PHYSICAL MEETING

#2 ANNUAL WORKSHOP

Nuclear Security in Maritime Infrastructure

24-25 JUNE 2021
Athens, Greece

INCLUDING

This project has received funding from the European Union's Horizon 2020 research and innovation under grant agreement No. 833573

WORKSHOP AGENDA - DAY 1

24/06/2021

DAY 1 - WORKSHOP
National and Kapodistrian University of Athens (NKUA)

09:30 **OPENING AND WELCOME**
Prof. S. Hadjiefthymiades - National and Kapodistrian University of Athens NKUA (Greece)
L. De Dominicis – Agency for New Technologies, Energy and Sustainable Economic Development ENEA (Italy)

SESSION 1

Nuclear Security in Maritime Infrastructure - strategic landscape

Chairperson:
K. Boudergui (CEA)

09:45 **MEASURES / PROCEDURES ON COUNTERING ILLEGAL TRAFFICKING OF RADIOACTIVE MATERIAL**
A. Boziari, Greek Atomic Energy Commission EEAE (Greece)

10:05 **ASRN AND NUCLEAR SECURITY IN MARITIME INFRASTRUCTURE**
I. M. Moussa – Président de l'Autorité Nationale de Radioprotection de Sureté et de Sécurité Nucléaire ASRN (Mauritania)

10:20 **FORENSIC ASPECTS OF CHAIN OF CUSTODY IN MARITIME CRITICAL INFRASTRUCTURE**
A. Rizzo, ENEA (Italy)

10:40 **NSCOE PRACTICES IN CONDUCTING FIELD EXERCISES**
L. Aleksejus - Nuclear Security Centre of Excellence NSCOE (Lithuania)

11:00 **COFFEE BREAK**

WORKSHOP AGENDA - DAY 1

SESSION 2

Nuclear Security in Maritime Infrastructure - operational landscape

Chairperson:
D. Neimontaité (NSCOE)

11:15 **INCLUDING FEDERATION: MODEL & PLATFORM**
Prof. S. Hadjiefthymiades - National and Kapodistrian University of Athens NKUA (Greece)

11:45 **CRISIS MANAGEMENT RESEARCH AT FRAUNHOFER IVI**
R. Hedel - Fraunhofer IVI (Germany)

12:10 **IMMERSIVE VIRTUAL REALITY TRAINING FOR CBRN SCENARIOS**
M. Melo - INESC TEC (Portugal)

12:30 **LUNCH BREAK**

14:30 **OPERATIONAL ASPECTS OF CIVIL-MILITARY COOPERATION IN RADIOLOGICAL SECURITY SCENARIOS ON MARITIME ENVIRONMENT**
S. Kolovos – Hellenic Ministry Of Defence (HMOD) (Greece)

14:50 **UAVS IN MARITIME SECURITY**
A. Nadziejko – Tekever (Portugal)

15:10 **AFFORDABLE RADIATION DETECTION SYSTEM FOR UAV APPLICATIONS**
Lt. F. Fumian - Italian Joint NBC Defence School (Italy)
PhD. A. Chierici - University of Rome "Tor Vergata" Industrial Engineering Dpt. (Italy)

15:30 **CAEN INNOVATION IN SECURITY**
J. Givelotti - CAEN (Italy)

including-cluster.eu

WORKSHOP AGENDA - DAY 2

25/06/2021

DAY 2 - WORKSHOP

National and Kapodistrian University of Athens

SESSION 3

Nuclear Security in Maritime Infrastructure - Collaboration among projects and international activities

Chairperson: Capt. S. Kolovos (HMOD)

09:30 **INSPECTION IN MARITIME INFRASTRUCTURE: THE C- BORD PROJECT**

K. Bodor - Hungarian Academy of Sciences Centre for Energy Research MTA EK (Hungary)

09:50 **EU- HYBNET AND LINKS WITH INCLUDING**

R. Brancaleoni – Università Cattolica del Sacro Cuore UCSC (Italy)

10:10 **INCLUDING CITIZENS AND PRACTITIONERS IN CBRNE RESEARCH & EXERCISES: THE PROACTIVE APPROACH**

L. Petersen – International Union of Railways (France)

10:40 **THE URBANAWARE CBRN/HAZMAT INFORMATION MANAGEMENT SYSTEM FOR INCIDENT PLANNING, TRAINING AND RESPONSE**

M. Purves - Riskaware (UK)

11:00 **COFEE BREAK**

11:15 **EXERTER**

Kemea - to be confirmed

11:35 **MEDICAL ASPECTS OF CBRN THREAT**

Col A. Zafirakis, - Hellienic Army General Hospital (Greece)

11:55 **WORKSHOP FINAL REMARKS AND CONCLUSIONS**

EEAE ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΑΤΟΜΙΚΗΣ ΕΝΕΡΓΕΙΑΣ
GREEK ATOMIC ENERGY COMMISSION

Combating The Illicit Trafficking Threat In Greece

Argiro Boziari
Calibration and Dosimetry Department
Greek Atomic Energy Commission
argiro.boziari@eeae.gr

EEAE: Regulatory body

- ✓ **Competent national regulatory authority in the fields of radiological protection and nuclear safety**

Our identity

Mission

The protection of the public, the workers and the environment from ionizing radiation and artificially produced non-ionizing radiation.

Vision

To be a modern regulatory authority, in the areas of radiological protection and nuclear safety, enjoying trustfulness and recognition nationally and internationally, and a model public service fulfilling its tasks with responsibility.

Values

Integrity and Impartiality, Competence, Quality and Credibility, Transparency, Social Responsibility, Scientific Excellence, Openness

Main tasks - Responsibilities

EEAE sets the radiation safety rules and ensures compliance mainly through:

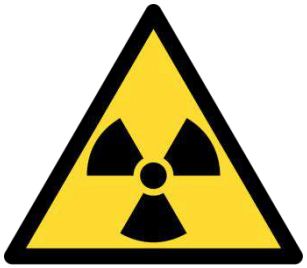
- inspections and measurement controls,
- monitoring of the environmental radioactivity,
- monitoring of the radiation doses of the occupationally exposed workers,
- providing continuous education and training,
- informing the public and other State Authorities.
- combating of radioactive materials illicit trafficking
    - scrap metal inspections
    - inspections in entrance points customs

Having safety as first priority, EEAE:

- provides high level quality services and operates state –of-the-art laboratories
- prepares for and responds to radiological/nuclear emergencies
- promotes the radiation protection safety culture and
- commits itself to scientific excellence.

Radiation uses:

medicine, research, industry



- **Radiotherapy: 46**

  e.g. linear accelerators, ^{60}Co systems, brachytherapy systems

- **Nuclear medicine: 159**

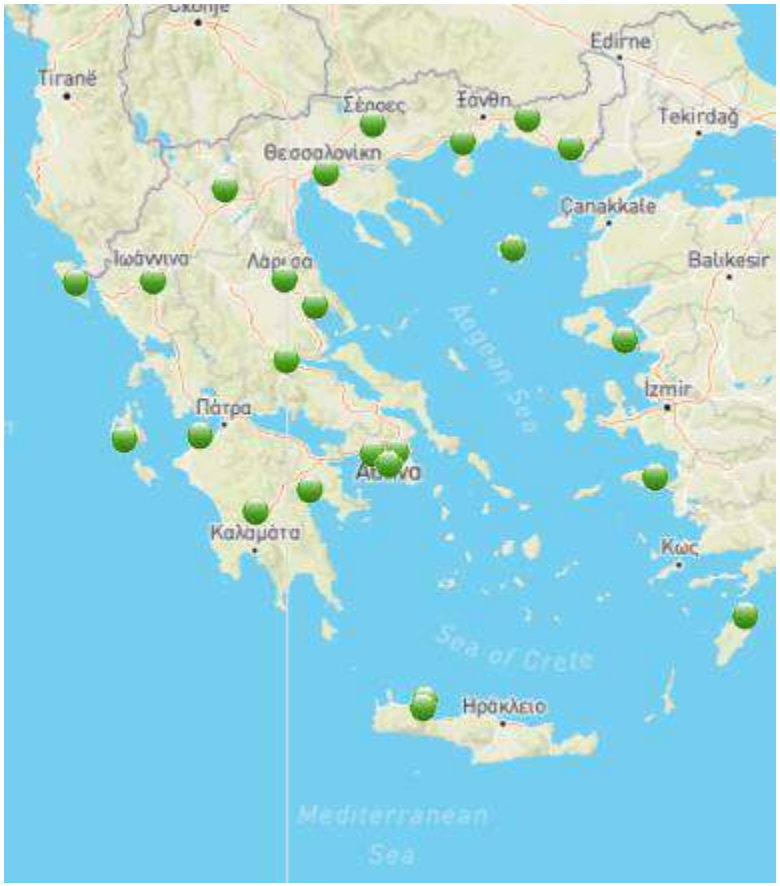
  e.g. γ-camera systems, PET/CT

- **Diagnostic/interventional radiology: 1253**

  e.g. CT, X-ray systems

- **Dental laboratories: 8272**
- **Veterinary: 357**
- **Research and education applications: 200**
- **Industrial applications: 378**
- **Research reactor** (extended shut down)

Environmental Radioactivity Monitoring



On-line connection with EEAE' s website

Automatic telemetric network for the measurement of radioactivity levels throughout Greece.

- 24 total γ air monitoring stations
- ▲ 3 aerosol monitoring stations

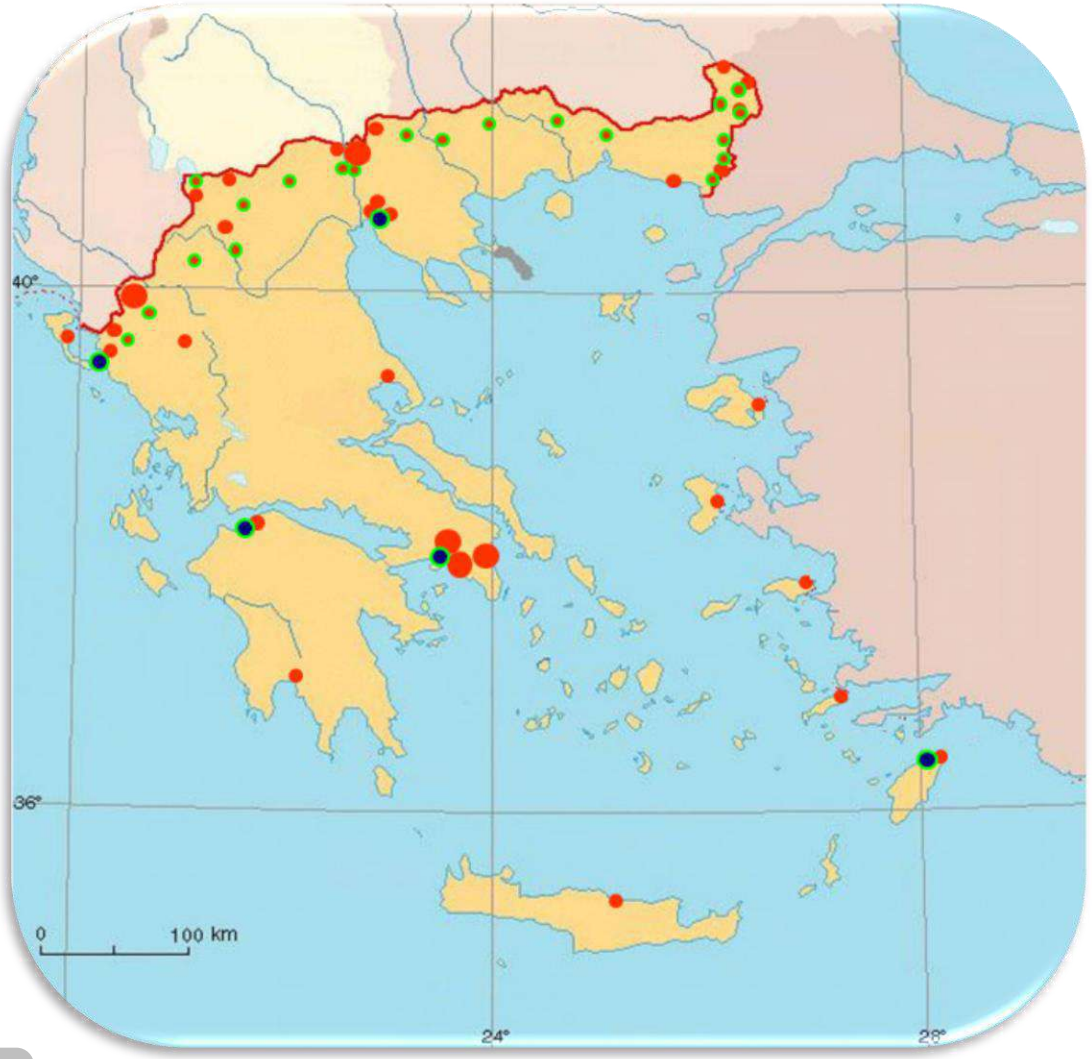
Radiation emergencies

Response

National Plan of Civil Protection and EEAE's Radiological Emergencies Internal Plan

- special teams for intervention and support
- specialized equipment
- support from the specialised network of collaborating laboratories
- connection with International networks and databases
- continuous connection and communication with national, European and international organisations

Combating illicit trafficking of radioactive or nuclear material



- Custom offices equipped with fixed radiation detection systems
- Custom offices equipped with portable detection devices
- Border guards
- Hellenic Coast Guard

Combating illicit trafficking of radioactive or nuclear material (1)

54 fixed radiation monitors at

4 main land borders, International Athens Airport and Piraeus Seaport

Portable detectors for secondary inspection.

Combating illicit trafficking of radioactive or nuclear material (2)

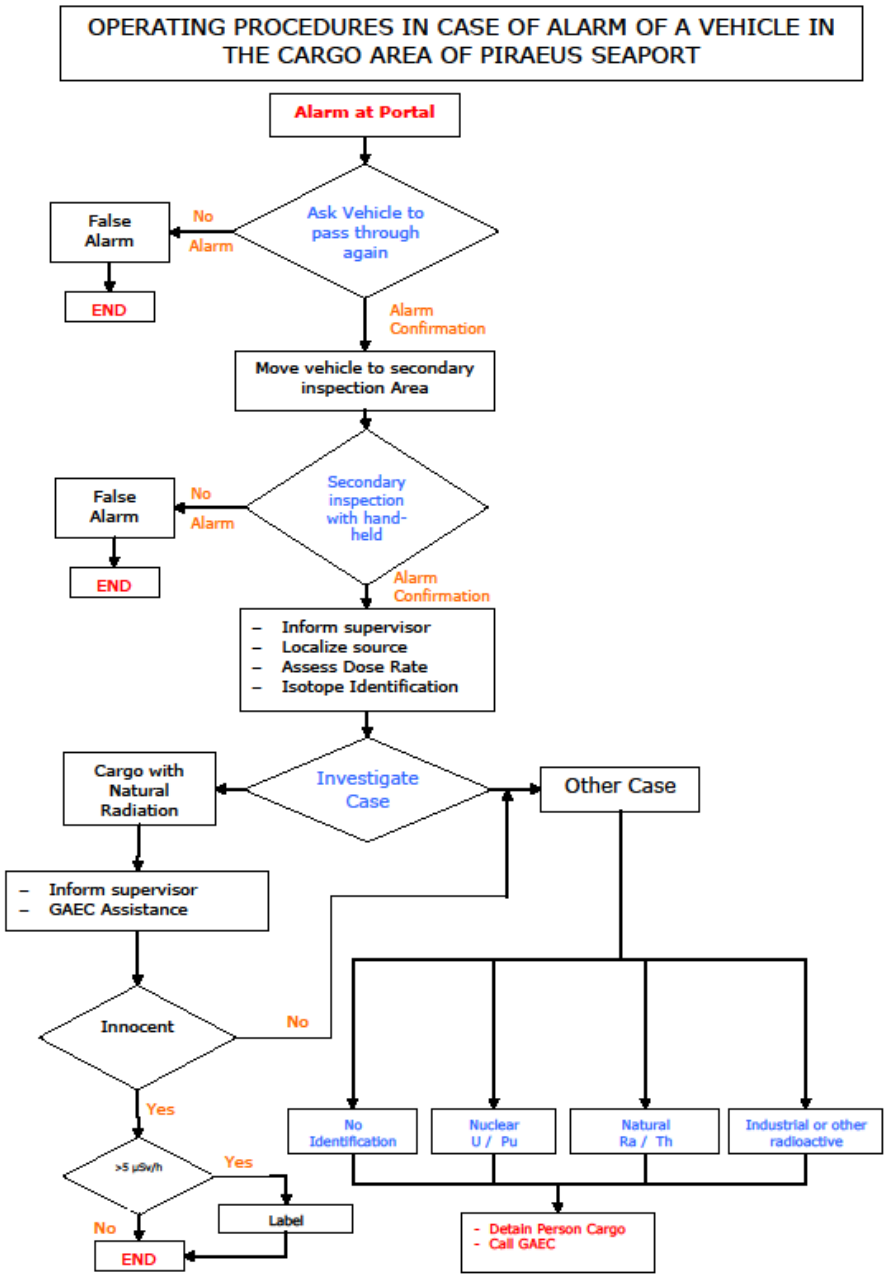
- portable radiation detection equipment for use by Customs at 26 additional points of entry.

- **Pagers**
  - Custom Officer protection
  - Radioactivity indication

- **Survey meters**
  - Secondary Inspection
  - Radiation Rate

- **Isotope Identifier**
  - Secondary Inspection
  - Localizes and Identifies radioactive material

Example of Operating Procedures for Vehicles



Radiation Portal Monitors installed in Industries

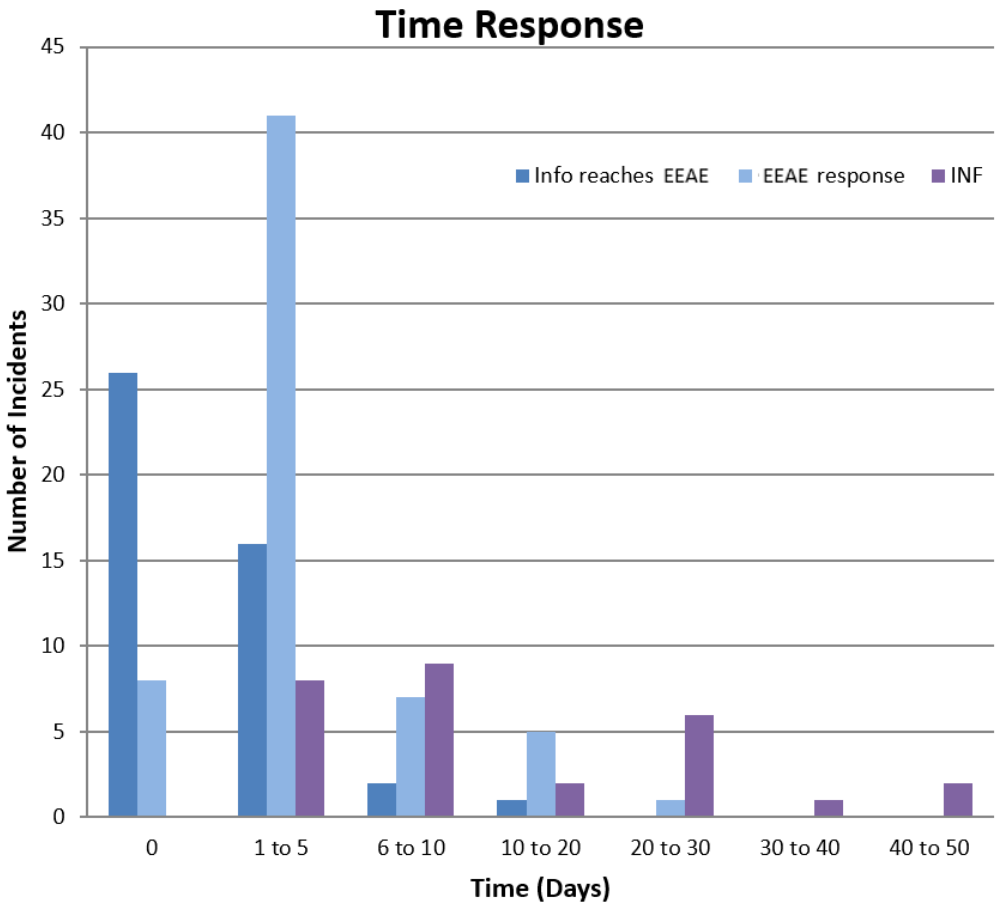
- Three major steel industries
- Two major copper industries
- One metal recycling industry
- One electrical appliances recycling industry
- Large scrap metal yards

Greek Legal Framework

- Government Gazette, Ministerial Decision No 11592(FOR)1125, Folio No.1633, Second issue, August 18, 1999, "Mandatory installation and use of equipment for the detection of radioactive materials in scrap metals and for their illicit import"
- Law 2960 "National Customs Code", Article 3.2 , "Custom officers are responsible for dealing with illicit trafficking of nuclear and other radioactive materials"
- Government Gazette, Ministerial Decision No. 10828/(EFA)1897, Folio No. 859, Second Issue, July 10, 2006, "Control of high-activity sealed radioactive sources and orphan sources"
- Government Gazette, 381, 24/03/2000, "Regulation for steel used in concrete"
- EU Regulation No 333/2011: "Establishing criteria determining when certain types of scrap metal cease to be waste under Directive 2008/98/EC of the European Parliament and of the Council"
- Ministry of Environment, Energy and Climate Change "Implementation of the legislation for the transboundary transport of non dangerous waste"

Time Response to Industry Portal Activation Alarms

- Info reaches EEAE:
  - 0 – 11 days,
  - over 50% on the same day
- Telephone communication on the same day
- Response time for on-site inspection:
  - 0 – 21 days
  - up to 5 days for 75% of the incidents
- ITDB Incident Notification Form:
  - 2 – 49 days,
  - with 60% within the first 10 days



Important Incidents
Imported Scrap Metal Load

- Steel industry portal activation alarm due to imported scrap metal load

(09-12-2005)

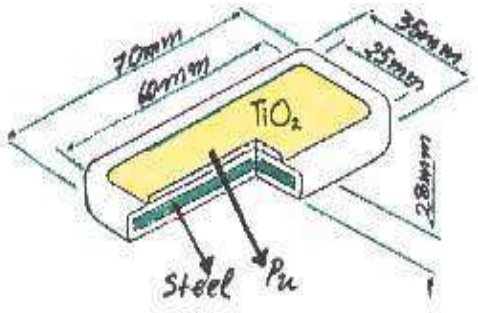
- Multiple radioactive sources and contaminated equipment were detected destined for scrap recycling
- Sealed Shielded sources: Cs-137 (18.5TBq), Cs-137 (unknown activity - 20µSv/h),
- Ra-226 - probably lightning conductor
- Military equipment Ra-226 (70µSv/h)
- NORM contaminated pipes – 7 items (3µSv/h)

Important Incidents
Radioactive material smuggling

- EEAE was notified by the Financial and Economic Crime Unit about the potential presence of radioactive material in a forest area in northern Greece 26/1/01
- In a depth 5-50 cm were buried 245 metal plates containing Plutonium and Americium weighing 40 g each
- Several plates were oxidized and the soil had to be decontaminated
- Total quantity of Plutonium 3 gr.

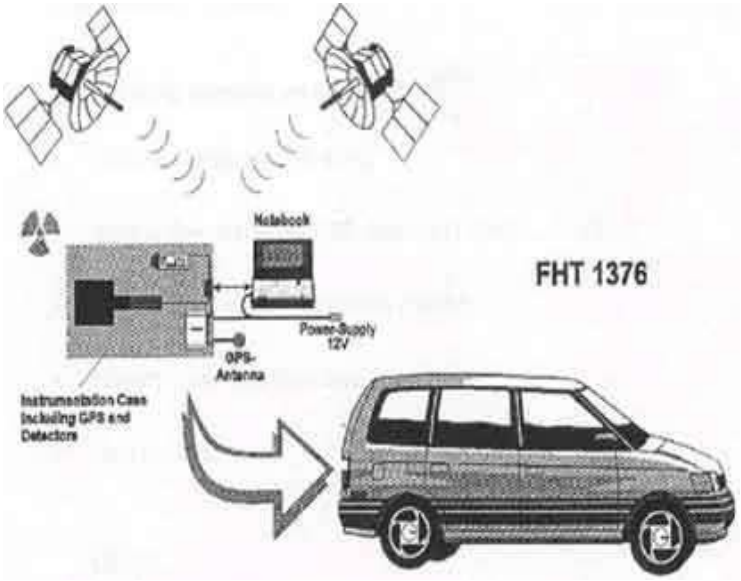
Important Incidents
Radioactive material smuggling

- Length: 70 mm, Width : 35 mm, Thickness : 2.8 mm
- Activity per plate: 20 MBq Pu-239 & 2 MBq Am-241
- Description: α-radiation source (Pu-238 και Pu-239) deposited on steel surface and covered with a thin TiO_2 film
- Active surface: 60 mm x 25 mm
- Uses: Industrial (static electricity elimination)
- Manufacturer: MAYAK (Russia)



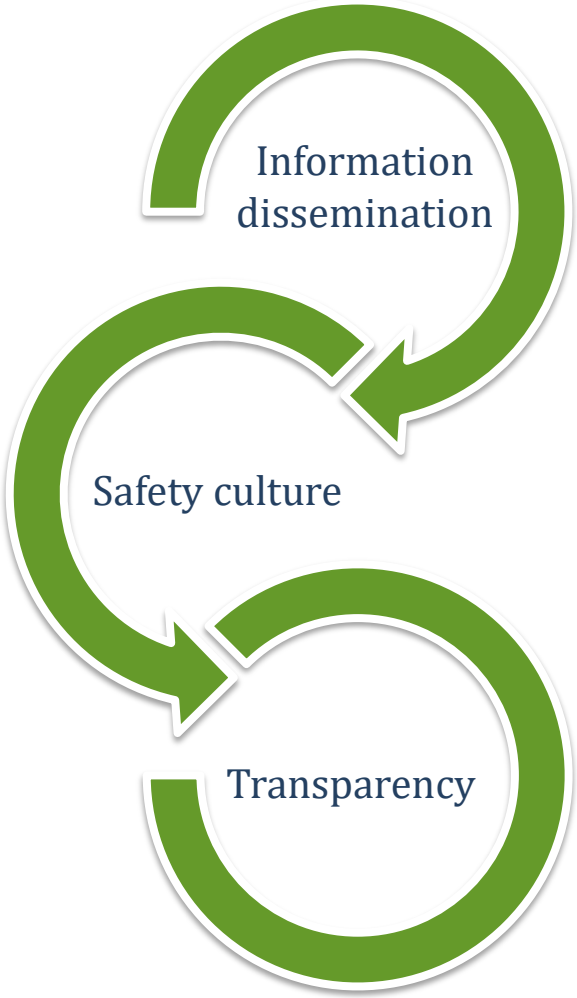
Important Incidents
Lost Source in Central Greece 22-01-2002

- EEAE was notified about the loss of an Ir -192 radiography source.
- The police was informed on the incident.
- A press release was issued informing the public on the potential risks.
- On 26-01-2002 the area was surveyed with a FHT 1376 Mobile Radiation Detection System (5L organic scintillator)
- The source was recovered and was finally returned to the authorized owner. It was suspected that the device was intended for illegal sale.



