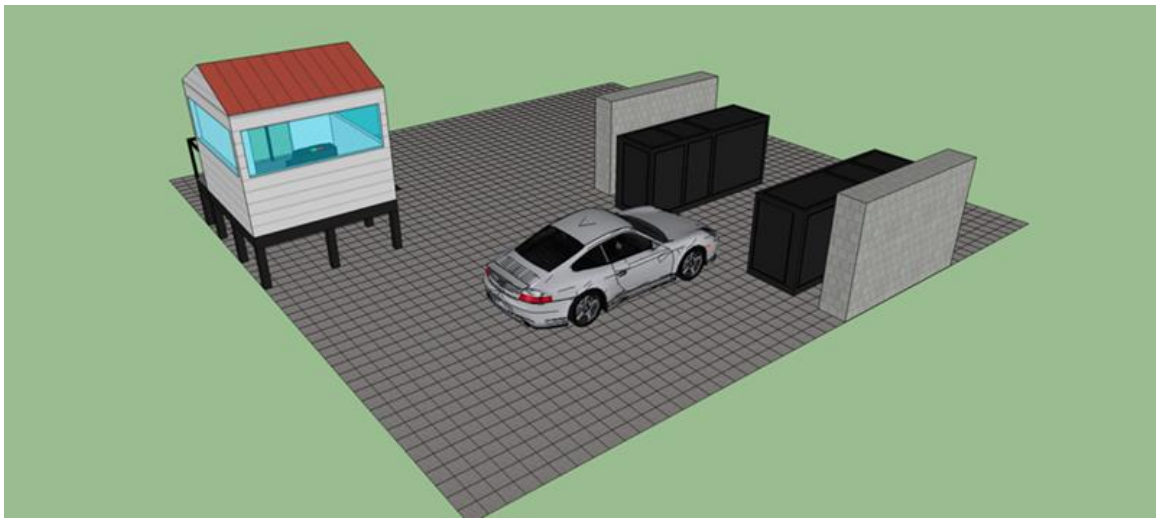
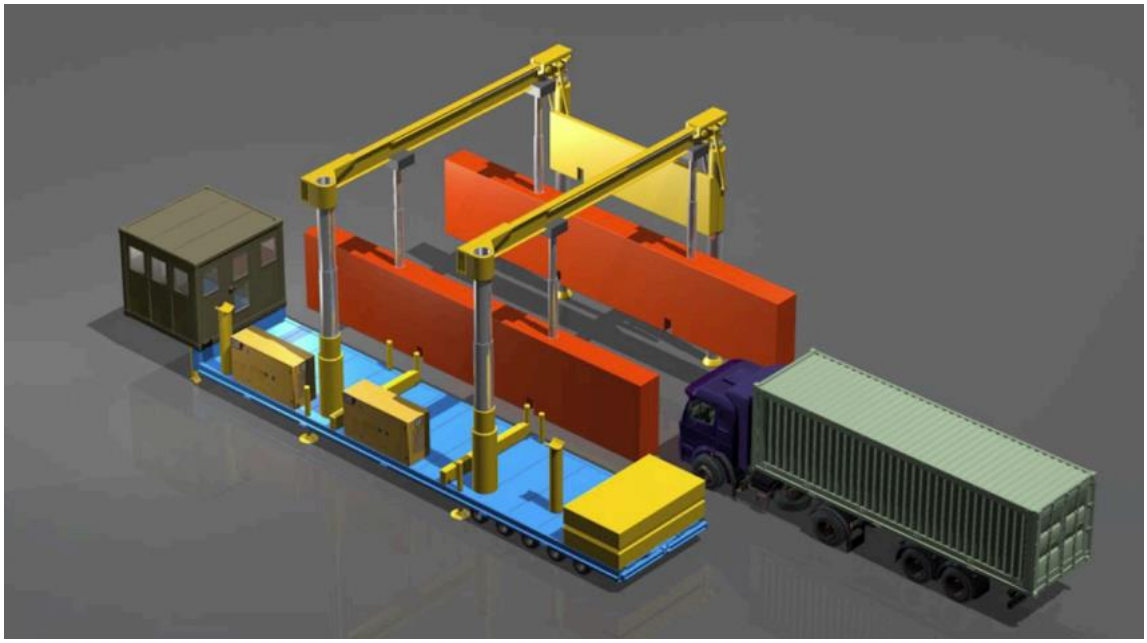
ADVANCED WARNING SYSTEMS





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User Interface

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ADVANCED WARNING SYSTEMS

Maritime Cargo Scanner

The largest model to be introduced to the IGRIS scanning technology family is the Maritime Cargo Scanner. Within seconds, a scan can be performed to determine with a high degree of accuracy whether contraband exists in virtually any quantity. This system can detect all explosive materials in both a liquid or solid state, illegal drugs, chemicals and nuclear materials, and items of interest to Customs even when they are in a camouflaged environment. It is dedicated for commercial cargo containers at seaports and airports. IGRIS technology is unmatched by any other explosive and contraband detection on the market today.