Public information: EEAE approach

- website: applications forms, protocols, basic protection measures, FAQ, etc.
- events/seminars/ lectures
- conferences organization
- information material (series of brochures and videos, protection measures)
- recommendations to the public for radiological emergencies
- press releases – press conferences
- media relations
- establishment of cooperation with stakeholders.



Nuclear security: the scene

strong fear of radiation risks

mistrust towards stakeholders

limited public awareness on nuclear security

public discussion only in case of emergencies

a “difficult” issue to discuss

Our strategy

proactive communication actions

gaining trust through transparency

addressing the stakeholders

prepared for emergency management

Being proactive

Πως μπορείτε να αναγνωρίσετε τις ραδιενεργές πηγές και συσκευές

Το σήμα της ραδιενέργειας

Σήμανση ειδικών δοχείων μεταφοράς ραδιενεργών πηγών

Στις ακόλουθες φωτογραφίες παρουσιάζονται συσκευές και πηγές που φέρουν ραδιενεργό υλικό και εντοπίζονται συνήθως και σε παλαιά σιδηρομεταλλεύματα:

Κλειστή πηγή Kr-85 (β ακτινοβολία) εντός της θωράκισης της

Φορητή συσκευή μέτρησης πυκνότητας και υγρασίας εδάφους με πηγές Am-241 και Cs-137

Φορητή συσκευή ραδιογραφήσεων

Διάταξη με κλειστή πηγή Am-241 για τη μέτρηση στάθμης υγρού

Βιομηχανικές πηγές Cs-137

Θωρακίσεις απεμπλουτισμένου ουρανίου

Καντράν με Ra-226

Συσκευή μέτρησης πυκνότητας ροής με πηγή Cs-137

Πυρανιχνευτής ιονισμού με ραδιενεργό υλικό

Αλεξικέραυνα ιονισμού με ραδιενεργά στοιχεία

Βιομηχανικές πηγές Cs-137 και Co-60

Βιομηχανική πηγή μέτρησης στάθμης με Co-60

Σταθερές κλειστές ραδιενεργές πηγές εντός θωράκισης

Χώροι στους οποίους πιθανόν υπάρχουν ραδιενεργές πηγές – συσκευές:

- εργοστάσια, κυρίως όπου υπάρχουν σιλό και μεγάλες δεξαμενές
- παλιά εγκαταλελειμμένα εργοστάσια με μηχανήματα
- χώροι συλλογής παλαιών άχρηστων μετάλλων (scrap metal)
- χώροι ιατρικών εργαστηρίων - νοσοκομείων – κλινικών και ιατρικά εργαστήρια πυρηνικής ιατρικής.

Οδηγίες προστασίας

Εφόσον αναγνωρίσετε κάποιο από τα παραπάνω αντικείμενα:

1. Μην το αγγίζετε.
2. Απομακρυνθείτε από το αντικείμενο.
3. Οριοθετήστε – αποκλείστε το χώρο σε ακτίνα 5 μέτρων (π.χ. τοποθετείστε εμπόδια - αντικείμενα ή κορδέλες περιμετρικά).
4. Ειδοποιείστε τον υπεύθυνο του χώρου και τηλεφωνήστε στην ΕΕΑΕ, περιγράφοντας όσο το δυνατόν σαφέστερα το αντικείμενο και τον χώρο.

Ειδικές περιπτώσεις

1. **Πυρανιχνευτές (σε χρήση - εγκατεστημένους ή σε αχρηστία):** Η χρήση των ραδιενεργών πυρανιχνευτών, εφόσον γίνεται σύμφωνα με τις προδιαγραφές τους, είναι απολύτως ασφαλής. Ωστόσο, οι εργασίες επισκευής και συντήρησής τους, η αποξήλωση, απόρριψη και η τελική τους διαχείριση πρέπει να γίνεται με απολύτως ελεγχόμενο τρόπο.

Σε περίπτωση που υποψιάζεστε ότι εντοπίσατε ραδιενεργούς πυρανιχνευτές:

- Διαπιστώστε μέσω της εταιρείας εγκατάστασης εάν πρόκειται πράγματι για ραδιενεργούς πυρανιχνευτές.
- Ενημερώστε την ΕΕΑΕ για το χώρο, όπου είναι εγκατεστημένοι και τον αριθμό τους.
- Τυχόν εργασίες (επισκευή, συντήρηση, αποξήλωση) πρέπει να γίνονται από εξουσιοδοτημένα συνεργεία.
- Μετά την αποξήλωσή τους απαγορεύεται να πεταχτούν στα κοινά απορρίμματα.

Για την τελική τους διάθεση πρέπει να αποσταλούν στο
οίκο κατασκευής τους στο εξωτερικό. Η ΕΕΑΕ είναι πρ
θυμη να συμβάλλει στις διαδικασίες για την τελική δι
χείριση – διάθεση των πυρανιχνευτών.

2. **Ραδιενεργά αλεξικέραυνα:** Τα ραδιενεργά αλεξικέραι
να είχαν εγκατασταθεί πριν από πολλές δεκαετίες κ
στη μεγάλη τους πλειονότητα έχουν αντικατασταθεί
συμβατικά. Σε περίπτωση που εντοπίσετε ή υποψιάζ
στε ότι βρήκατε ραδιενεργό αλεξικέραυνο ειδοποιε
στε την ΕΕΑΕ.

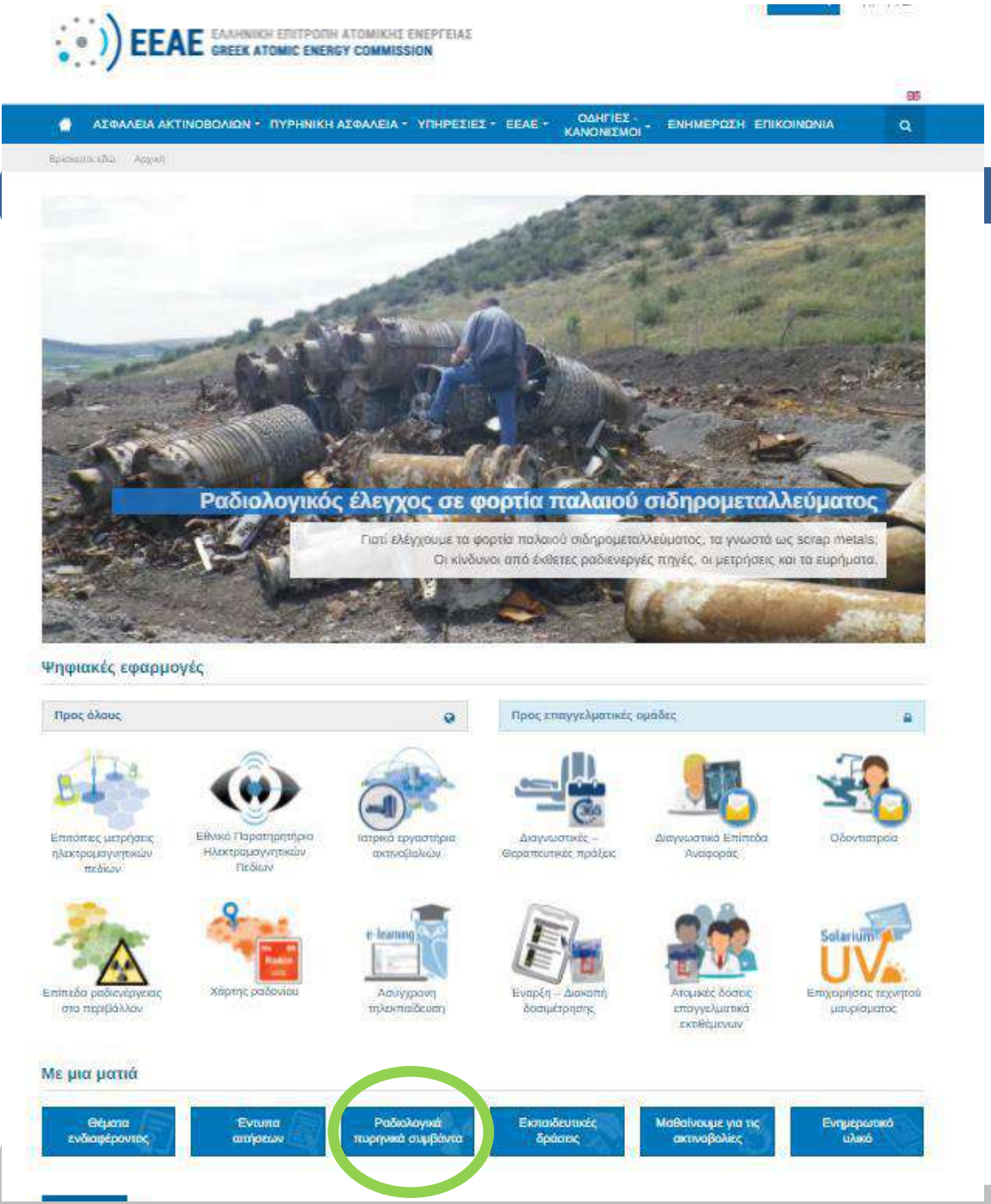
3. **Ορφανές ραδιενεργές πηγές σε φορτία παλαιών σ
δηρομεταλλευμάτων (scrap metal).** Η κατάληξη μι
«ορφανής» ραδιενεργού πηγής σε φορτίο παλαιού σ
δηρομεταλλεύματος μπορεί να ενέχει κινδύνους, το μ
γεθος των οποίων εξαρτάται από την ποσότητα και
είδος του ραδιενεργού υλικού που περιέχει.

Η πρόκληση ραδιορρύπανσης μπορεί να επηρεάσ
τη λειτουργία μιας χαλυβουργίας ή και να προκαλέσ
έκθεση εργαζομένων ή πολιτών σε ραδιενέργεια. Μ
θωρακισμένη ραδιενεργός πηγή μπορεί να αποτελέσ
αφορμή σοβαρού ραδιολογικού ατυχήματος, σε περ
πτωση που με οποιοδήποτε τρόπο αφαιρεθεί η θωράκ
ση της.

Με σκοπό την ανίχνευση τυχόν ραδιενεργών πηγών σ
φορτία παλαιού μετάλλου, οι χαλυβουργίες της χώρ
υποχρεούνται βάσει της νομοθεσίας και έχουν εγκατ
στήσει κατάλληλες μετρητικές διατάξεις στις εισόδου
τους. Επιπλέον, ακολουθώντας τις οδηγίες της ΕΕΑ
τα τελωνεία της χώρας δεν επιτρέπουν την εισαγωγ
παλαιών μετάλλων από τρίτες χώρες, εφόσον δε συν
δεύονται από επίσημο πιστοποιητικό της αρμόδιας κρ
τικής αρχής της χώρας προέλευσης που βεβαιώνει ό
είναι ελεύθερα ραδιενέργειας.

Τα σταθερά συστήματα ανίχνευσης ραδιενέργειας πο
έχουν εγκατασταθεί σε όλες τις χαλυβουργίες και τ
τελωνεία της χώρας λειτουργούν αυτόματα. Ο συναγερ
μός τους ενεργοποιείται κάθε φορά που καταγράφοντ
επίπεδα ραδιενέργειας υψηλότερα από το φυσικό υπ
βαθρο της περιοχής. Η ευαισθησία των συστημάτω
αυτών είναι ιδιαίτερα υψηλή, ώστε να ενεργοποιούντ
από χαμηλά επίπεδα αύξησης του φυσικού υποβάθρο
και κατά συνέπεια να διασφαλίζεται ο ραδιολογικό
έλεγχος των εισερχόμενων φορτίων.

Gaining trust through transparency



- ✓ Announcement of radiological incidents
- ✓ Statistics
- ✓ INES reports
- ✓ Lessons learned
- ✓ Good practices

Co-operation with Stakeholders

- Workers
- First responders
- Portal Operators (obligation to inform EEAE on portal alarms)
- Notification of regulatory authorities of implicated countries
- International Co-operation
  - IAEA's Incident and Trafficking Database
    - The ITDB provides an essential resource for States to share information and to enhance their knowledge about the threats/risks, and thus assist them in planning and implementing nuclear security measures.
  - USIE

ITDB Work Flow

National Competent Authorities

ITDB Point of Contact

INF/Web INF

INF

ITDB Confirmed

Web INF

INF's, Reports, Web ITDB, Dashboard

NUSEC - ITDB Restricted Area

IAEA

State POCs

International organizations

Thank you for your attention!!!

Greek Atomic Energy Commission

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Mauritania experience in

Nuclear Security in Maritime Infrastructure - strategic landscape

INCLUDING Project Workshop

ISHAGH MOHAMED MOUSSA
Président de l'Autorité Nationale de Radioprotection de Sureté et de Sécurité Nucléaire
Premier Ministère

Greece, from 24 to 25 June 2021

Mauritania

Honor, Fraternity, Justice

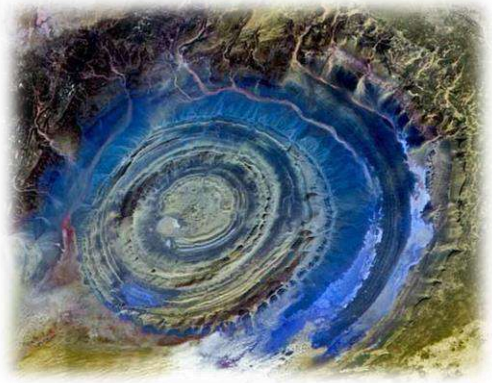
4.2 million Population

131st most populous country on earth

15 Regions

Capital : Nouakchott
Currency : Ouguiya (MRO)
Languages : Arabic, Pulaar, Soninke, French, Hassaniyya, Wolof

AFRICA



Islamic Republic of Mauritania, is a country in the Maghreb region of western Africa.
It is the eleventh largest country in Africa and is bordered by the Atlantic Ocean to the west, Morroco in the north, Algeria in the northeast, Mali in the east and southeast, and Senegal in the southwest.

The National Authority for Radiation Protection, Nuclear Security and Safety (ARSN) the host of CTBTO's NDC

The ARSN has been created by the Law 2010-09 on Nuclear Energy which was enacted in January 2010.

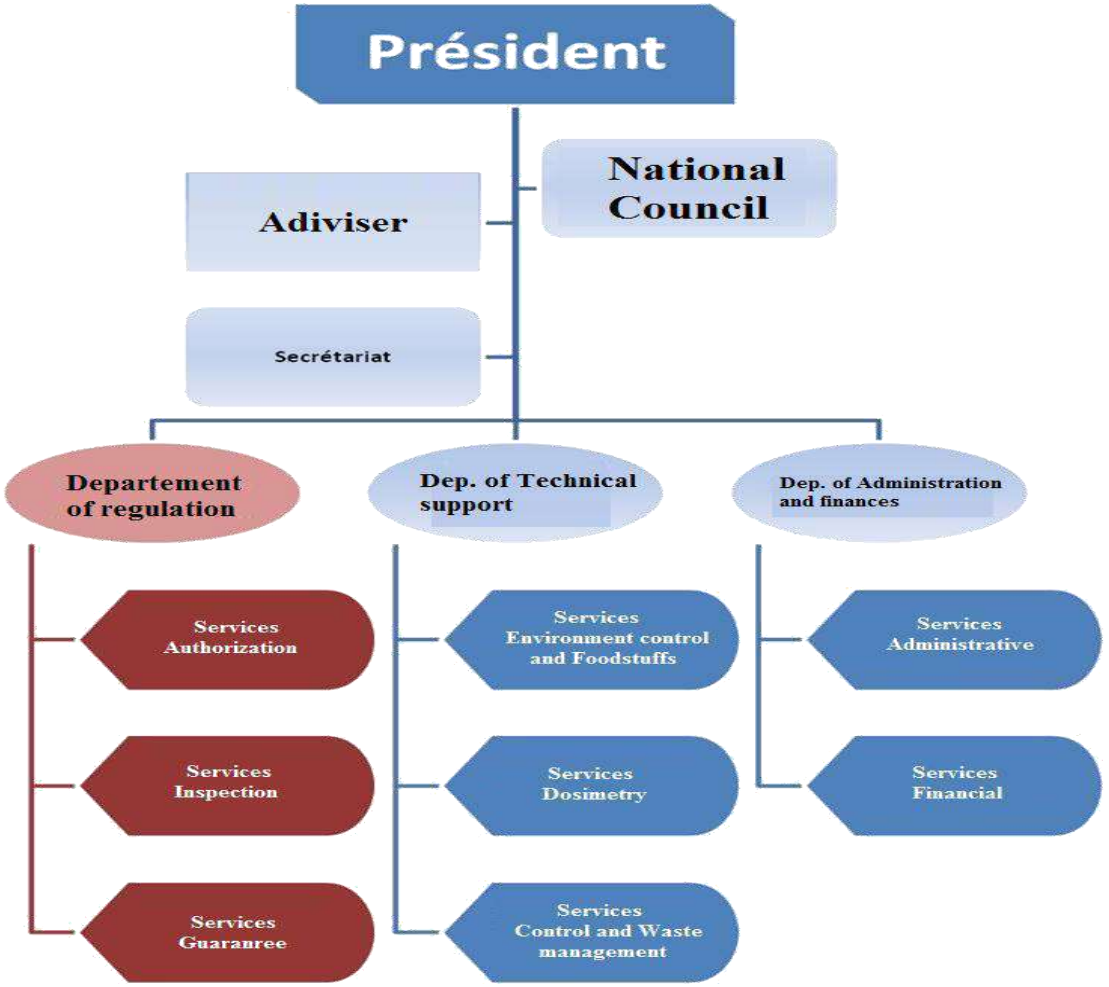
The ARSN is the national regulatory authority for radiation protection, nuclear safety and security and to implement safeguards.

The organization and operation of the ARSN are fixed by Decree 2010-082 dated 31 March 2010 that the Authority attaches directly to the Prime Minister. The Authority Chairman is appointed by order of the Prime Minister on 7 September 2010.

The National Authority for Radiation Protection was chosen to be the office of the data centre and is responsible for its work

www.arsn.mr

NATIONAL AUTHORITY OF RADIATION, SAFETY AND NUCLEAR SECURITY (ARSN) Organizational chart



Regulations

- ✓Law 2010-009 of 20 January 2010 on Nuclear Energy;
- ✓Decree 2012-170 implementing the provisions of Law n ° 2010-009 of 20 January 2010 relating to nuclear energy;
- ✓Decree No. 2010-082 of 18 March 2010 Laying down the organization and functioning of the National Radiation Protection Authority, Nuclear Safety and Security and its modifying texts;
- ✓Memorandums of Understanding between ARSN and national institutions concerned with radiation protection and nuclear safety.

THE APPLICATION USING IONIZING RADIOACTIVE SOURCE IN MAURITANIA

- 117 radiology units used in public hospitals.
- 50 radiology units used in private hospitals.
- 1 radiotherapy unit used in the National Oncology Centre (NOC).
- 1 unit of nuclear medicine (NOC).
- 15 scanners used (public and private hospitals).
- 7 Oil and Gas processing
- 5 Mining compagnies
- 1 company in advanced stage in extracting uranium

ALL the applications and the activities using ionizing radioactive sources are registered in RAIS soft ware (web version).

PORT OF NOUAKCHOTT

PORT OF NOUAKCHOTT
Port de l'Amitié, Nouakchott, Mauritania
is advantageously located at the crossroads of the routes connecting Africa, Europe and America, and is one of the leading public commercial ports in the south Sahara for ships sailing from Europe.
Handling performance at the Port of Nouakchott generally ranges from 1,200 to 2,500 tons/day for bagged cargo, and 3 containers/hour. Unloading accounts for 95% of traffic. The overall potential traffic capacity is 1 million tons.

Port Autonome de Nouakchott
« Dit Port de l'Amitié » (PAN-PA)

TECHNICAL SPECIFICATIONS OF THE PORT OF NOUAKCHOTT
•Current total wharf length: 450 m
•Draught: berth from 9.8 to 10.3 m
•Storage yard area: 160,000m2
•Warehouse: 8,000m2
•Equipment - Reachstackers: 5/45T SEP equipment (Société d'Equipements Portuaires)
•Storage capacity (containers): 1,318 TEU

Stakeholders

Nuclear terrorism and the illicit trafficking of nuclear and other radioactive materials and devices threaten the security of all nations. Effective detection systems and nuclear detection architectures can help reduce the threat and consequences of nuclear terrorism. These systems can also protect public and environmental health by increasing a nation's ability to monitor and control the movement of nuclear and other radioactive materials and devices.

Identification of stakeholders

National Competent Authorities directly or indirectly, involved in the detection strategy designated to establish a national committee to develop and follow up the national strategy for the detection of nuclear and radioactive material out of regulatory control and are as follows:

- Prime ministry, Represented by National Authority of Radiation protection, Safety and Nuclear Security ARSN;
- Ministry of Foreign Affairs and Cooperation;
- Ministry of Défense (The army and the gendarmerie);
- Ministry of the Interior (National Police);
- Ministry of Finance(Customs);
- Ministry of Transport;

About Radiation and Shipping Port Security

Cargo comes into Mauritania from all over the world. This cargo sometimes contains hazardous materials such as chemicals or radioactive materials.
Port security blocks radioactive material from illegally entering to Mauritania.

Customs and Border Patrol has the capability to check and evaluate radioactive materials by using the detectors that given to them by ARSN .

Cargo containers are checked for radioactive material that could pose a threat to national security or public safety. Security measures include:

Enforcing licensing requirements for the import and export of radioactive material.
Pre-screening all cargo.
Inspecting potentially threatening shipments with radiation detectors.

Detection and identification tools we use

The ARSN ensures that radioactive and nuclear shipments are legal and secure. Several different types of radiation detectors are used by shipping port security officials. Examples include:

Personal radiation detectors: Small, highly sensitive devices that sound an alarm when radiation is detected. Customers, police, and gendarmerie officers and agents use these at ports and airports.

Radiation isotope identifiers: Hand-held instruments that identify specific radionuclides, including nuclear weapons, medical and industrial radioactive materials. Security officers use these devices to identify the type of radionuclide that triggered an alarm.

Large-scale gamma ray/x-ray imaging systems: These systems use radiation to show images of the contents of cargo containers, rail cars, vehicles, or trailer trucks.

Radiation Facts

Cargo comes into the Republic Islamic of Mauritania from all over the world.

www.arsn.mr

CONTROL OF IMPORT / EXPORT SOURCES

- The ARSN adopted in cooperation with relevant institutions all necessary measures, including the creation of a licensing system, to control the export and import, re-export, transit and transshipment of material, and nuclear technology which the Authority has held that they should be monitored to ensure safety and protect the strategic interests of the state. (Law on nuclear energy, including provision of Chapter 15).

In this context the ARSN consider:

- Develop memoranda of understanding with all concerned departments including the customs, border police, the example of one that was signed with the ministry of health;
- several training course on radiation protection has conducted for staff of the customs, police, and all agents of border security;
- Radiation detectors have distributed to customs and border police.

Cooperation

- Cooperation between Mauritania and the IAEA Agency is relatively recent. The program started in 2004 by the country's accession to the Agency.
- Member in the Forum of Nuclear Regulatory Bodies in Africa (FNRBA)
- Member in the Arab Network for Nuclear Regulators (ANNuR)
- Cooperation between Mauritania and The Comprehensive Nuclear-Test-Ban Treaty Organization CTBTO
- Several memorandum of understanding have signed between Mauritania and neighboring countries, Morocco and Senegal.
- Mauritania founded and leading Forum of Nuclear Safety and Security Authorities in G5 Sahel and Senegal (FASSN)
- Mauritania has close cooperation with the Italian national data center NDC

COMMUNICATION AND INFORMATION

Among the main tasks of the ARSN, that of making available to the public and users all relevant information relating to radiation safety.

Public information: the ARSN is being set up a website www.arsn.mr In order to give all information deemed useful on tasks assigned to it and the results achieved or expected.

Challenges

The ARSN is a young structure that lack of experience enabling it to play its full role where certain weaknesses that can be summarized as follows:

- Human resources: lack of training and experience in the radiation protection and nuclear safety fields
- equipment : lack of equipment and training on the use of these materials

THANK YOU

شكرا

Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

INCLUDING
INNOVATIVE CLUSTER
FOR RADIOLOGICAL AND NUCLEAR EMERGENCIES

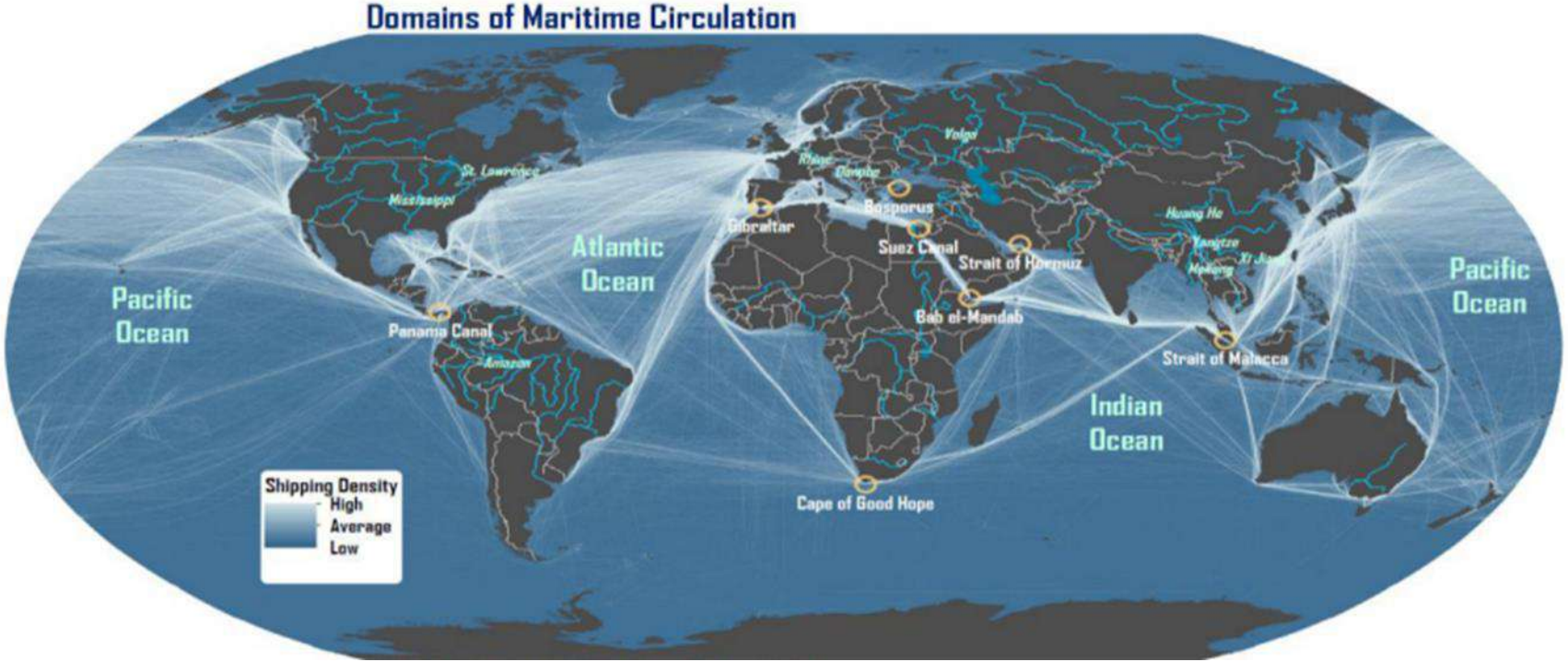
FORENSIC ASPECTS OF CHAIN OF CUSTODY IN MARITIME CRITICAL INFRASTRUCTURE

Antonietta Rizzo

Laboratory of Methods and Techniques for Nuclear Safety, Monitoring and Traceability

Fusion and Technology for Nuclear Safety and Security Department

MARITIME TRAFFIC



Source: Shipping density data: National Center for Ecological Analysis and Synthesis, A Global Map of Human Impacts to Marine Ecosystems, Dr Jean-Paul Rodrigue, Dept. of Global Studies & Geography, Hofstra University.

90% of the EU's external trade and 40% of its internal trade is transported by sea

MARINE INFRASTRUCTURES IN EUROPE

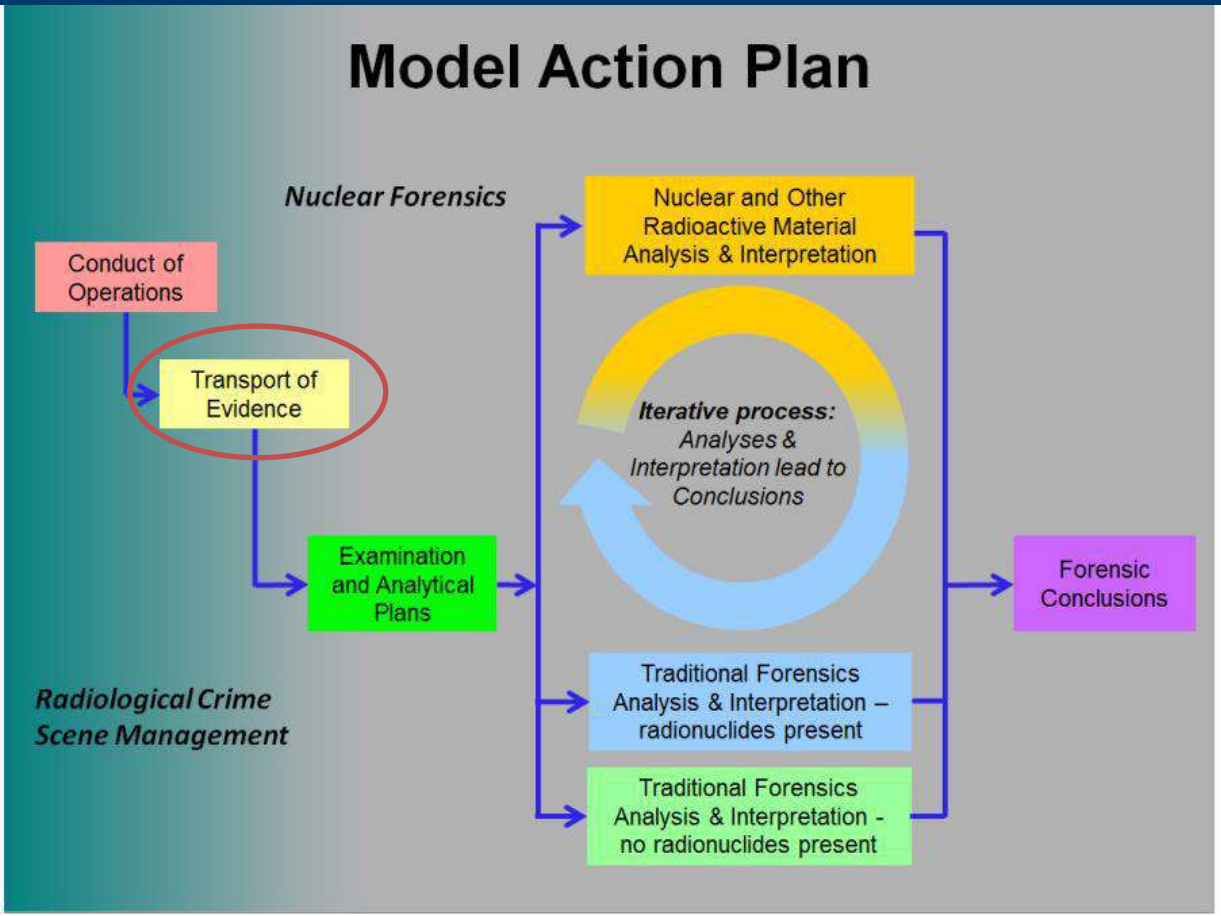
EU maritime security strategy

- To safeguard security in EU and protect its member states and citizens
- To prevent conflicts
- To protect critical infrastructures

ASSUMPTIONS FOR MARITIME SECURITY

- Recovery operations are based on risk management principles—100% security cannot be guaranteed before or following an incident;
- Facilitate achieving the optimum balance between ports and waterways security and the recovery of maritime transportation capabilities
- Minimize disruption to the economy from unnecessarily constrained cargo flow: the maritime infrastructure should not be shut down as an automatic response to a maritime security incident;

FORENSIC ACTION PLAN



Ref. Nuclear Forensics in Support of Investigations IAEA Nuclear Security Series No. 2-G (Rev.1)

CATEGORISATION OF THE EVENT

Group I: incidents that are, or are likely to be, connected with trafficking or malicious use; (5-10/year)

Group II: incidents of undetermined intent; (20-40/year)

Group III: incidents that are not, or are unlikely to be, connected with trafficking or malicious use. (120-160/year)

1 EVENT GROUP 2
1 EVENT GROUP 3

Data from IAEA's Incident and Trafficking Database 2020

CHAIN OF CUSTODY

The chain of custody is the most critical process of evidence documentation.

It should assess:

- The continuity of **possession** of evidence or **custody** of evidence
- Its **movement** and **location** from the point of discovery and recovery (at the scene of a crime or from a person), to its transport to the laboratory for examination and until the time it is allowed.

WHERE, WHO, WHEN

WHEN, WHO AND WHERE….on the scene…

Scene-based chain of custody strives to answer the following questions:

A. “**Where was located the sample**?”

B. “**Who has been in possession of the sample**?”

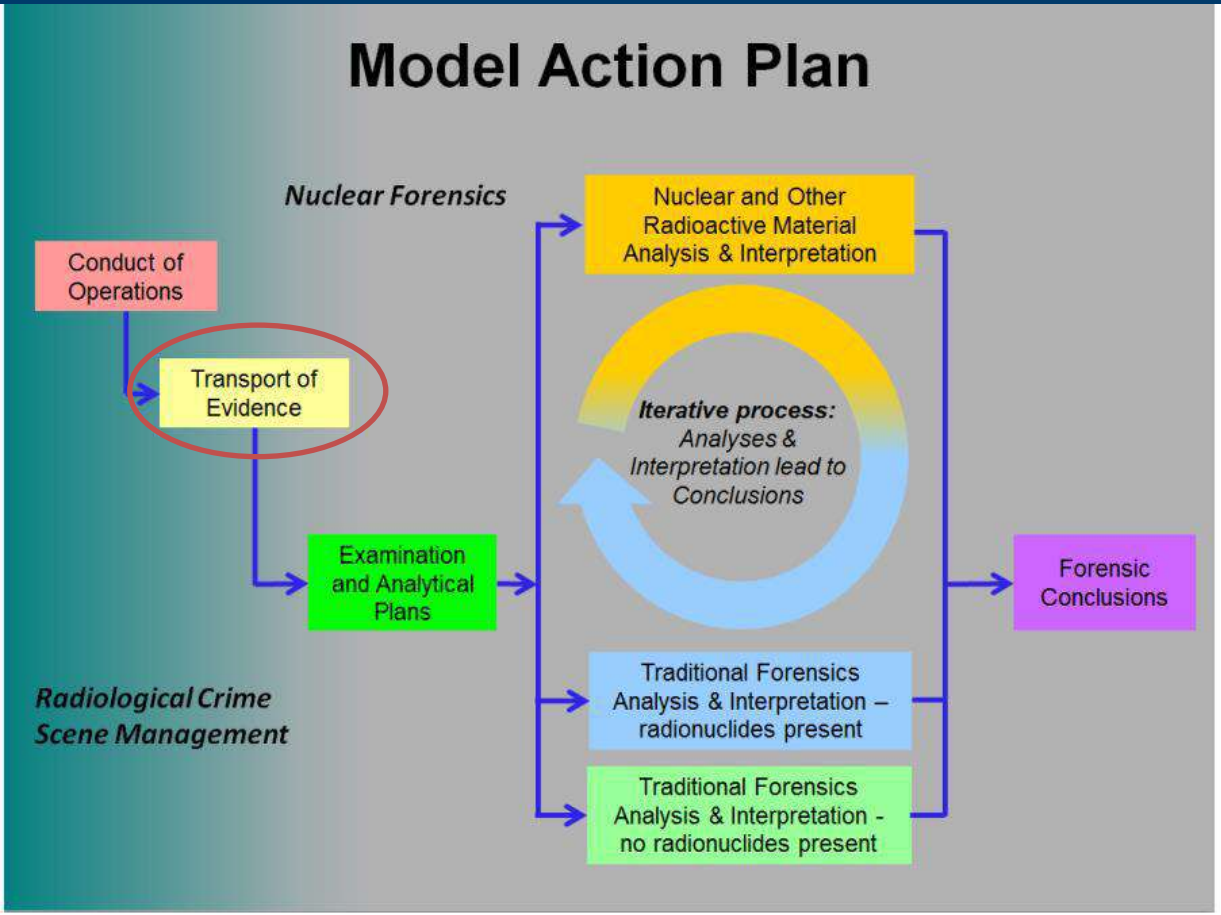
C. “**Who have moved the the sample?**”

D. “**Where has the sample been moved?”**

Lockard’s exchange principle:

“Every time someone enters an environment, something is added to and removed from the scene”

FORENSIC ACTION PLAN



Ref. Nuclear Forensics in Support of Investigations IAEA Nuclear Security Series No. 2-G (Rev.1)

First step of CoC - Integrity of trace evidence

- Protection of trace evidence from loss or contamination is essential.

  →in **MI**: storage, securing of the container, fire hazard, meteo conditions,

  transport of the sample to land

- But one of the primary paths of contamination is from the collector to the evidence.

  → in **MI**: operators not well trained

CHALLENGES FOR CoC IN MARITIME INFRASTRUCTURES

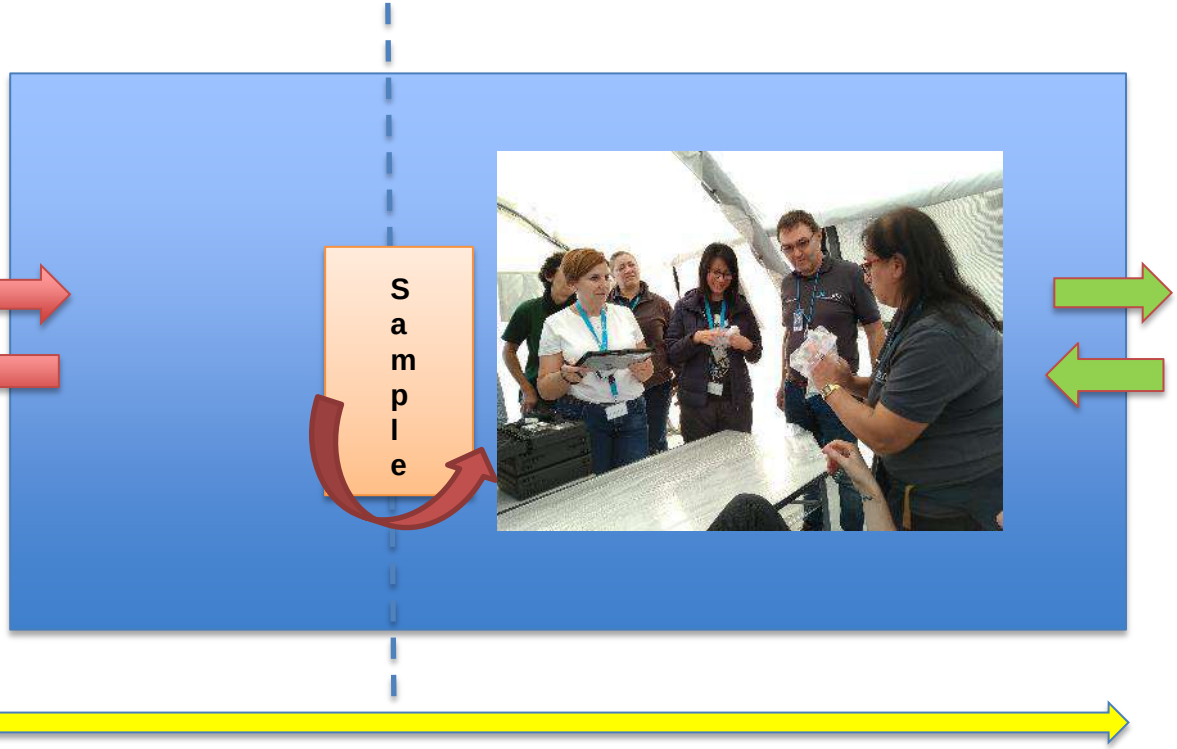
- Large area difficult to control
- Environmental conditions could be hard
- Need to avoid a complete shut down of MI
- Presence of many people
- Interaction with different authorities
- International waters…..
- Places without jurisdiction of any countries

HANDOVER OF THE SAMPLES

INCIDENT AREA

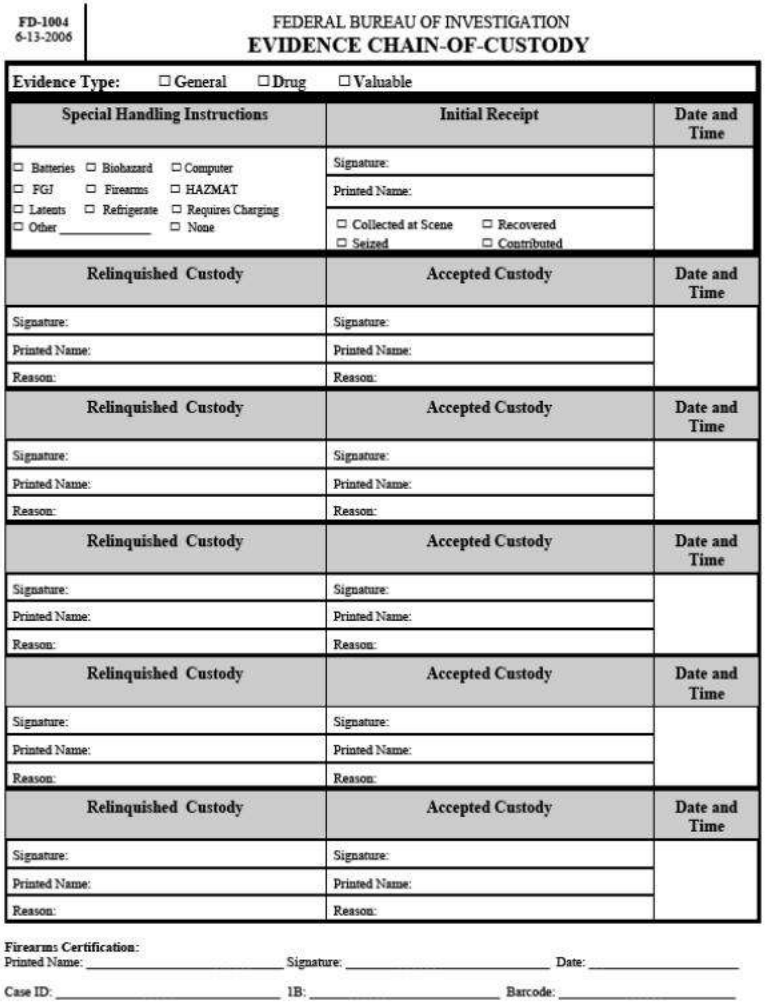
BASE OF OPERATION

Entry and exit for sampling teams



Entry and exit for the sample custodian

Transfer of the samples



FD-1004
6-13-2006

FEDERAL BUREAU OF INVESTIGATION
EVIDENCE CHAIN-OF-CUSTODY

Evidence Type: ☐ General ☐ Drug ☐ Valuable

Special Handling Instructions	Initial Receipt	Date and Time
☐ Batteries ☐ Biohazard ☐ Computer ☐ FGJ ☐ Firearms ☐ HAZMAT ☐ Latents ☐ Refrigerate ☐ Requires Charging ☐ Other ______ ☐ None	Signature: Printed Name: ☐ Collected at Scene ☐ Recovered ☐ Seized ☐ Contributed	
Relinquished Custody	**Accepted Custody**	**Date and Time**
Signature: Printed Name: Reason:	Signature: Printed Name: Reason:	
Relinquished Custody	**Accepted Custody**	**Date and Time**
Signature: Printed Name: Reason:	Signature: Printed Name: Reason:	
Relinquished Custody	**Accepted Custody**	**Date and Time**
Signature: Printed Name: Reason:	Signature: Printed Name: Reason:	
Relinquished Custody	**Accepted Custody**	**Date and Time**
Signature: Printed Name: Reason:	Signature: Printed Name: Reason:	
Relinquished Custody	**Accepted Custody**	**Date and Time**
Signature: Printed Name: Reason:	Signature: Printed Name: Reason:	

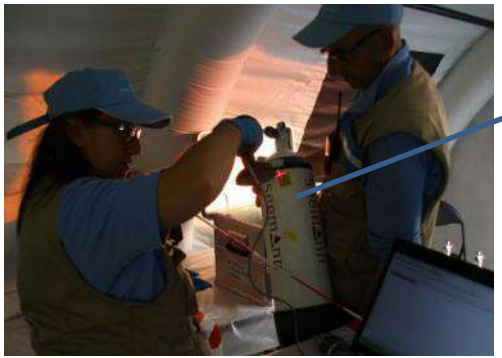
Firearms Certification:
Printed Name: ______ Signature: ______ Date: ______

Case ID: ______ 1B: ______ Barcode: ______

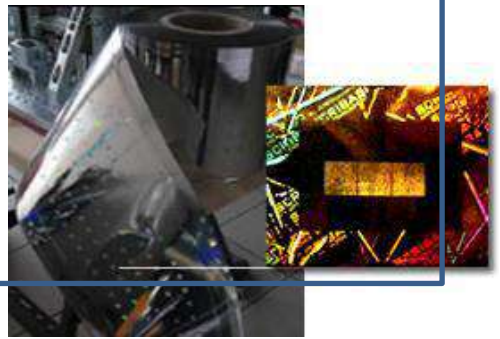
AT THE BEGINNING

- Paper CoC
- Possible identification of the type of the samples
- Sensitive information disclosure
- “Need to know principle” difficult to be applied

NEW SOLUTIONS



Reading of barcode



Embedded code in the sample container

- Still paper CoC but with encryption and digitalisation
- No identification of the type of the samples
- Sensitive information more difficult to be disclosed
- “Need to know principle” applied

NEW SOLUTIONS

- Sample-based chain of custody
  - Traditional
  - Problems with duplicate/splitting samples

- Location-based chain of custody
  - RFID radio frequency identification
  - expensive equipment

- Container-based chain of custody
  - Electronic data key
  - Tracking identification
  - Breach detection (tamper evidence)

WHEN, WHO AND WHERE…in the lab

Laboratory-based chain of custody strives to answer the following questions:

A. “**Where is my sample now**?”
B. “**Who possesses my sample now**?”
C. “**When did he/she take possession of my sample?**”
D. “**Where has my sample been?**”
E. “**Who has been in possession of my sample?**”

MAIN CHALLENGES

- Integration of expertises and authorities
- Different national approaches in the procedures
- Forensic team should be present as soon as the categorization has been done
- First responder has to be trained for categorization task
- Contamination and cross-contamination issues to be addressed
- Health and Safety/Security interfaces

INCLUDING
INNOVATIVE CLUSTER
FOR RADIOLOGICAL AND NUCLEAR EMERGENCIES

THANKS

ENEA

NUCLEAR SECURITY CENTRE OF EXCELLENCE

Practices in conducting exercises

June 2021

Content

1. Nuclear security centre of excellence
2. Why we are exercising?
3. Exercise methodology
4. NSCOE exercises
5. Lessons learned
6. Exercise “Air Gate 2018”

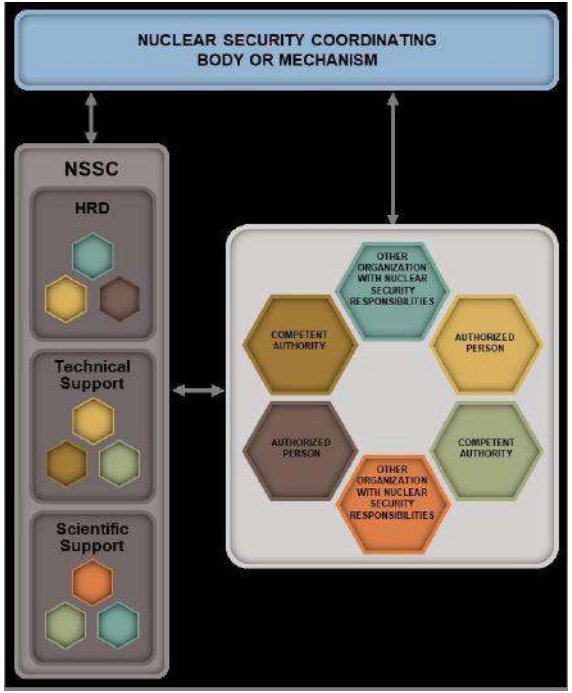
Nuclear security centre of excellence

NSCOE is a structural unit of the State Border Guard Service's (SBGS) Border Control Management Board and responsible for:

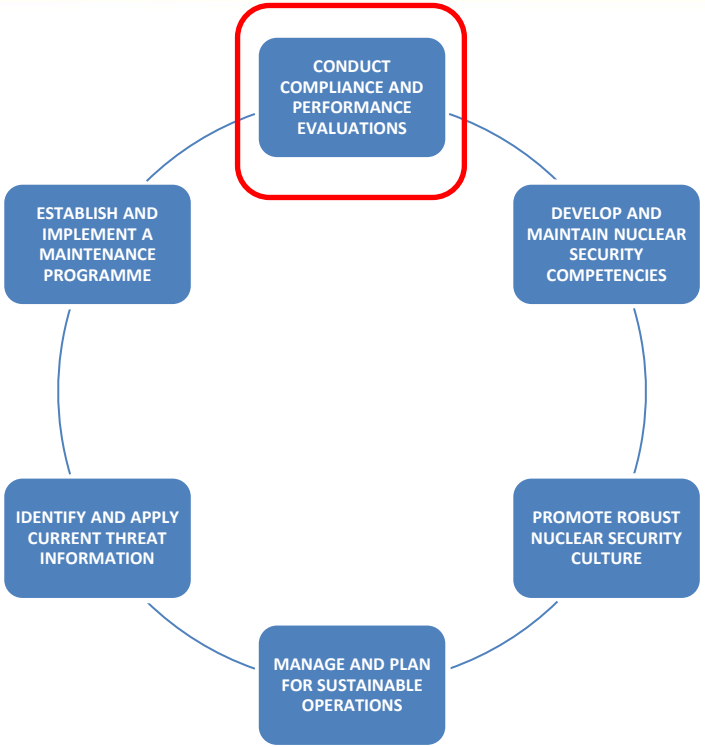
1. **Nuclear security training and exercise services for the national stakeholders;**
2. **Managing and supervising radiation detection activities at the state border;**
3. **Providing support and technical advice to first-line officers resolving detection cases;**
4. **Managing SBGS radiation detection infrastructure including equipment maintenance and repair functions;**
5. **Collection, analysis and sharing of good practices and lessons learned;**
6. **Developing nuclear/ radiological emergency preparedness capabilities;**
7. **Development of interagency cooperation and coordination as well as international cooperation.**

Nuclear security centre of excellence

- **NSCOE is a member of the IAEA coordinated Nuclear security support centres network**
- **From the IAEA NSSC perspective, the NSCOE mission – to provide specific services and support to the stakeholders**



NSCOE activities



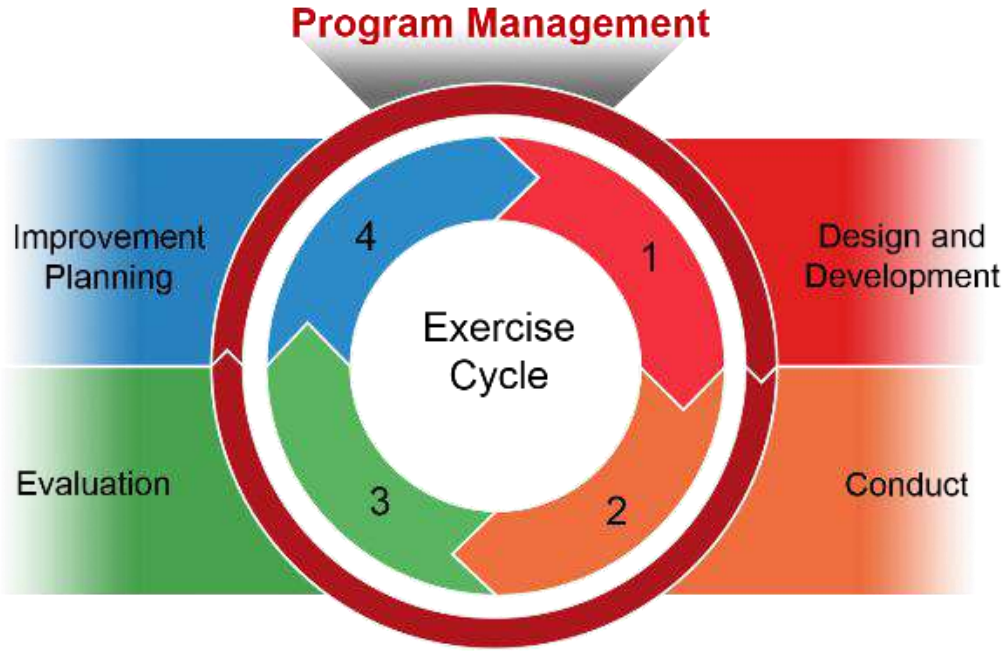
2. Why we are exercising?