Detection Capabilities

IGRIS scanning technology will scan and identify all substances of interest based on the list provided by each individual country. The first part of the list, normally prepared by police or national security, deals with security issues and generally includes items such as drugs and explosives. A list of the explosive materials that will be routinely detected by the IGRIS maritime cargo scanner includes: C4, Pentolite, Detasheet, Octol 75/25, Composition B, Smokeless Powder, TNT, and PBX. Virtually any other explosive or harmful compound can be detected, including nerve gas. Nuclear weapons and nuclear waste is also detected.

The second part of the list is prepared by Customs and describes the items that they would like to tax either upon import or upon export, such as coffee, tobacco, alcohol, etc. The IGRIS system enhances the security of the country and increases revenue from Customs by providing them with a reliable tool to put an end to the evasion of duties.

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ADVANCED WARNING SYSTEMS

Performance Objectives

IGRIS, or Inelastic Gamma Ray Imaging Spectroscopy, is a revolutionary computerized detection system that analyzes the atomic composition of contraband, identifying any and all organic and inorganic substances with a high degree of accuracy within seconds.

Labor Requirements

One minimum wage employee with training can operate the IGRIS cargo scanner. The operator presses a single button, which will initiate the scanning process. A "PASS" (green light) or "FAIL" (red light) reading appears to indicate whether explosive or contraband materials are present, eliminating human interpretation error when screening images. The detection light can be simultaneously linked with additional safety measures, which raise or lower exit gates to allow or restrict vehicles from further movement.

Safety

The IGRIS scanner is safe to operate both for the personnel and the public with less than 1/100th the radiation exposure of a dental X-Ray, which is well below the published ANSI standards for radiation safety. The scientists who invented this technology have been working for over 20 years with IGRIS scanners and the safety of this scanner is well documented and presents no risk.

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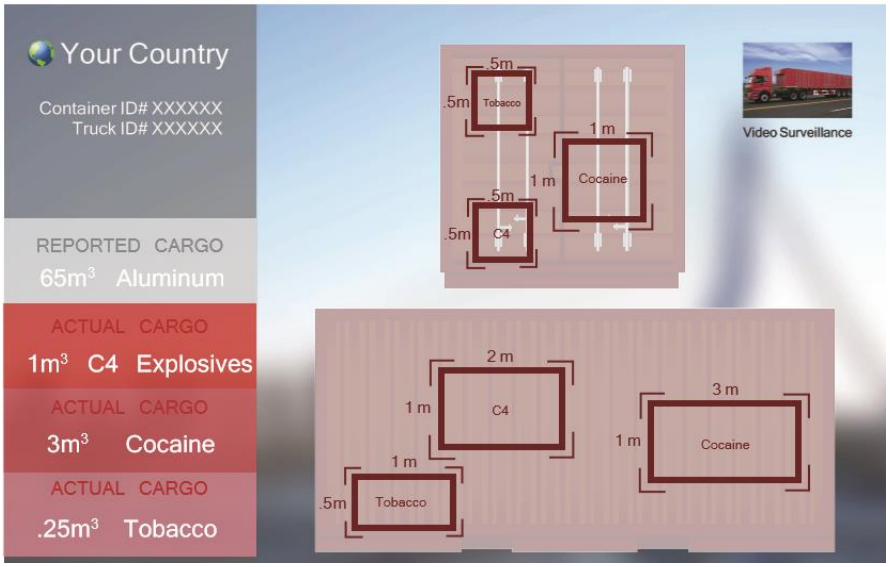
ADVANCED WARNING SYSTEMS