Exercise is a structured activity that places participants or organizations in a simulated situation in which they should perform in the capacity that would be expected during a nuclear security event.

Exercise is the tool for a State, selected organizations or single organization for the following purposes:

1. **To test the knowledge, skills and state of readiness of individuals and organizations**
2. **To validate detection and response strategies, and to evaluate new approaches and technologies**
3. **To inform States (organizations) on the state of existing capabilities (strengths and weaknesses)**
4. **To motivate personnel and decision makers, and promote society's confidence in States' abilities**
4. **To promote coordination and cooperation among participating organizations**
5. **To identify good practices and lessons learned**
6. **To define and agree on the improvement measures.**

3. Exercise methodology



Methodology was provided by the U.S. Department of Energy/National Nuclear Security Administration's Office of Nuclear Smuggling Detection and Deterrence (NSDD)

Exercise circle

80 %

20 %

Reason for the exercise → **Design and development** → **Implementation** → **Evaluation**

- Planned/ periodic exercising
- Triggering events
- Systematic performance failure
- Need to test personnel competency
- New legal basis and procedures
- New equipment

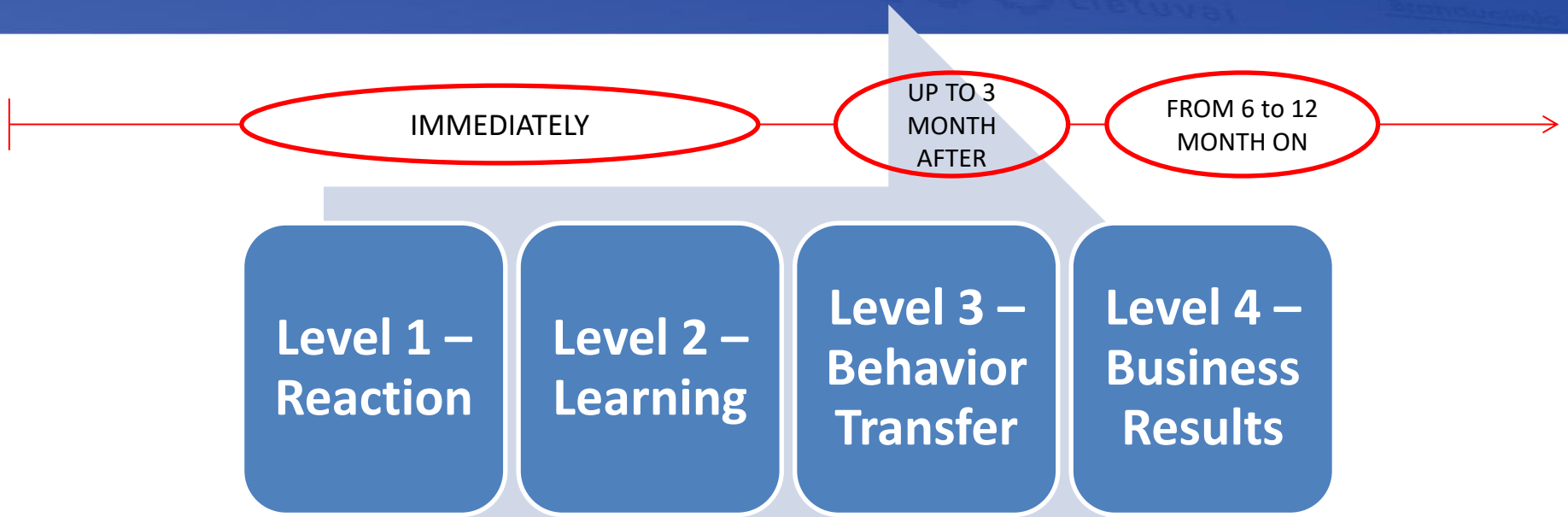
- Exercise development team
- Objectives and expected outcomes
- Stakeholders selection
- Scenario development
- Coordination and collaboration

- Exercise Commander and implementation team
- Players and observers
- Logistics
- Venue preparations
- Actual performance
- Promotion and media support

- Lead Evaluator and team
- Evaluations at multiple locations
- Debrifing, remarks and observations
- Agreement on the key findings and possible improvement actions
- Final report

Continuos evaluation often feeds new reasons for exercises

Evaluation – the key element of the exercise



4. NSCOE exercises

Our exercises are directed at:

1. **Prevention, detection and response to nuclear/ radioactive materials out of the regulatory control**
2. **Emergency response to the major nuclear incident and mitigation of consequences**

International references for MORK exercises

- **Recommendations :**
- **(IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities;**
- **IAEA Nuclear Security Series No. 14, Nuclear Security Recommendations on Radioactive Material and Associated Facilities;**
- **IAEA Nuclear Security Series No. 15, Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control.**
- **Guidance:**
- **IAEA Nuclear Security Series No. 21, Nuclear Security Systems and Measures for the Detection of Nuclear and Other Radioactive Material out of Regulatory Control;**
- **IAEA Nuclear Security Series No. 37-G, Developing a National Framework for Managing the Response to Nuclear Security Events [6];**
- **IAEA Nuclear Security Series No. 2-G (Rev. 1), Nuclear Forensics in Support of Investigations;**
- **IAEA Nuclear Security Series No. 24-G, Risk Informed Approach for Nuclear Security Measures for Nuclear and Other Radioactive Material out of Regulatory Control;**
- **IAEA Nuclear Security Series No. 22-G, Radiological Crime Scene Management;**
- **IAEA Nuclear Security Series No. 41-T, Preparation, conduct and evaluation of exercises for detection of and response to acts involving nuclear and other radioactive material out of regulatory control.**

5. Lessons learned

- **Exercise require significant investments, with regard to human resources, time and logistics.**
- **Exercise needs patience and systematic coordination with external stakeholders.**
- **Mutual trust is crucial, especially when it comes to security operations.**
- **The most effective exercises are those set up by the legal requirements and long-term exercising plans (national or institutional).**
- **Exercise evaluation and following improving proposals are the products of that are developed and agreed by all involving parties.**
- **Even though exercise points out certain weaknesses and areas for improvement, this is just interim result. Finally, it will help to become stronger.**
- **Exercise usually have high profile, therefore it may attract attention of the decision makers and facilitate their support fostering respective capabilities.**

6. Exercise “Air Gate 2018”

www.nscoe.lt

THANK YOU FOR ATTENTION

Prepared by: Aleksejus Livšic
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Please visit us at www.nscoe.lt

INCLUDING Federation: Model & Platform

Stathes Hadjiefthymiades

National and Kapodistrian University of Athens

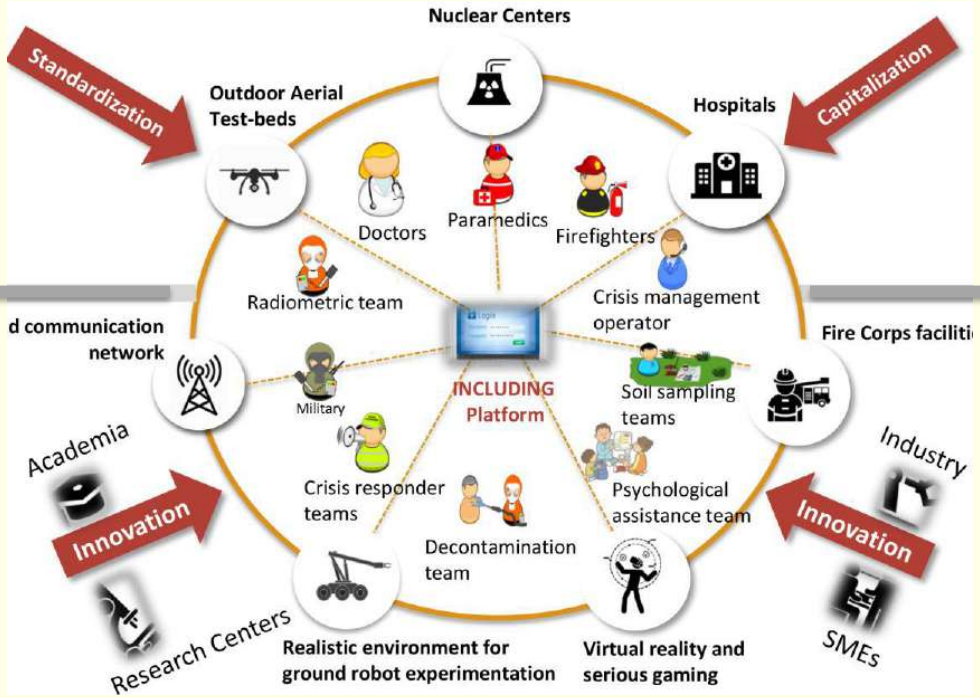
A European Commission H2020 Programme. This document is produced by the INCLUDING consortium and the research leading to these results has received funding from the European H2020 programme under grant agreement no 833573

Objectives

The objectives of Including Federation model are:

- To collect and update information on the training facilities in the INCLUDING cluster (testbeds);
- To **develop** a federated architecture for the cluster and to realize **a web based platform** for the management of training activities and aimed at optimizing pooling and sharing of **resources** as well data and expertise;
- To pursue standardization at technical and organizational level.

INCLUDING Federation Data



Static

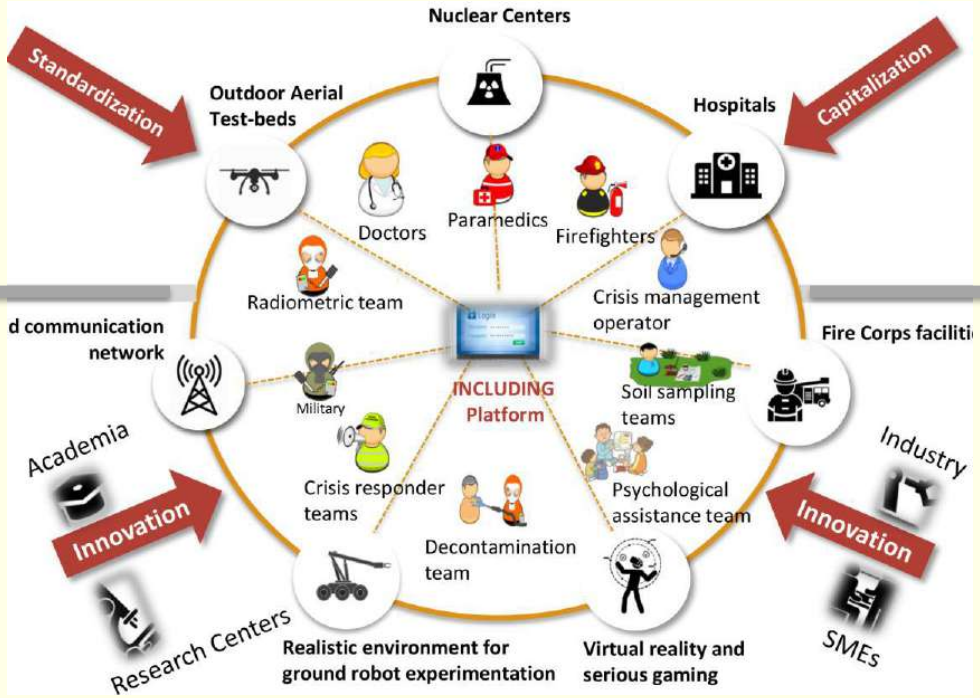
Dynamic

In the Static Representation/ Database we can

- Describe useful description of the testbeds and the resources
- Update information for all assets
- Search resources
- Book Resources
- Write Drill Experiments
- Monitor Reports from the drills

INCLUDING Federation Data

Static



Dynamic

In the Dynamic Representation we can

- Handle in real time drills
- Visualization of a drill
- VR Applications and Equipments
- Live feedback from the field
- Control unmanned vehicles and groups of human operators

Data Representation

Static Data

Dynamic Data

INCLUDING Database

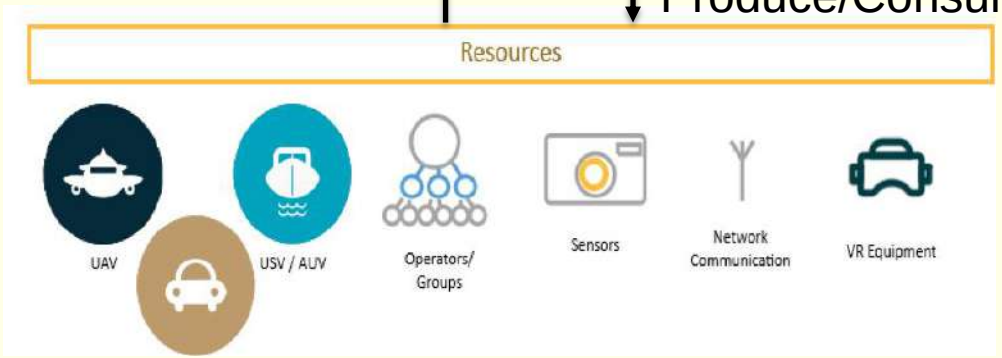
PostgreSQL

Master Data Repository

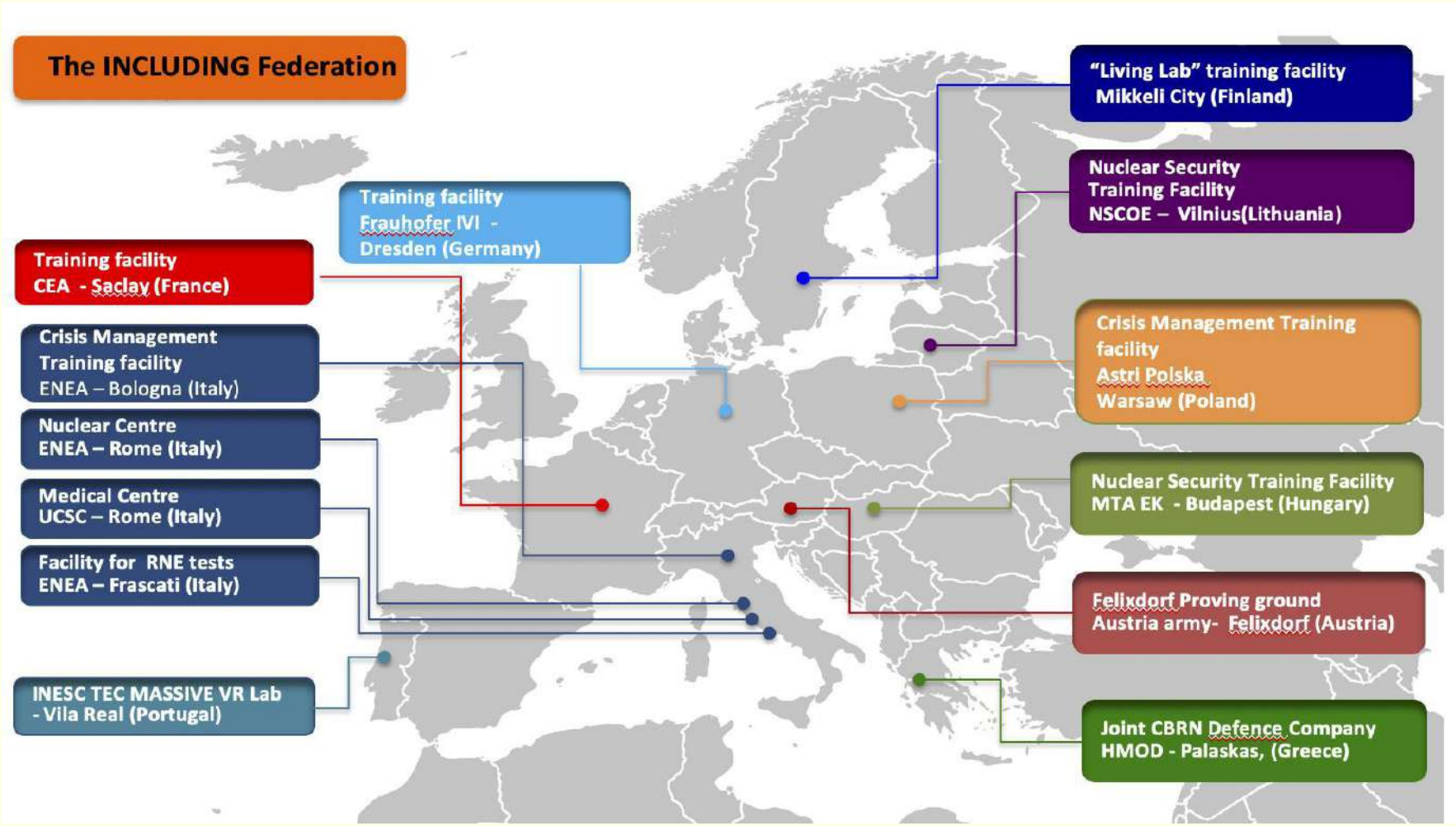
- to contain all the management data sets
- Drills
- DDL scripts
- Bookings,
- Testbeds
- Resources status

Message Streams

Produce/Consume



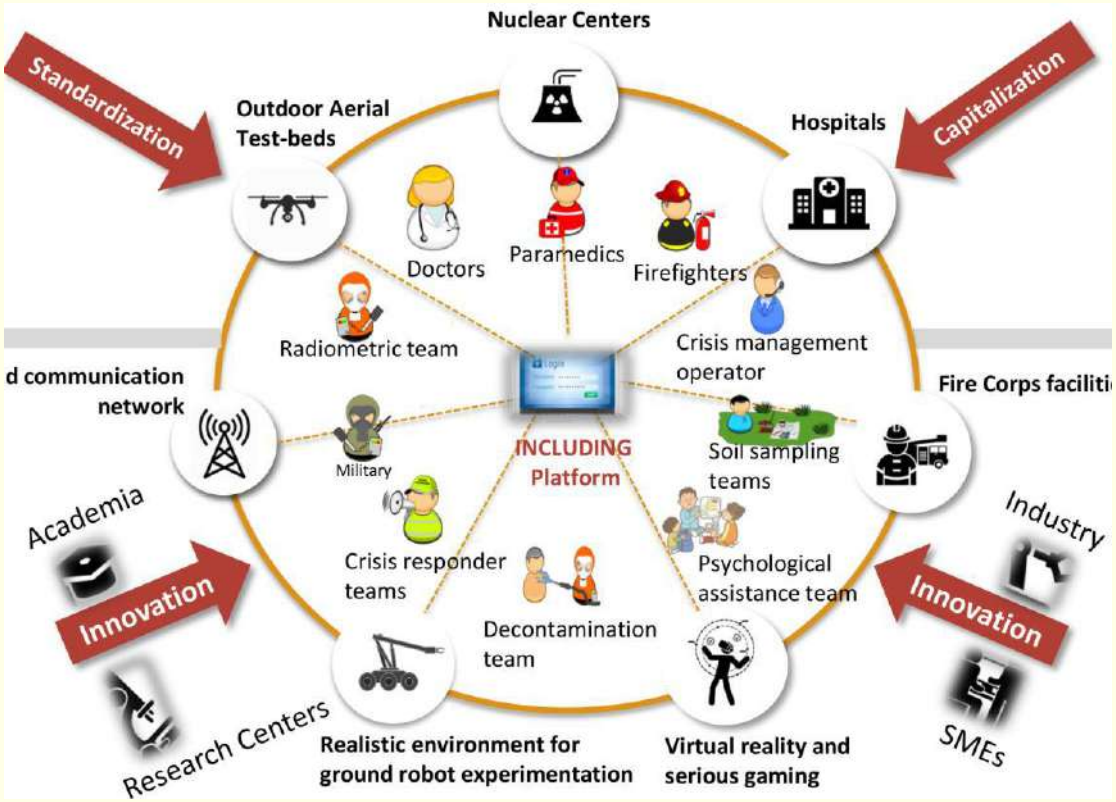
Training Facilities



Web based platform

- Resources:
  - robotic devices and their onboard sensors,
  - human resources (i.e., groups or individuals with specific expertise),
  - equipment required for the RN operations
  - software components (e.g., simulators, serious games, immersive VR).

"*All these resources are modeled at the system in order to accurately designate in space and time their reservation, use and release as a set of hierarchically structured assets.*"

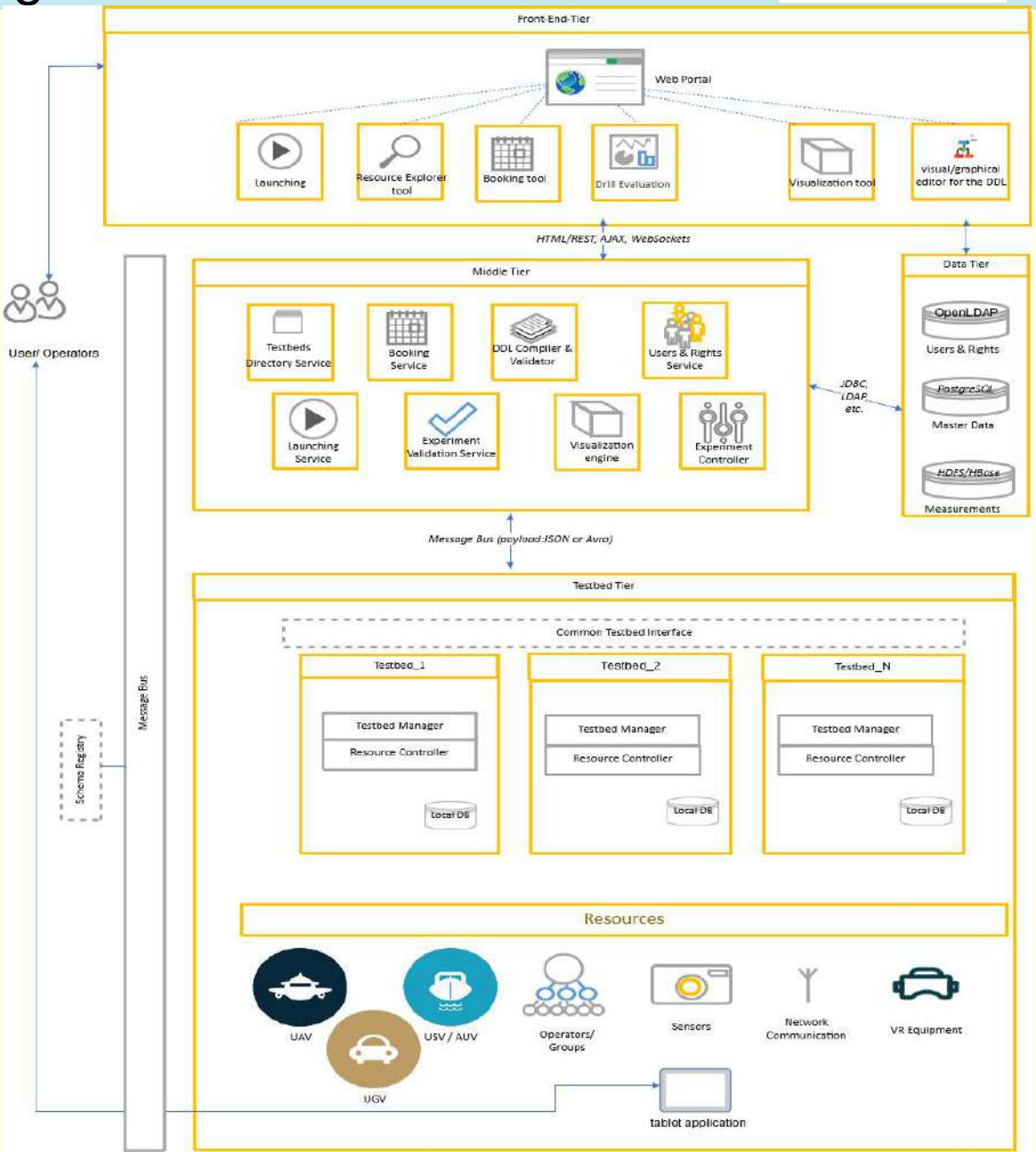


Web based platform

- The main actors of the federation involved in the process are:
  - Experimenters: users who belong to the federation with acknowledged credentials;
  - Testbed Operators: owners and managers of testbed facilities
  - INCLUDING Platform Administrator: administrator of the INCLUDING tool suite and middleware (software components that glue together all the managed assets).
  - INCLUDING testbed manager: responsible appointed by the testbed operator and with the duty to address initial testbed registration in the Platform and periodically updates its status (new resources, on going experiments, available time slots for use of resources, etc.)

Including Architecture

- Loosely coupled components
- Connected via
  - Web Services (REST based)
  - Message Bus (Kafka)
- Layered:
  - Front Tier
  - Middle & Data Tier
  - Testbed Tier



Step 1. Remotely book resources for a Drill Exercise

Phase 1) Experimenter accesses the INCLUDING web portal to explore resources available in the Testbeds of the Federation.

The INCLUDING platform will guide the users:

- in developing a scenario and finding the resources in the federation to execute it
- in assessing a scenario developed by another experimenter and decide to what extent to contribute.

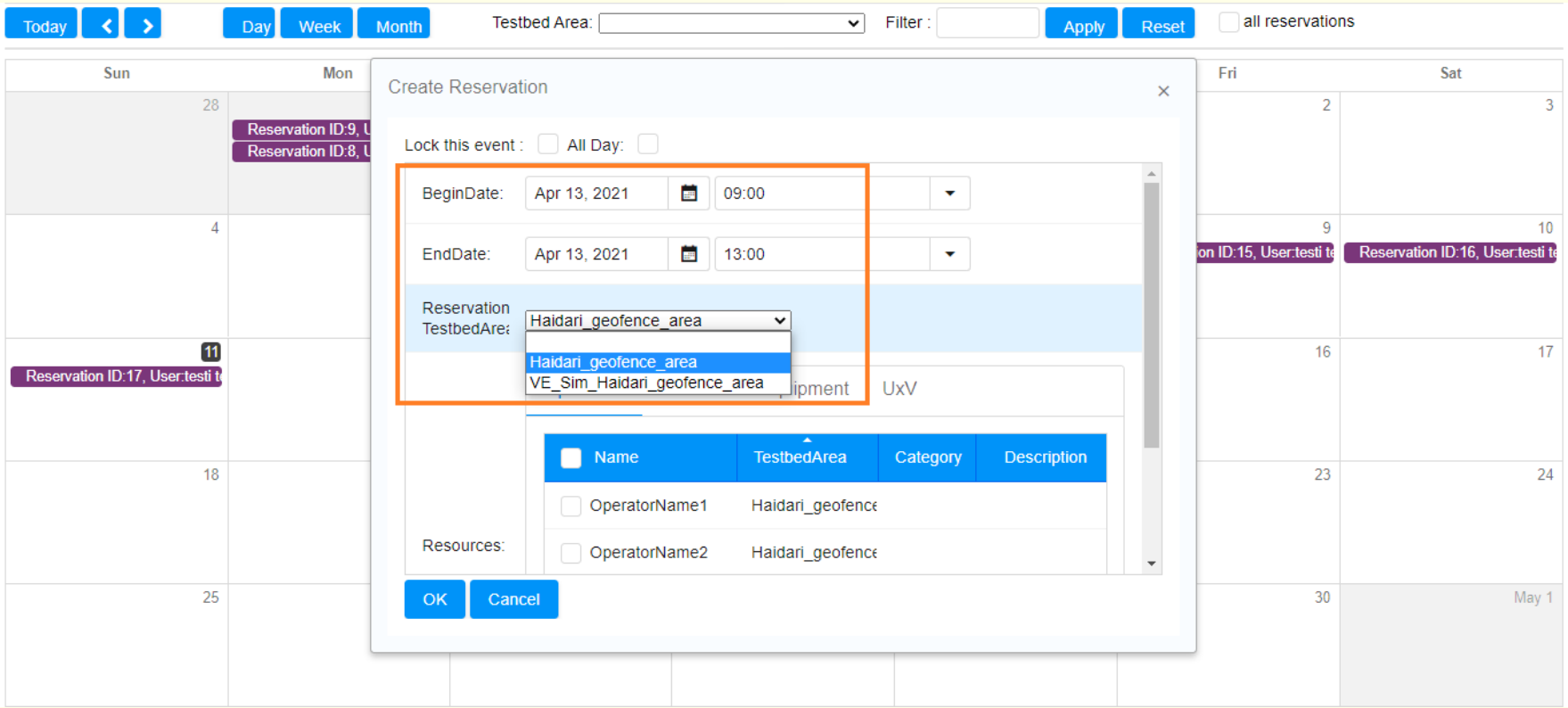
Phase 2a) In case the tool to run the test or the training session is accessible remotely, the user will book the resource through the INCLUDING Platform.

Phase 2b) The team of Practitioners run the exercise in the testbed premises.

Phase 3) The Experimenter upload on the INCLUDING Platform data and evaluations on the test/ training/exercise that are accessible by all authorized users.

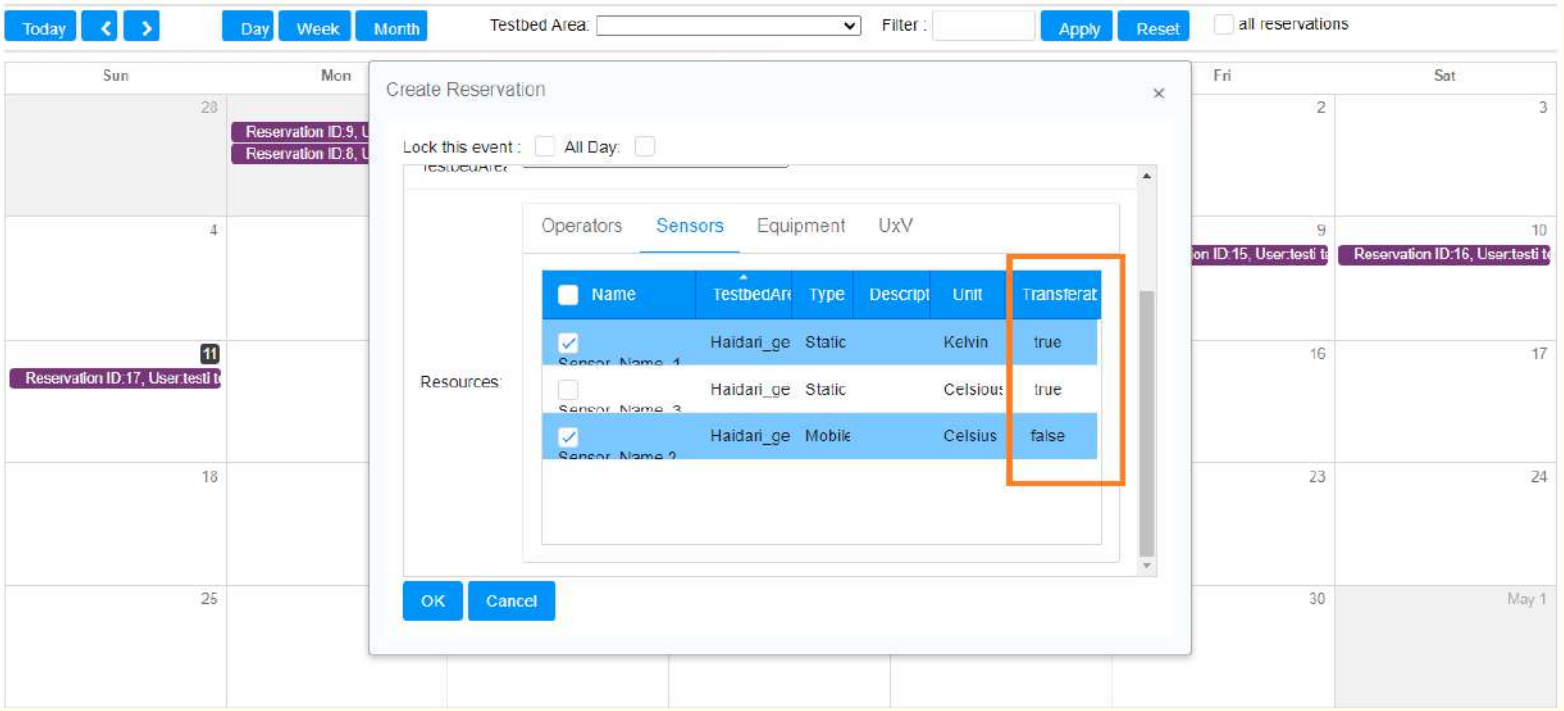
Step 1. Remotely book resources for a Drill Exercise

- Booking Tool
  1. Selection of a Testbed



Step 1. Remotely book resources for a Drill Exercise

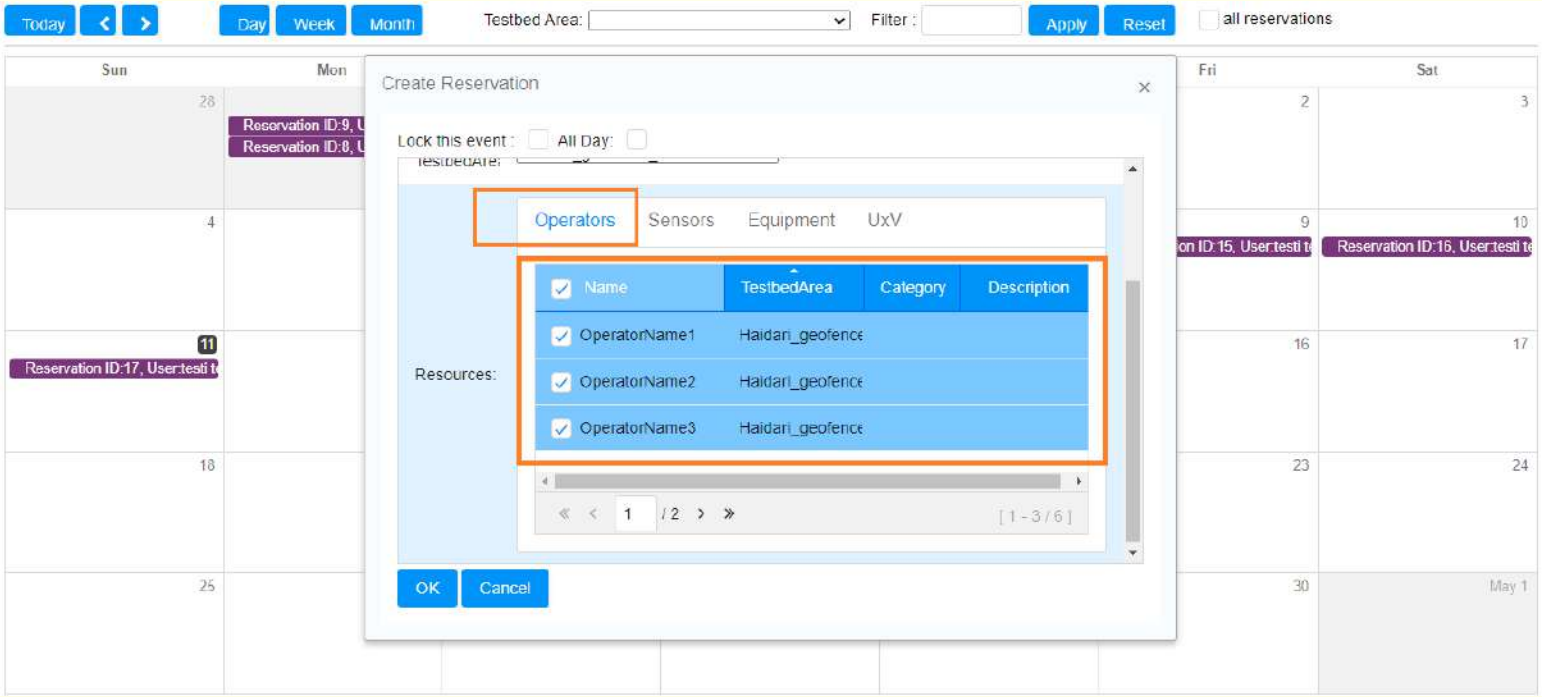
- Booking Tool
  1. Selection of a Testbed
  2. Selection of the fixed Infrastructure from the Testbed
  3. Selection of Mobile Resources from Other testbeds



Step 1. Remotely book resources for a Drill Exercise

- Booking Tool
  1. Selection of a Testbed
  2. Selection of the fixed Infrastructure from the Testbed
  3. Selection of Mobile Resources from Other testbeds
  4. Selection of Human Actors Involved in the Exercise

→ Testbed Operator's approval is needed



Step 2. Develop a scenario for in field exercises

Phase 1) Experimenter accesses the INCLUDING web portal to explore resources available in the Testbeds of the Federation.

The INCLUDING platform will guide the users:

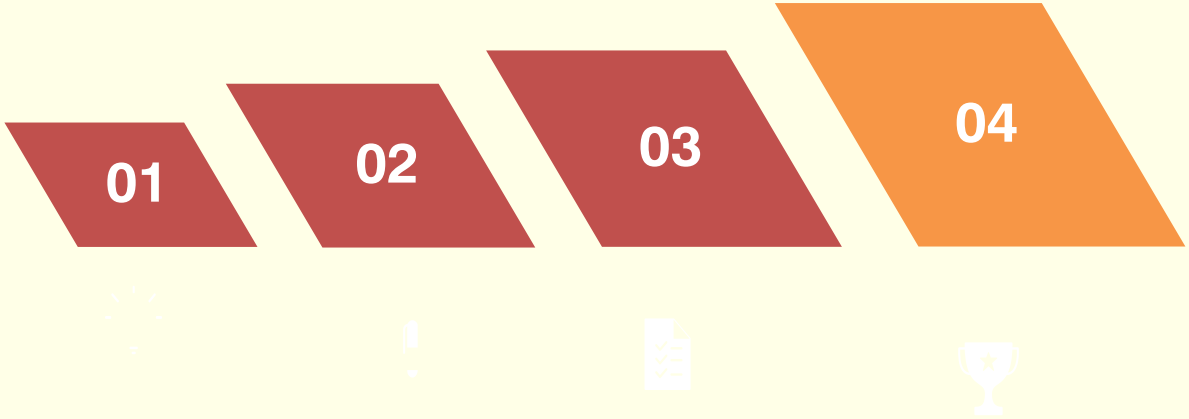
- in developing a scenario and finding the resources in the federation to execute it
- in assessing a scenario developed by another experimenter and decide to what extent to contribute.

Phase 2a) In case the tool to run the test or the training session is accessible remotely, the user will book the resource through the INCLUDING Platform.

Phase 2b) The team of Practitioners run the exercise in the testbed premises.

Phase 3) The Experimenter upload on the INCLUDING Platform data and evaluations on the test/ training/exercise that are accessible by all authorized users.

Drill Description Language (DDL)



1 Abstraction

Terminology for defining drill parts/components

2 Grammar

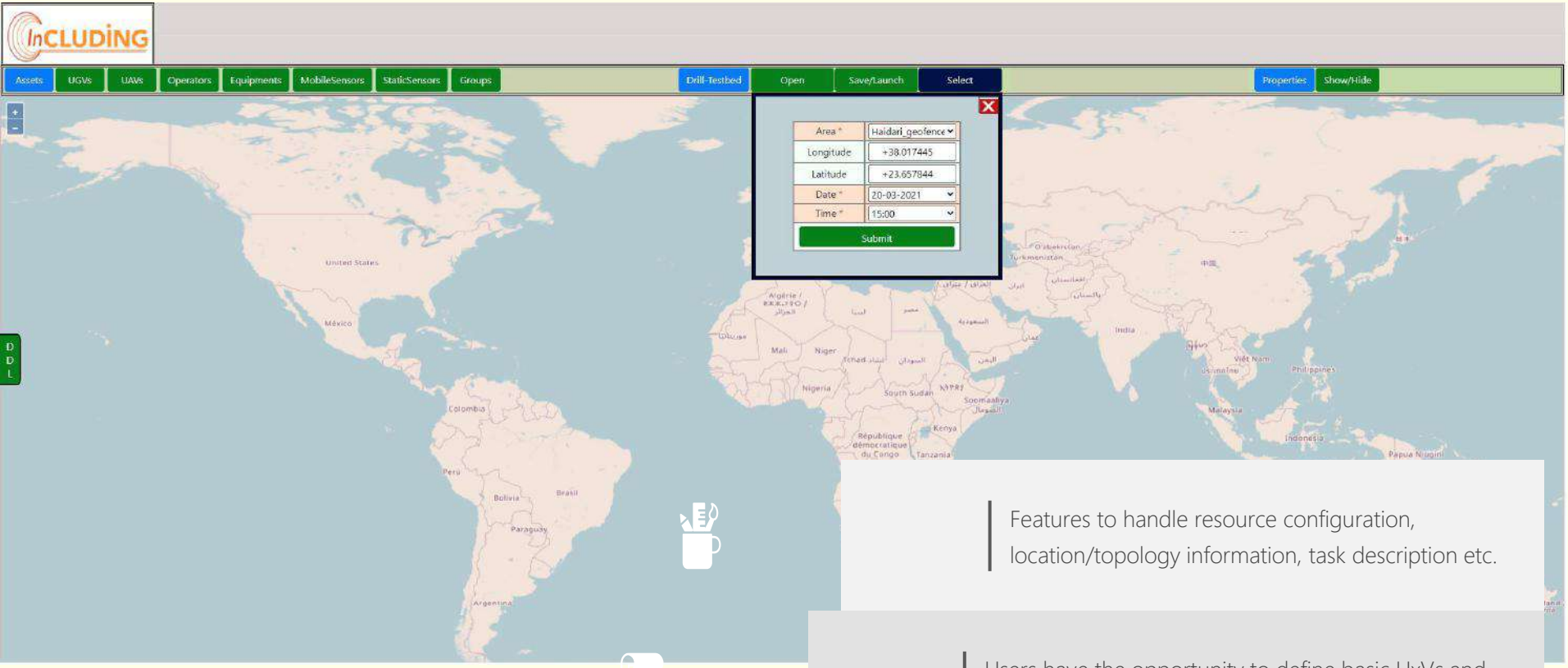
3 Rules

Syntactic and semantic validation

4 Authoring

Tools for authoring a drill from non-experienced users

Drill Authoring Tool



Features to handle resource configuration, location/topology information, task description etc.

Users have the opportunity to define basic UxVs and teams actions

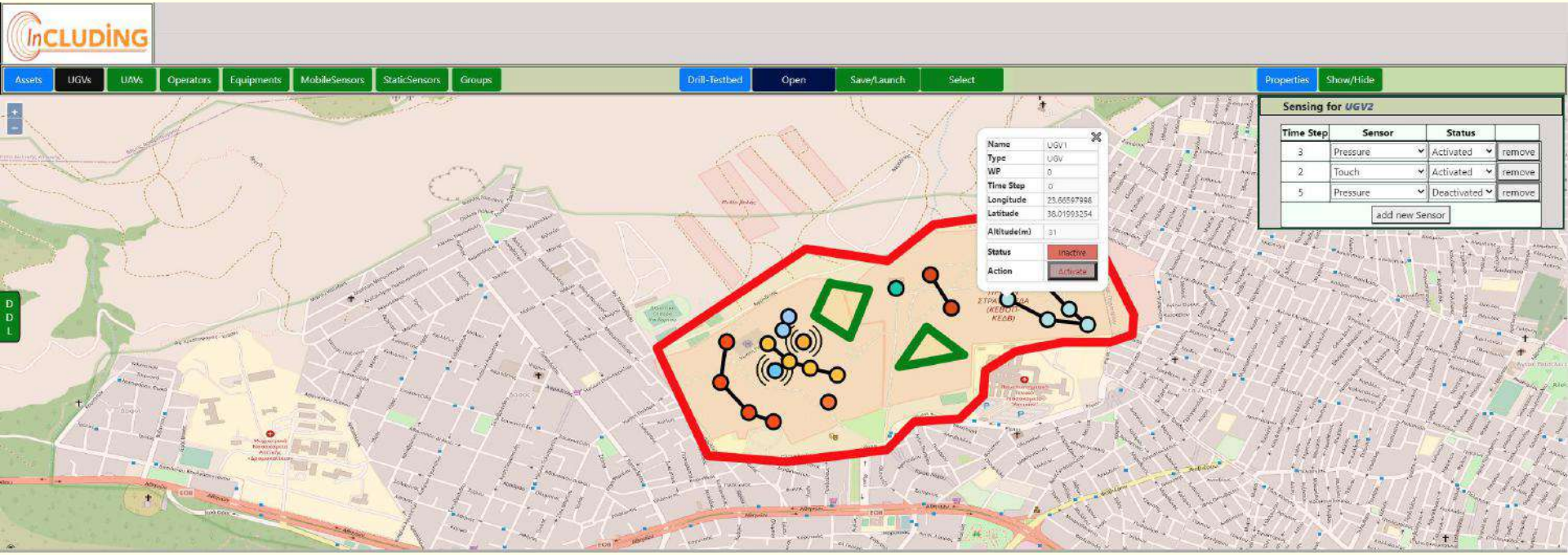
Commands to resources (e.g., waypoint definition, taken actions).

Drill Authoring Tool

Features to handle resource configuration, location/topology information, task description etc.