IGRIS Scanner



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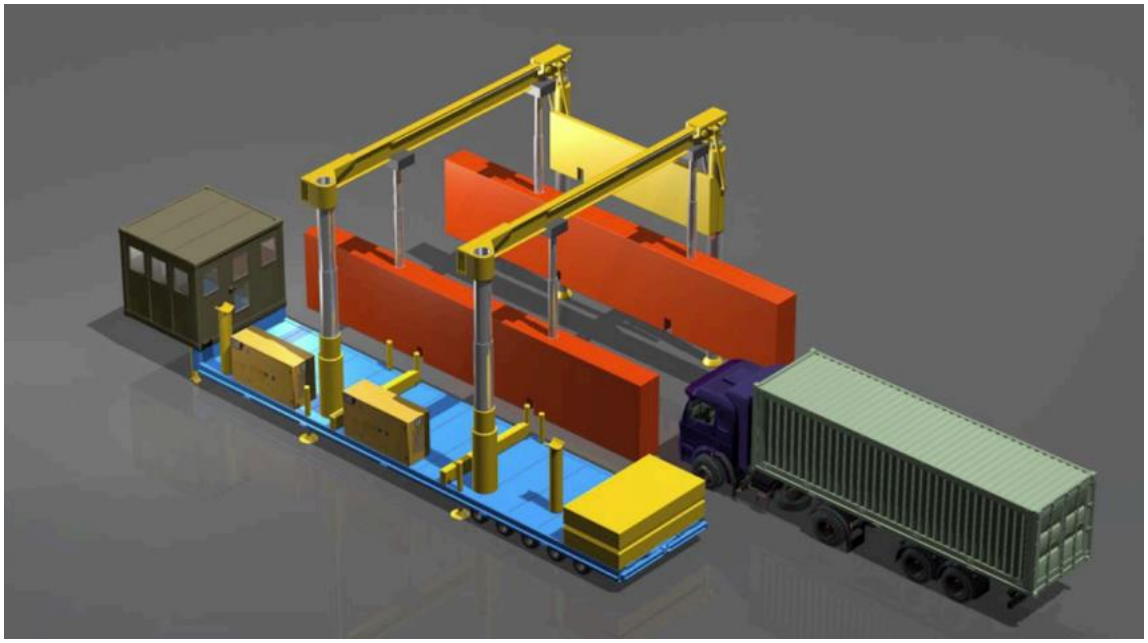

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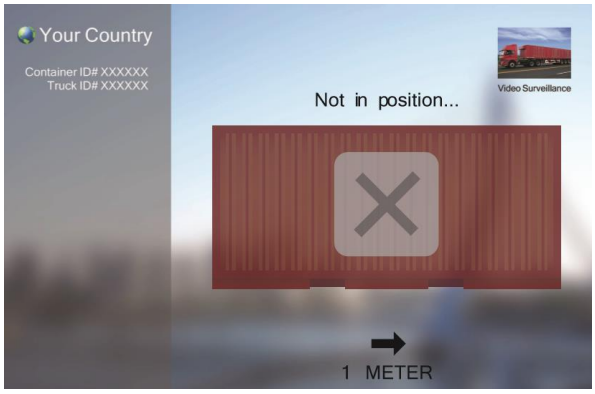
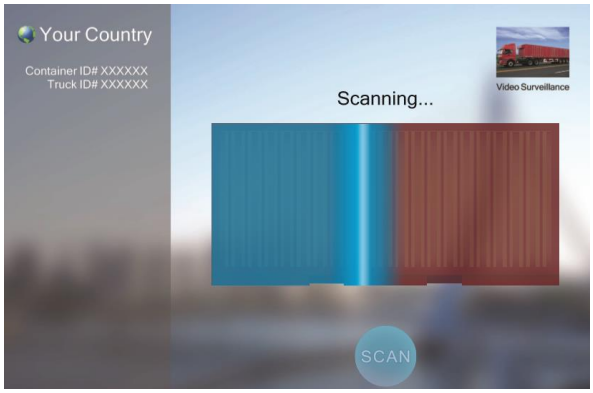
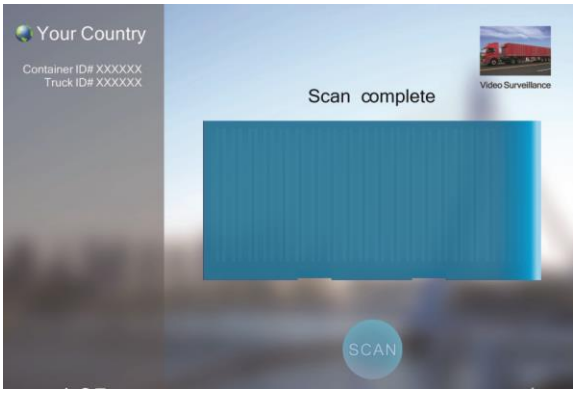
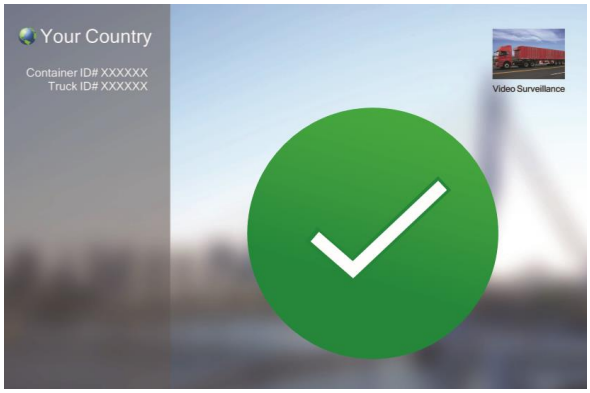
ADVANCED WARNING SYSTEMS