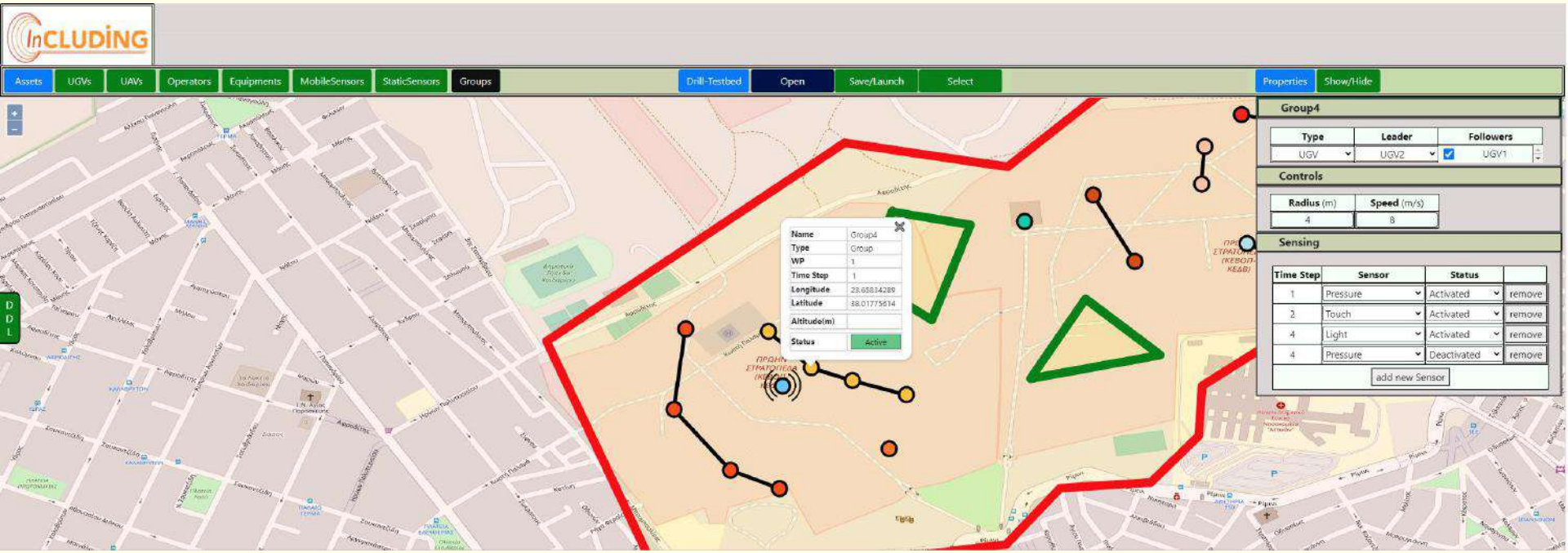
Drill Authoring Tool

Users have the opportunity to define basic UxVs and Groups actions



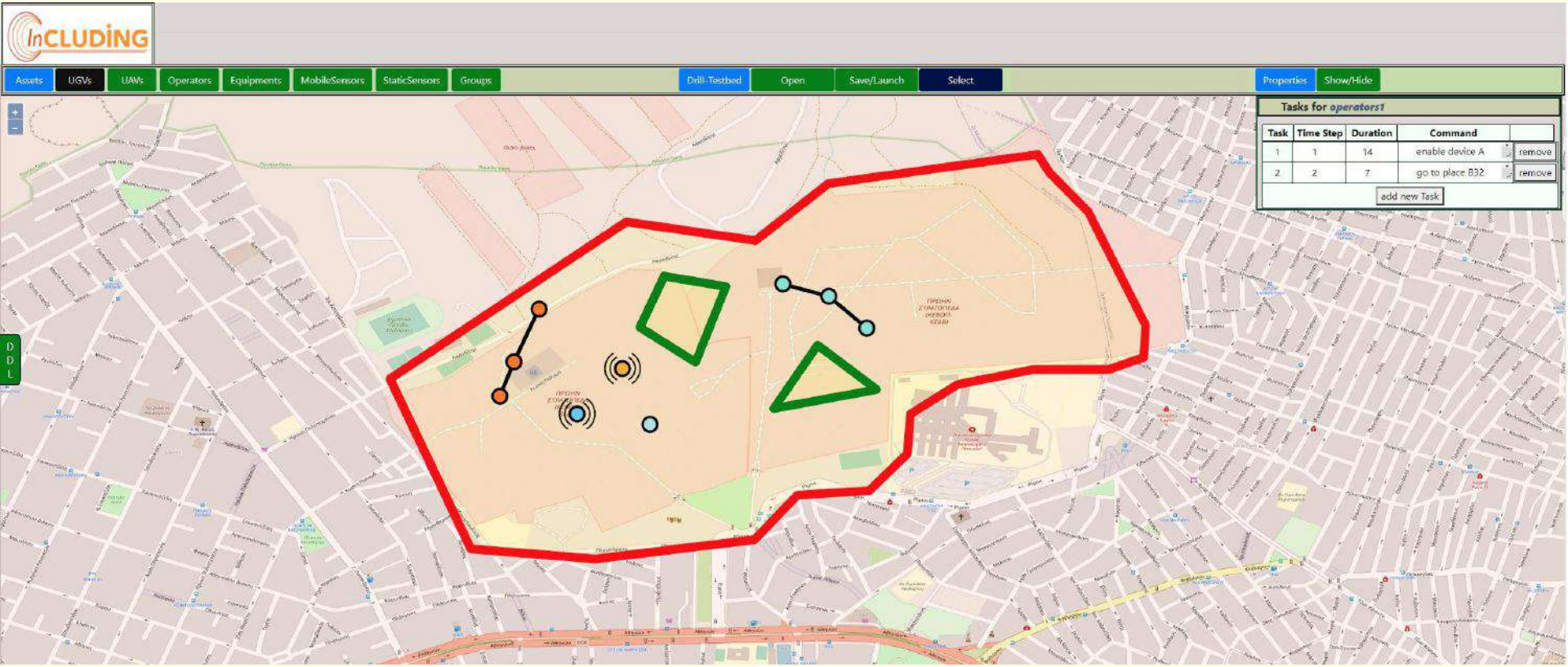
Drill Authoring Tool

Users have the opportunity to define basic UxVs and **Groups** actions



Drill Authoring Tool

Users have the opportunity to define **basic tasks** to Operators



Drill Authoring Tool

Parts of an Experiment

- **BeginExperiment**
  - *Metadata Section*
  - *Requirements Section*
  - *Declarations Section*
  - *Execution Section*
- **EndExperiment**

The Editor produces a set of files needed for experiment execution

- Example: Json file containing the location of each node at each time instance

Example Functionalities

Drill

The code generation component delivers the final outcomes.

Management

The drill can be stored locally for future use before the execution

Validation

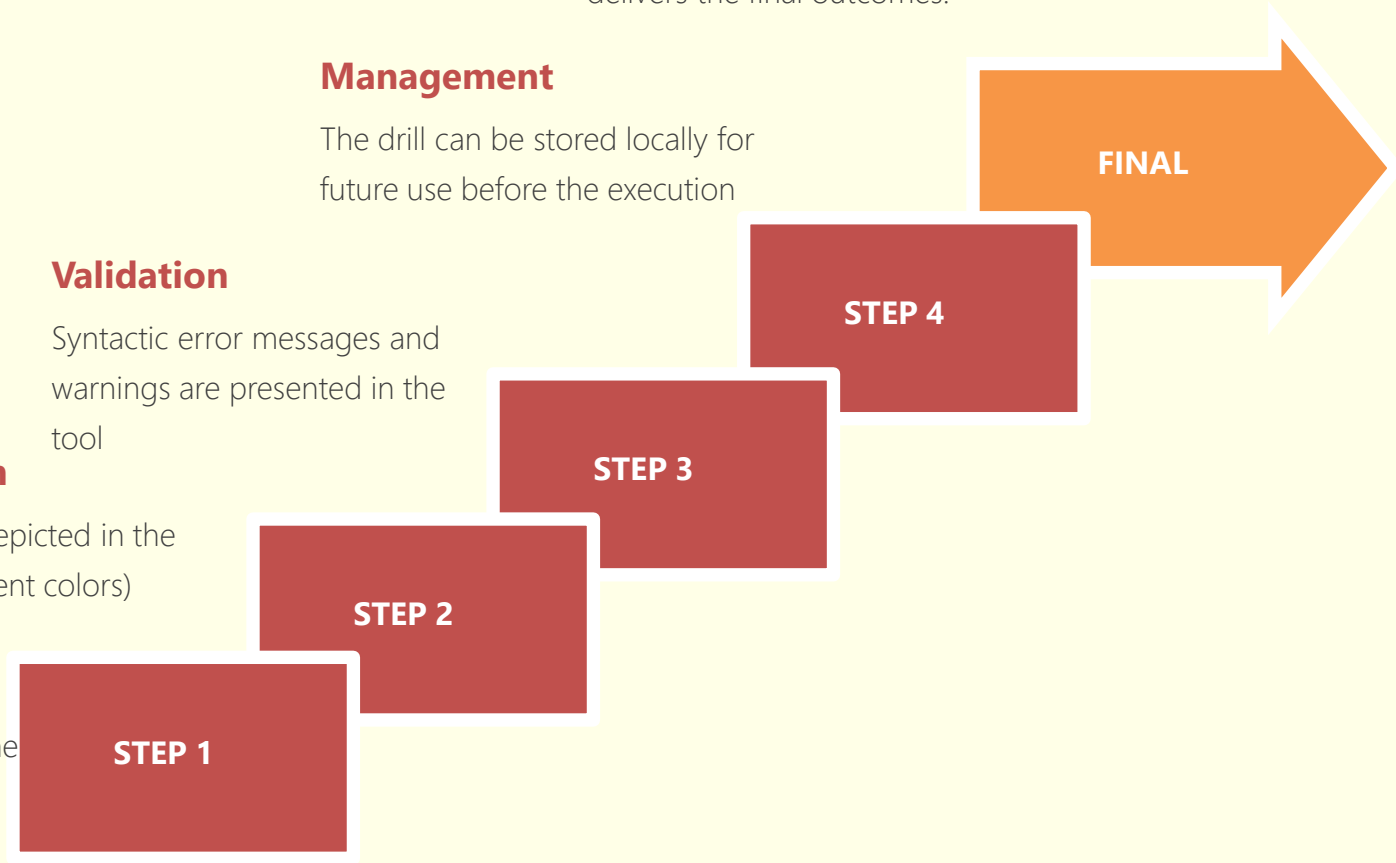
Syntactic error messages and warnings are presented in the tool

Visualization

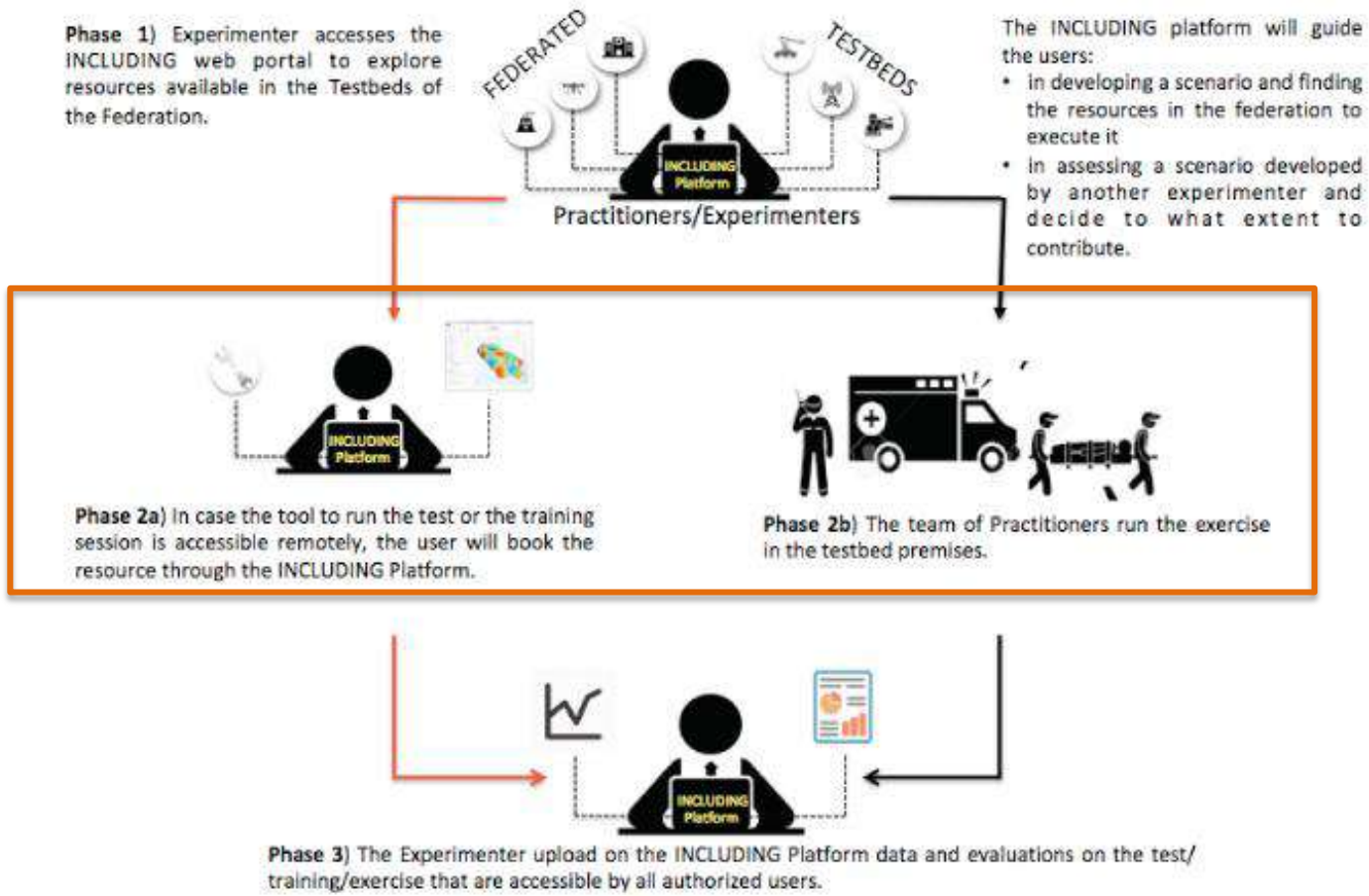
Resources are depicted in the map (with different colors)

Scenario

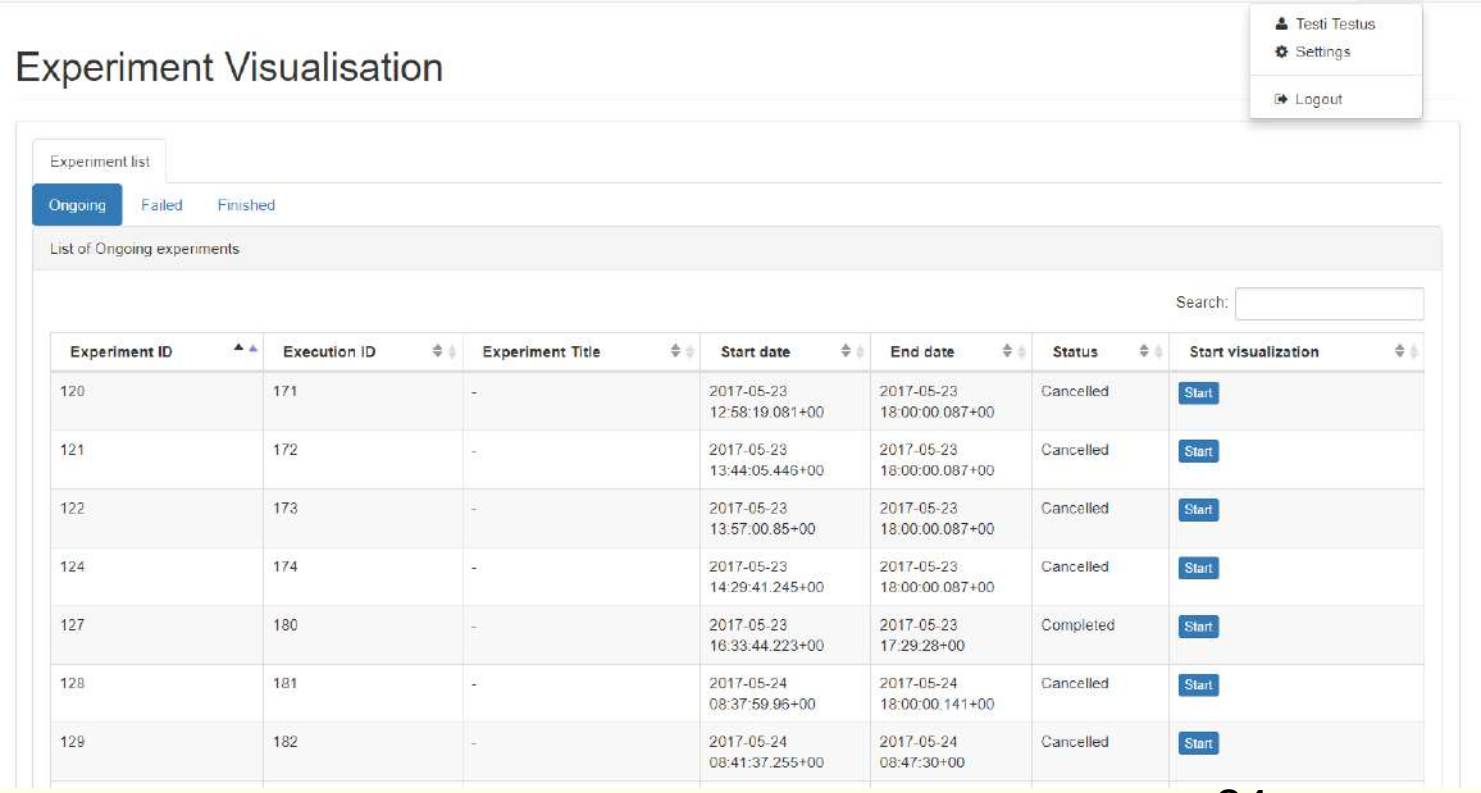
Users through the GUI can define the route of each UxV / human resource in the area



Step 3. Run real scenario, simulator and serious gaming



- After the successful launching of a drill, the experimenter should be able to track all assets during the execution of the drill scenario via the **Visualization tool** of the Front End Tier



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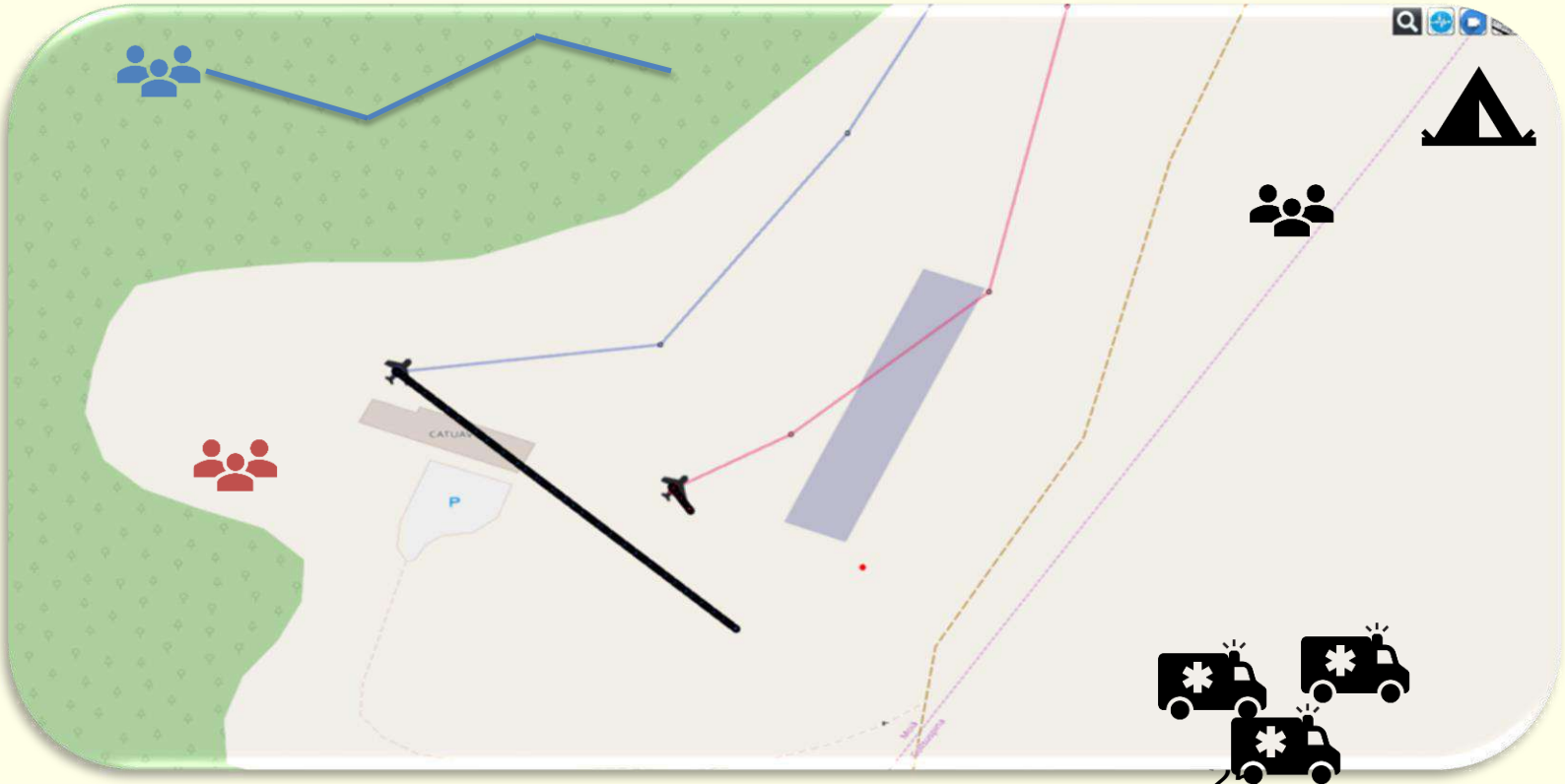
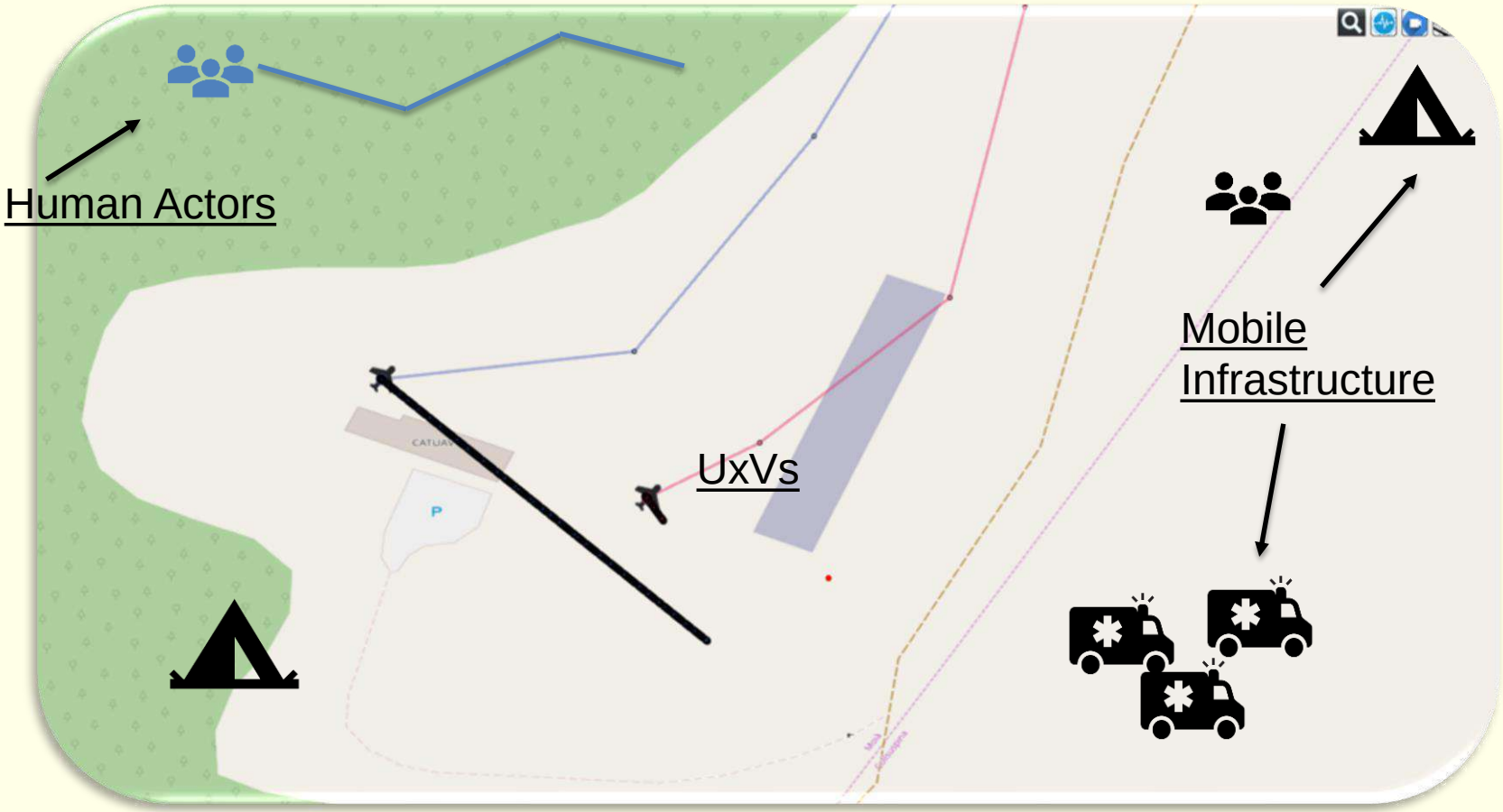
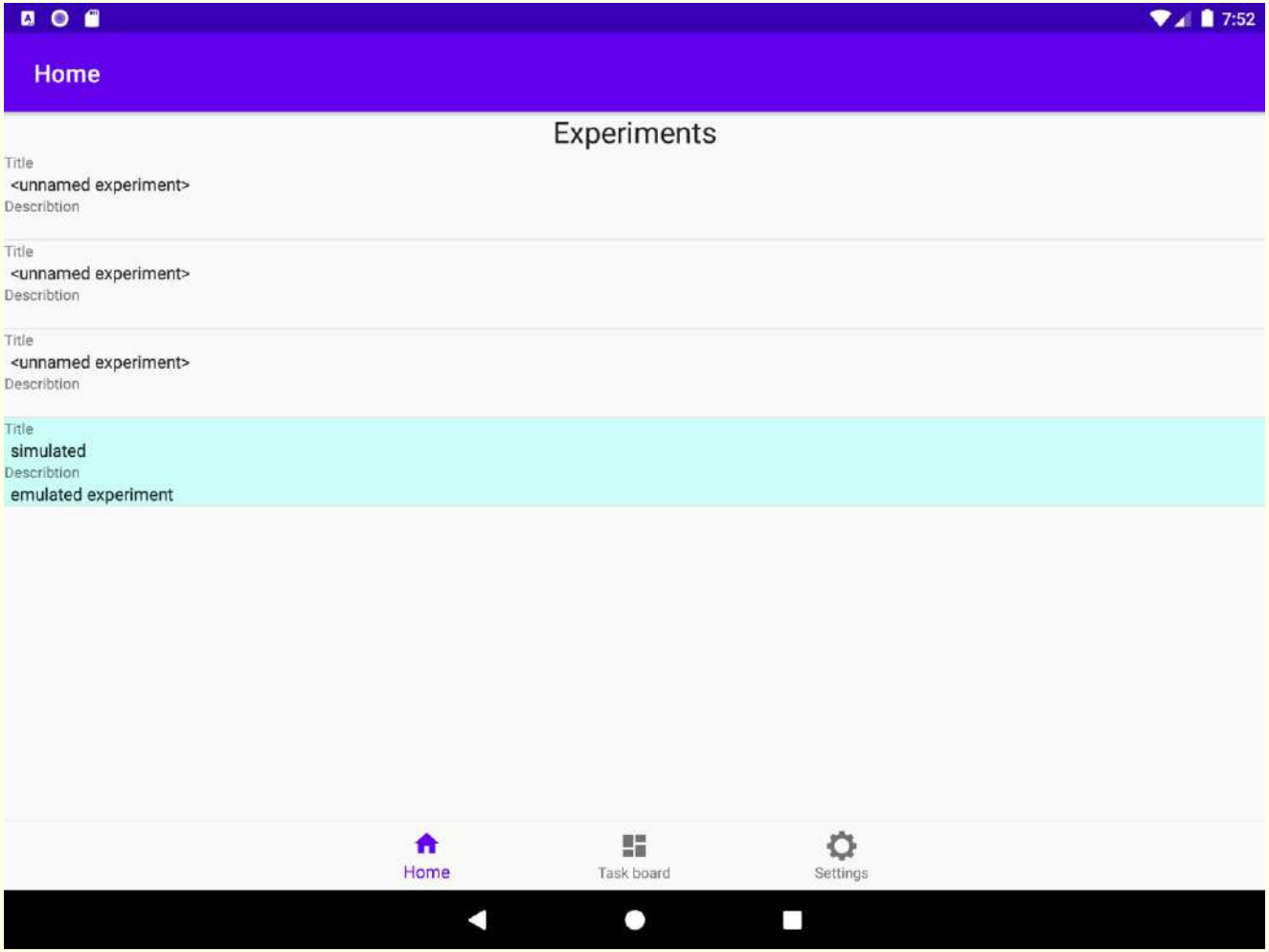


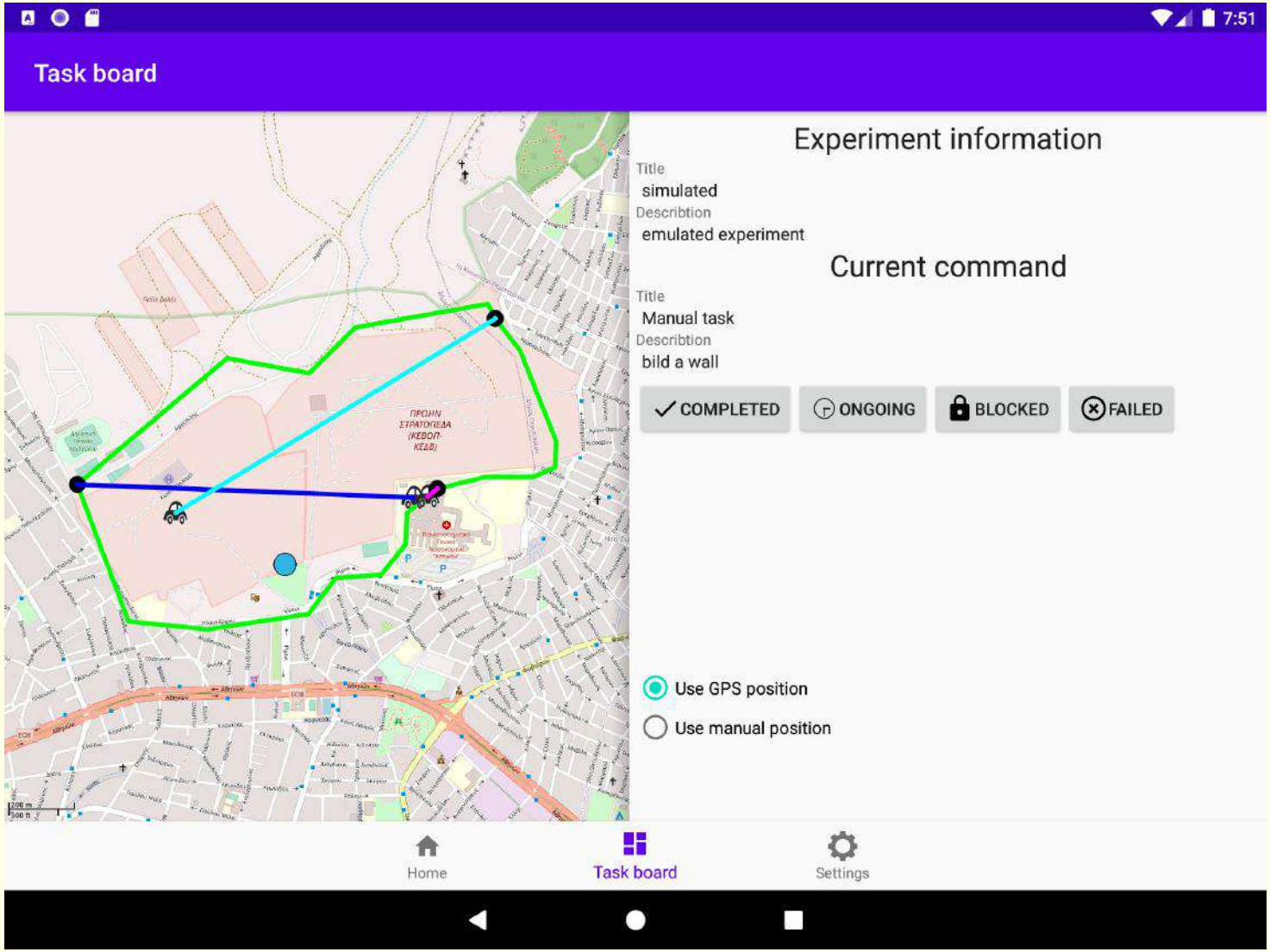
Visualization Tool – Mobile resources



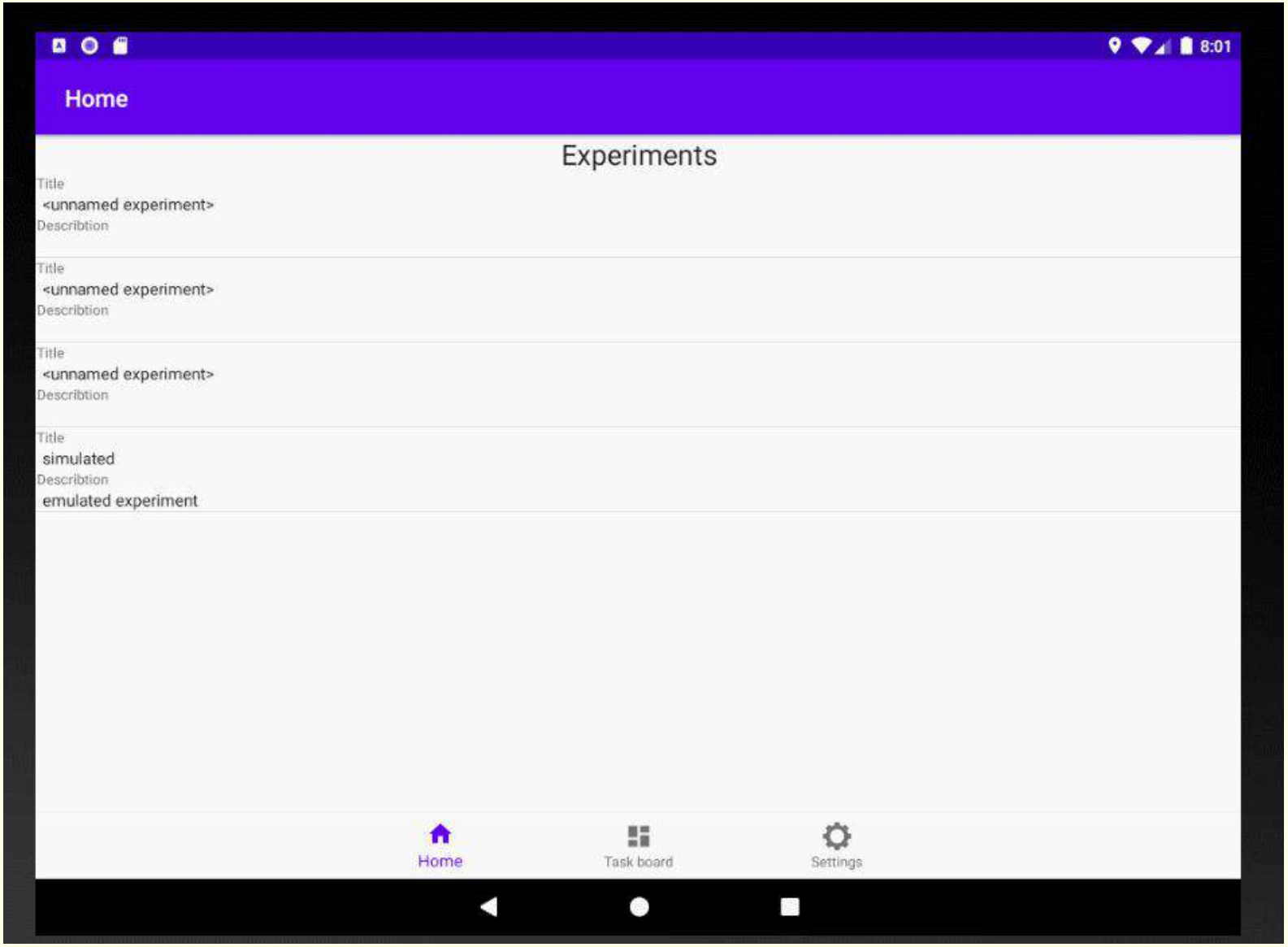
Visualization Tool – App



Visualization Tool – App



Visualization Tool – App



Standardization and optimization of the resources sharing

- Optimization on the use of resources
  - Optimization scheme for the better spatiotemporal arrangement of drills.
  - Resource availability, characteristics, previous engagement and drill requirements are collectively managed to derive a federation-wide schedule.
  - expected output: drills with full asset support (equipment, practitioners, expert groups) throughout EU.
- Standardization: Resource Descriptions standardized to enable the active exchange of information within the federation.
  - Data exchange standards and platforms within the INCLUDING systems (e.g., drill descriptions, middleware platforms)

Discussion

Crisis Management Research at Fraunhofer IVI

Dr. Ralf Hedel – Contributions and material from projects TARGET, IMPRESS, EU-CIRCLE

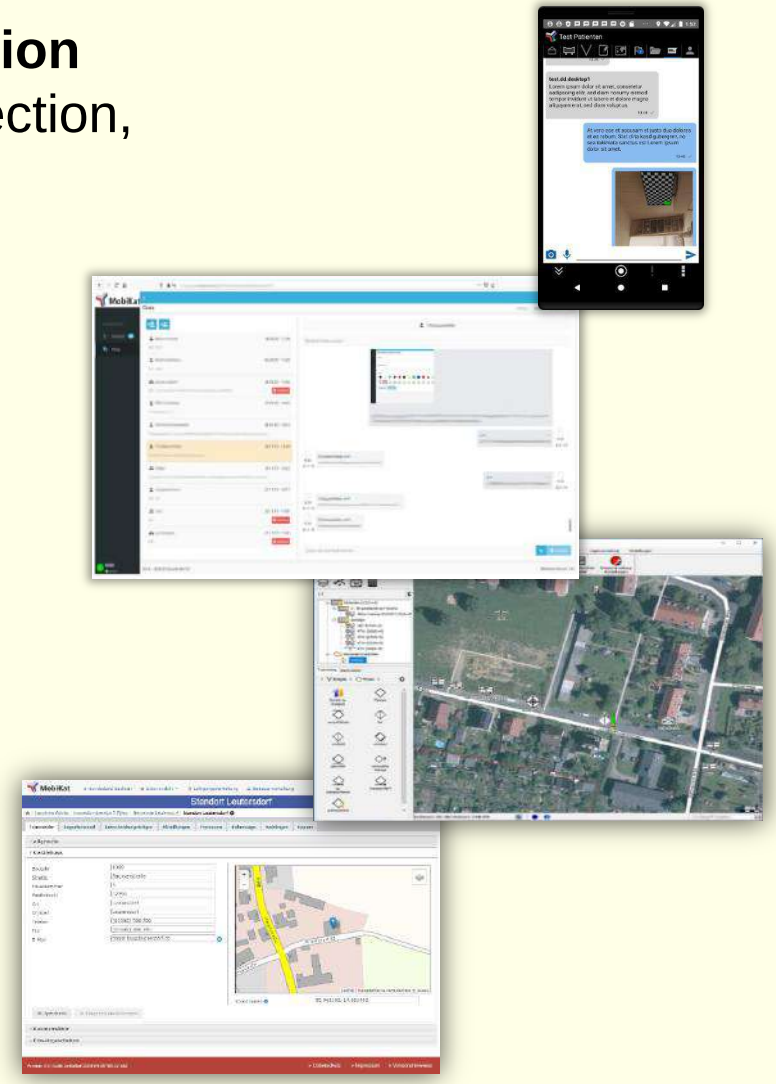
Fraunhofer IVI
ralf.hedel@ivi.fraunhofer.de

Workshop Athens, June 2021

A European Commission H2020 Programme. This document is produced by the INCLUDING consortium and the research leading to these results has received funding from the European H2020 programme under grant agreement no 833573

Fraunhofer IVI working areas

- **Command & Control & Communication** for Police/special forces, disaster protection, fire brigades etc.
- **Decision support algorithms/tools**
- **Computer-based scenario analyses**, consulting on security aspects
- **Resilience**
  - Framework development
  - Modelling/Simulation
  - Response/Management
- **Related hardware**
  - Cameras
  - Drones
  - AR/VR/MR



R&D related to CBRN crises management

(1) Strategic planning taking into account cascading impacts
(Project EU-CIRCLE)

(2) Operational patient data management
(Project IMPRESS)

(3) Police training with crowd movement simulation
(Project TARGET)

Strategic planning taking into account cascading impacts

Analytical questions

- How will a network {transportation, energy, ICT, … } respond to extreme hazards?
- Which components (assets) of a network have the highest risk of service disruption and failure propagation?
- How to reduce domino effects - What are optimal adaptation measures for a Critical Infrastructure (CI)?
- What are the impacts to businesses / society / economy of hazards resp. increased resilience?
- How to optimize response to hazards, taking into account increasing severity and frequency?

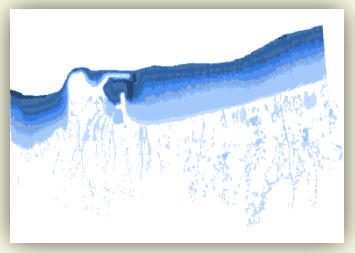
Critical Infrastructure Resilience Platform (CIRP)

CIRP – flexible, GIS based modelling platform

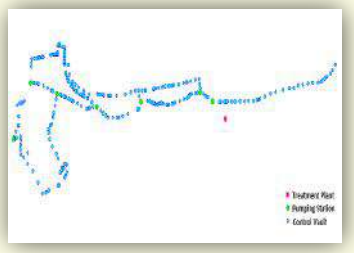
- **Inputs** - Hazards, Inventory, Fragility Models
- **Output** - Damage Prediction, Reporting, Decision Support
- **Repetition of calculations** for different future scenarios / strategy combinations etc.

Climate Change

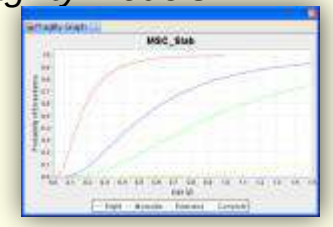
Hazard Definition



Inventory Selection



Fragility Models

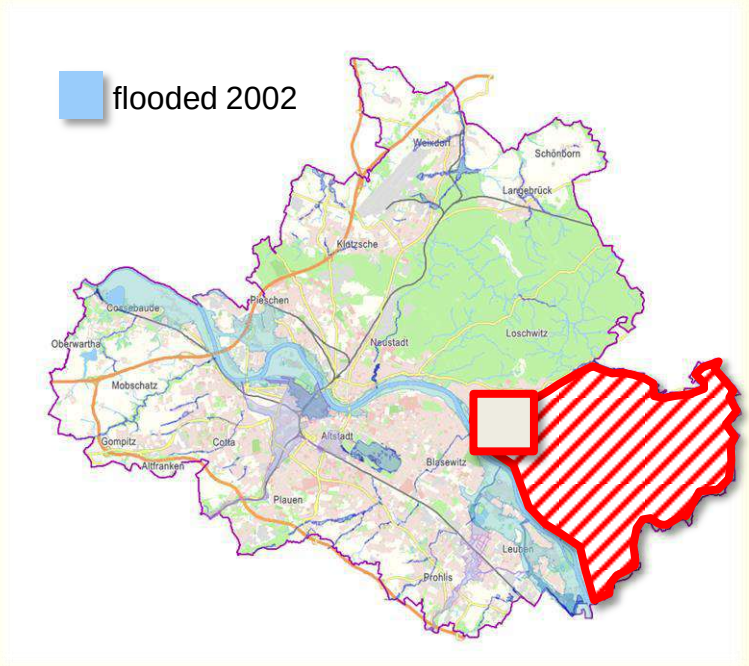


Decision Support

Damage Prediction

Case study area Dresden - South East

- Location:
  - East of city center close to river Elbe
  - Between Dresden and Pillnitz
- Previous incidents
  - Flood 2002
  - Flood 2013
- Infrastructures inundated and impacts
  - **Buildings - residential, public** → evacuation, costs and efforts
  - **Road - general traffic and public transport** → both detour, additional costs, time
  - **Power substation** → power cut, revenue losses
  - **Sewage pump station**: the last pump station in a chain of sewage pumps, depending from electricity → service interruption



Population: appr. 35 000 of 560 000

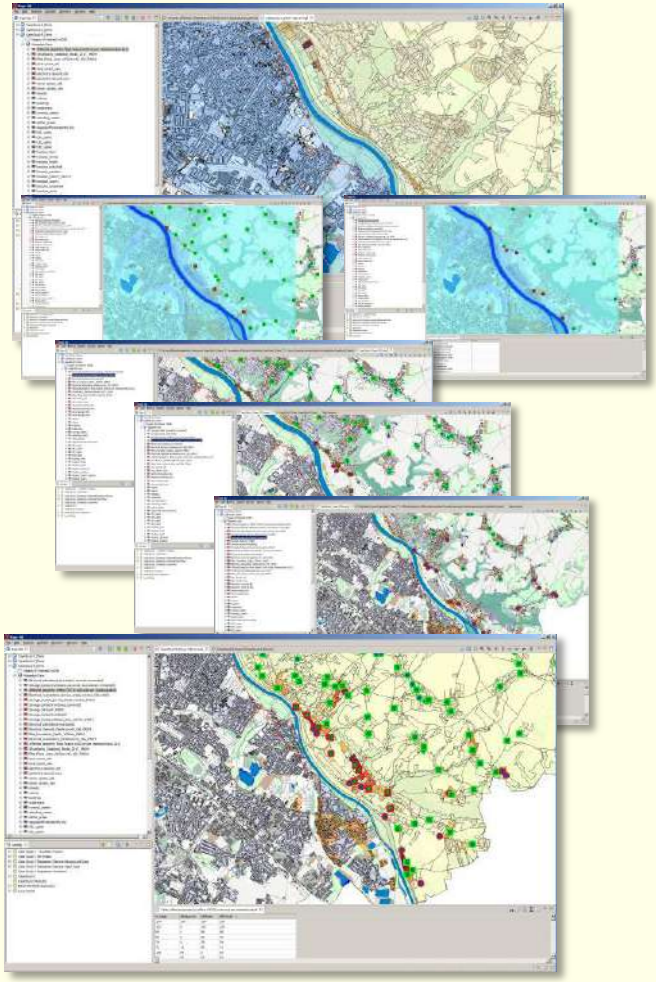
Dependency!

Map source: Themenstadtplan Dresden

CIRP analyses

- **General scenarios**:
  - Population 2018 and 2025
  - Flood level: 7.00 m (Alert level 4), 9.24 (HQ100), 10.50 (HQ500/extreme)
- **Adaptation scenarios**:
  - Relocation of electricity statoin against business-as-usual (BAU)
  - Construction of culvert against BAU
- **Determination of directly from flood affected buildings, pumping and power stations and person** (based on stat. blocks)
- **Determination of shut-down electricity distribution stations and depended sewage pumping stations under consideration of topologies and connections between networks** (sewage working only if *pumping is operational until and along the „Neustädter Canal“*)
- **Determination of people indirectly affected by flood due to power cut or sewage disruption**

Dependencies and cascading effects make a big difference!



DIRECTLY from flood affected people
(can be calculated with any GIS)
~2 000

Consideration of damage functions for electrical sub-stations and sewage pumps (operation status)

Cascading effect in electrical grid through loss of connection to „source“

Offline sewage pump entities due to dependency from electrical energy

Sewage pumps blocked by downstream problem

Inhabitants in case study area INDIRECTLY affected by inoperable infrastructure:

~ 6 1 00 without adaptation

~ 5 700 with adaptation

Operational patient data management in mass casualty incidents

The main functionality of INCIMOB is to register patient data in the field and connect them with Command posts

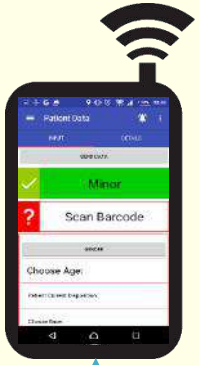
→ **Patient tracking:**

- Registration of patients
- Triage support
- Update patient data

→ **Communication** and **Situational Awareness:**

- Receive tasks, Update status
- Exchange messages
- Send situational reports
- Map View of event related data

INCIMOB
(in the field)



3G/4G/
WiFi

Command & Control
Center

Patient Tracking - Functionalities

INCIMOB aims to ease the handling of patient information through:

→ In-situ digital **registration of patients**, including:

- Patient-Identification: scan barcode or NFC-tag
- Enter physical characteristics
- Enter Symptoms / Injuries.
- **Triage support**
- Support by triage algorithms
- Direct input of triage category

→ Continuous **update of patient data**:

- Symptoms and severity/triage code
- Vital signs (pulse, oximetry and blood pressure → medical devices / Bluetooth)
- etc.

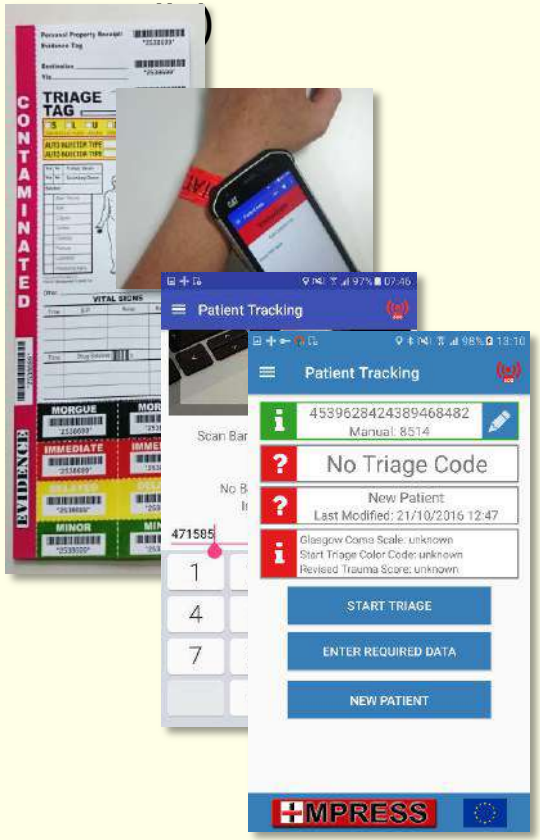
→ Submit patient data to Command & Control system

→ Update **patient status**: transport → admit to hospital → release

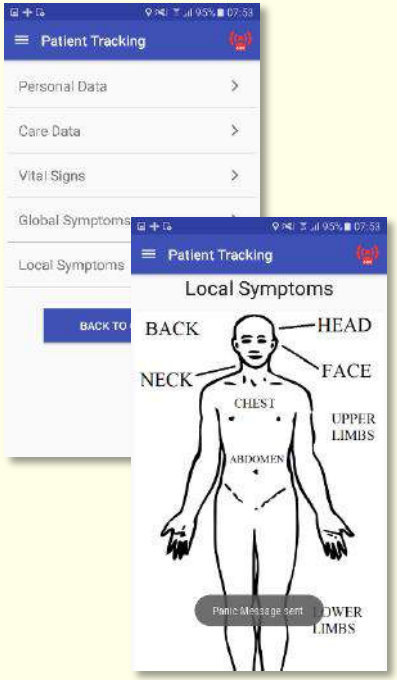
Patient Tracking - Workflow

1. Triage (multiple methods)

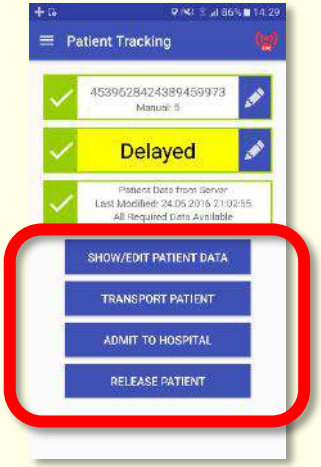
2. Registration of new patient with unique ID (barcode, NFC,



3. Enter patient details



4. Transport / admit to hospital / release



INCIMOB at pilots

Palermo 06/2016



Montenegro 10/2016



Sofia 04/2017



TARGET: Simulation of crowd movement

Motivation

- Worldwide growing population and urbanisation
- Strong consideration of security/safety aspects at large-scale events after severe incidents (2010 “Love parade”, 2015/2006/2004… Hajj)

Approach

- Support planning of events and preparation for incidents
- Target group: police senior command personnel usually in charge of leading such operation
- Aim is to improve the strategic and tactical skills, response capacity, judgement and decision-taking as well as the ability to delegate
- Development of training platform that integrates modelling capabilities, specific training components and command & control tools