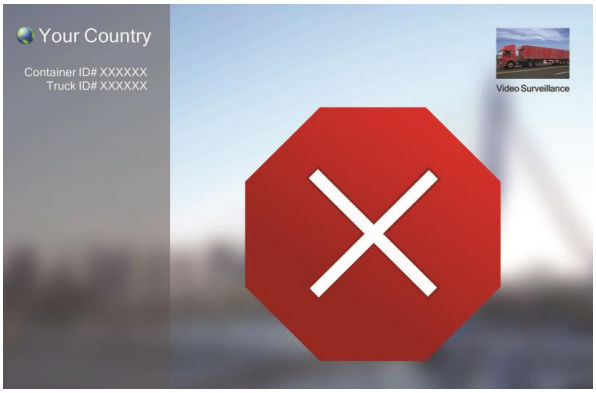
User Interface











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ADVANCED WARNING SYSTEMS

14 MeV-2 Luggage and Parcel Scanner

The Model 14 MeV-2 was designed to be the fastest and the most sensitive luggage and small parcel scanner in the world today and will be dedicated for use of travel luggage and small parcels. Within seconds, a scan can be performed to determine with a high degree of accuracy whether contraband exists in virtually any quantity. This system can detect all explosive materials in both a liquid or solid state, illegal drugs, chemicals and nuclear materials, and items of interest to Customs even when they are in a camouflaged environment. IGRIS technology is unmatched by any other explosive and contraband detection on the market today.

Detection Capabilities

IGRIS scanning technology will scan and identify all substances of interest based on the list provided by each individual country. The first part of the list, normally prepared by police or national security, deals with security issues and generally includes items such as drugs and explosives. A list of the explosive materials that will be routinely detected by the IGRIS luggage and parcel scanner includes: C4, Pentolite, Detasheet, Octol 75/25, Composition B, Smokeless Powder, TNT, and PBX. Virtually any other explosive or harmful compound can be detected, including nerve gas. Nuclear weapons and nuclear waste is also detected.

The second part of the list is prepared by Customs and describes the items that they would like to tax either upon import or upon export, such as coffee, tobacco, alcohol, etc. The IGRIS system enhances the security of the country and increases revenue from Customs by providing them with a reliable tool to put an end to the evasion of duties.

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ADVANCED WARNING SYSTEMS

Performance Objectives

IGRIS, or Inelastic Gamma Ray Imaging Spectroscopy, is a revolutionary computerized detection system that analyzes the atomic composition of contraband, identifying any and all organic and inorganic substances with a high degree of accuracy within seconds.

Labor Requirements

One minimum wage employee with training can operate the IGRIS luggage and parcel scanner (14 MeV-2). The operator presses a single button, which will initiate the scanning process. A "PASS" (green light) or "FAIL" (red light) reading appears to indicate whether explosive or contraband materials are present, eliminating human interpretation error when screening images. The detection light can be simultaneously linked with additional safety measures, which raise or lower exit gates to allow or restrict vehicles from further movement.

Safety

The IGRIS scanner is safe to operate both for the personnel and the public with less than 1/100th the radiation exposure of a dental X-Ray, which is well below the published ANSI standards for radiation safety. The scientists who invented this technology have been working for over 20 years with IGRIS scanners and the safety of this scanner is well documented and presents no risk.

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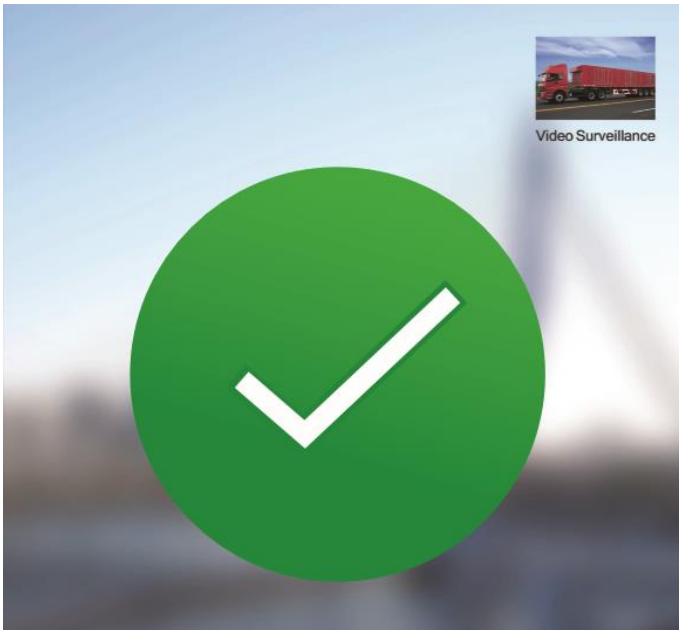
ADVANCED WARNING SYSTEMS

User Interface



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