TARGET: Simulation of crowd movement

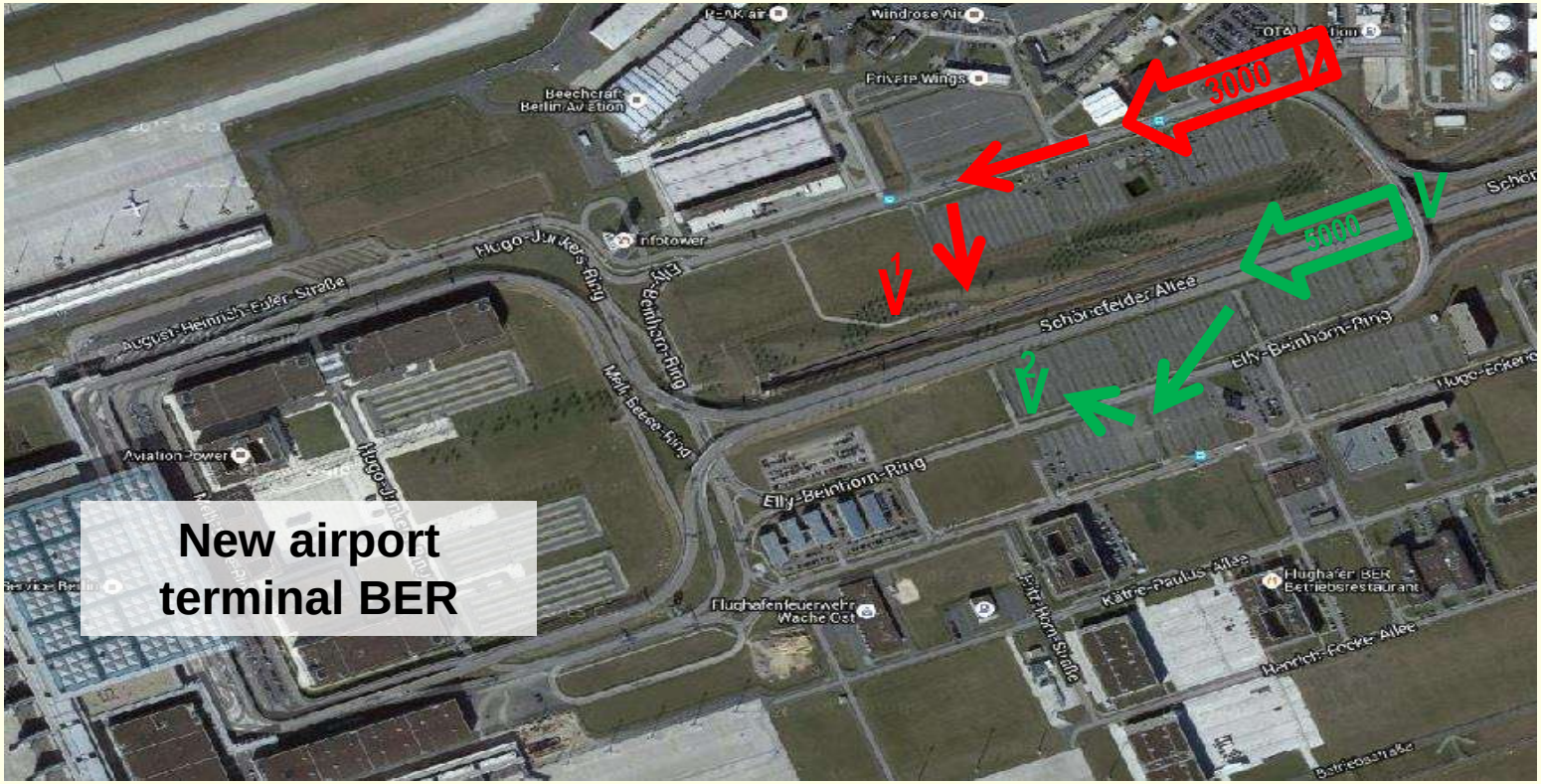
- **Method:**
  - Social Force Model from Helbing (1995, 2005),
  - Microscopic, based on empirically analysed behaviour of people
  - Calibrated with video analysis after Johansson et al. (2007) und Moussaïd et al. (2009)
  - Straightforward implementation

- **jCrowdSimulator**
  - Java-based, open-source
  - Supports ESRI-shape, WKT … to define crowds (point data) and associated routes (point data)
  - Multiple crowds, each having an individual route can be simulated simultaneously
  - Point/Line/Polygon data can be used to define obstacles
  - The outline of crowds can be computed
  - Resulting forces within the simulation can be visualized
  - The simulation library may be used independently from the user interface
  - https://www.youtube.com/watch?v=1Pn2VdOSdPw

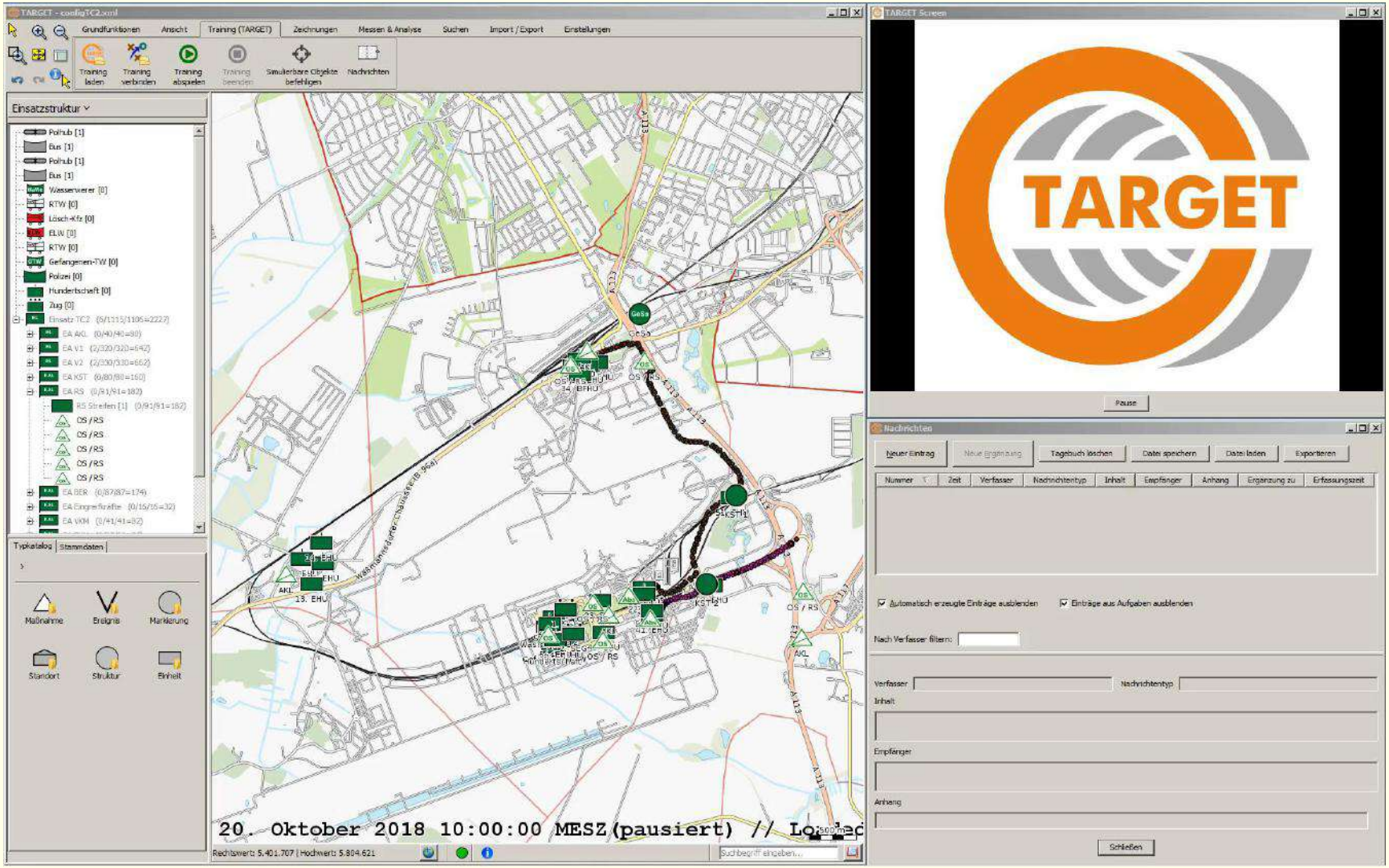
Introduction to jCrowdSimulator (pedestrian and crowd simulation)

TARGET: Simulation of crowd movement

First map of the scenario



TARGET: Simulation of crowd movement



TARGET: Simulation of crowd movement

Main features and advantages

- Planning, execution and assessing of trainings becomes more efficient and effective.
- Faster and easier planning results in a higher repetition rate of trainings.
- Programmed automatically run trainings disburdens the exercise controllers significantly.
- Visualisation in the form of “real-time” 3D-simulations and virtual life feeds of events and injects make the scenario more realistic.

Immersive Virtual Reality Training for CBRN Scenarios

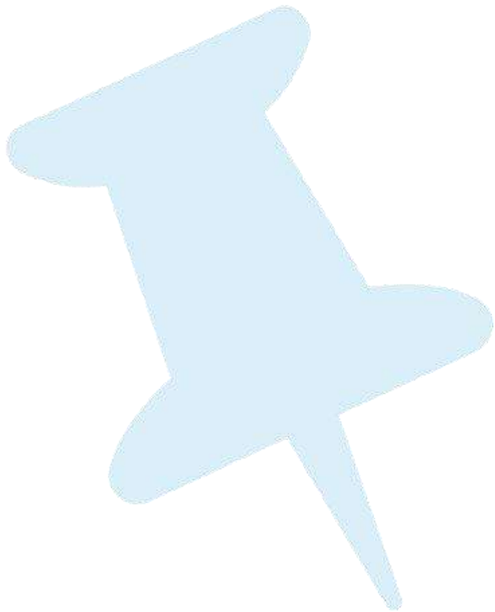
Miguel Melo

2nd INCLUDING Annual Workshop on the Radiological and Nuclear Training Framework in the European Union

utad INESCTEC massive

Summary

- Brief intro to Virtual Reality
- The impact of VR training
- How VR is being used for training
- How we envisage VR training in INCLUDING



Virtual Reality

Strengths

Virtual Reality for training and certification

Strengths

- Possibility of recreate real scenarios in a High-fidelity VR environment
- Interactivity
- Improves knowledge retention
- Reduced costs

Strengths and opportunities

Virtual Reality for training and certification

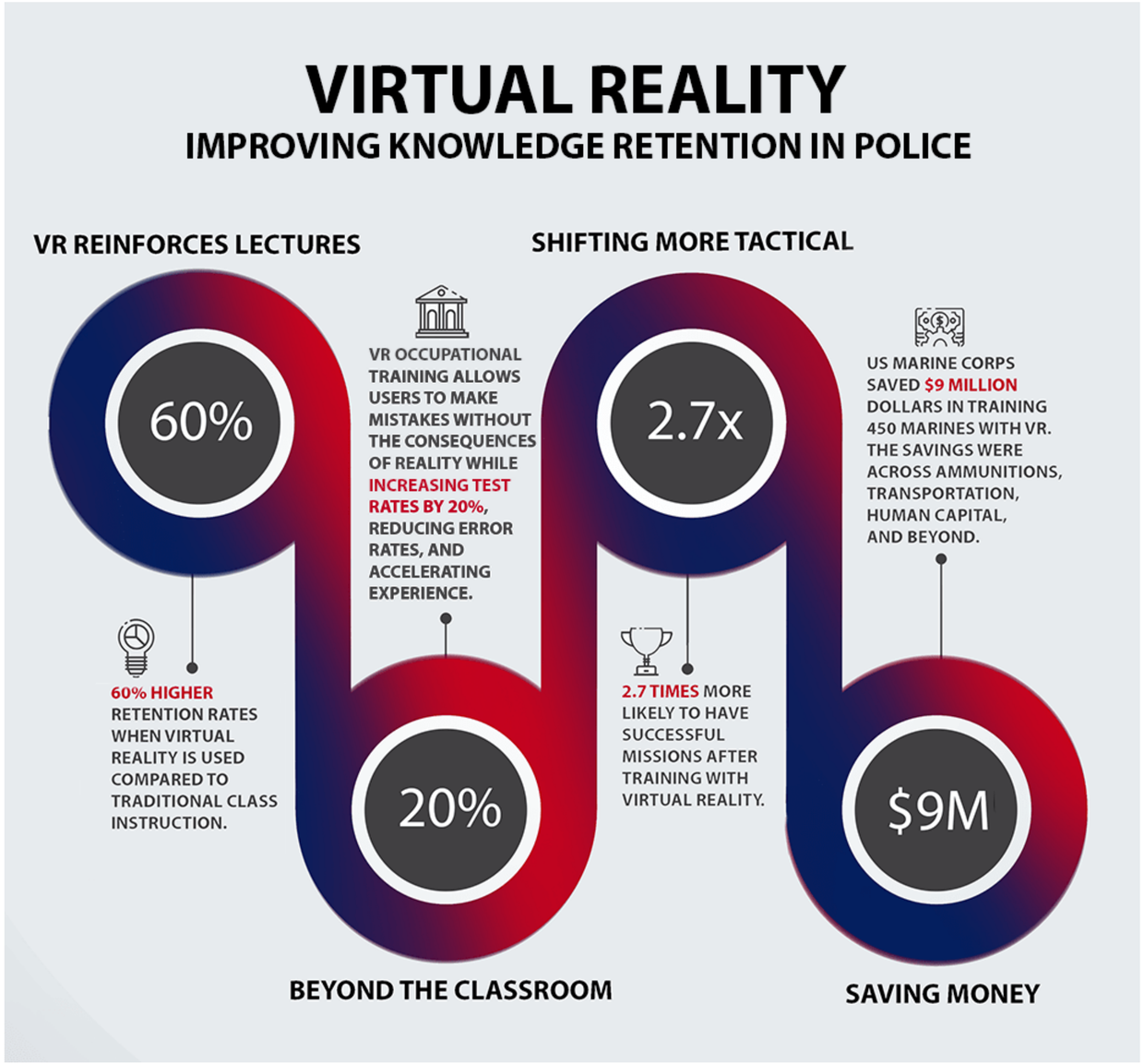
Strengths

- Possibility of recreate real scenarios in a High-fidelity VR environment
- Interactivity
- Improves knowledge retention
- Reduced costs

Opportunities

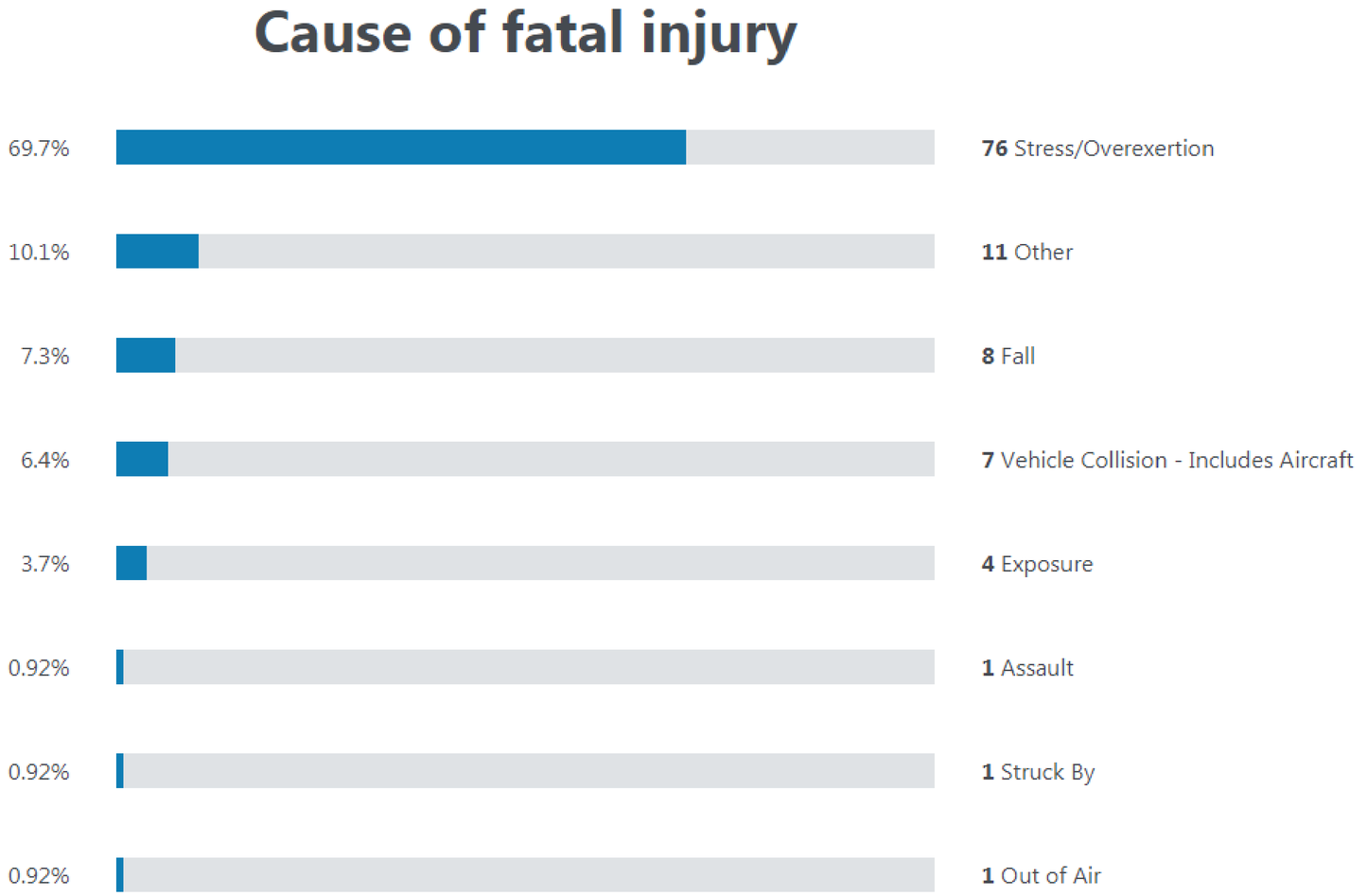
- Create safe training environments
- Allow the training of individuals or teams
- Enables a systematic training of unusual events

Virtual Reality Training Impact



Virtual Reality training can save lifes

- From 2008-2019, 109 firefighters lost their lives due to training injuries only in the USA



How VR is being used in training

- Tactical Training

- Operational Training

High fidelity multisensory virtual environments

- Content must deliver a percetual equivalent experience to the user

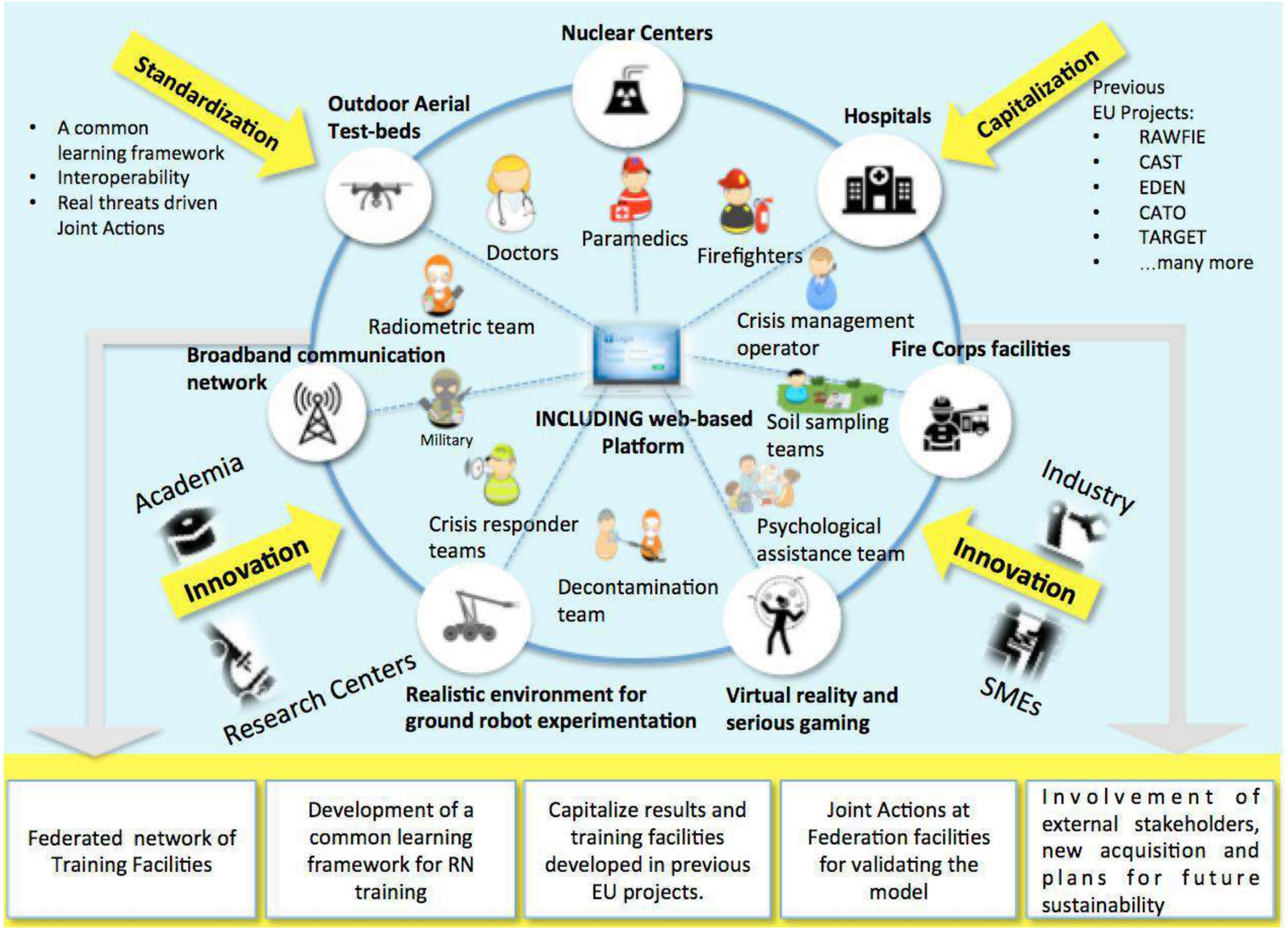
- This enables a direct knowledge transition from VR to the real world

High fidelity multisensory virtual environments

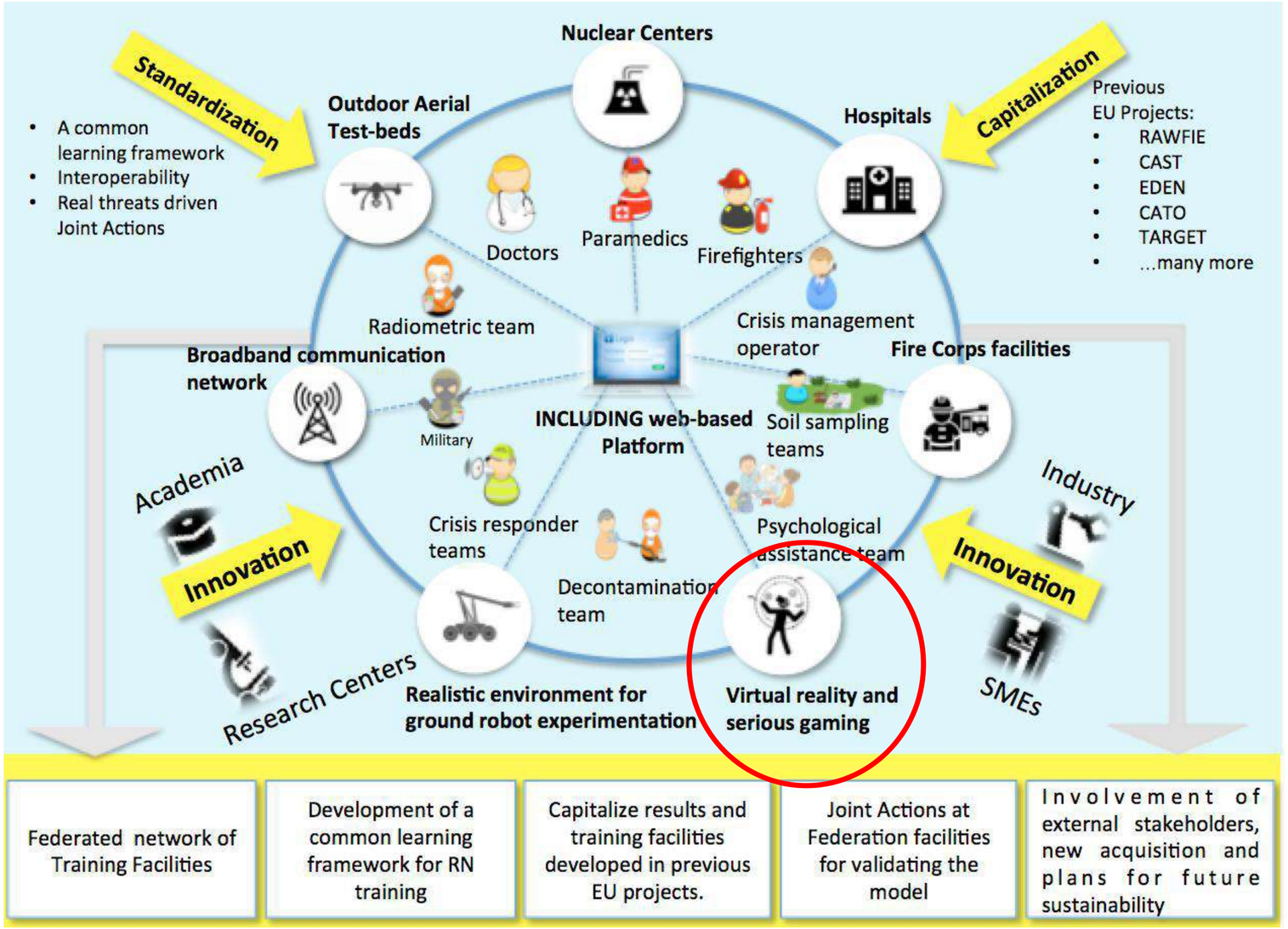
A good example: project FAIM


INCLUDING

Integration of VR training tools in the European Training framework



Integration of VR training tools in the European Training framework



Virtual Reality Training Platform

(how we envisage it)

INCLUDING web-based platform will serve as point of access where it would be possible to:

- Request access to the virtual training content
  - The federation evaluates/grants access to partners
  - The partner will be responsible for acquiring the VR setup (all the support is given by the federation in terms of equipment and setup)

Virtual Reality Training Platform

(how we envisage it)

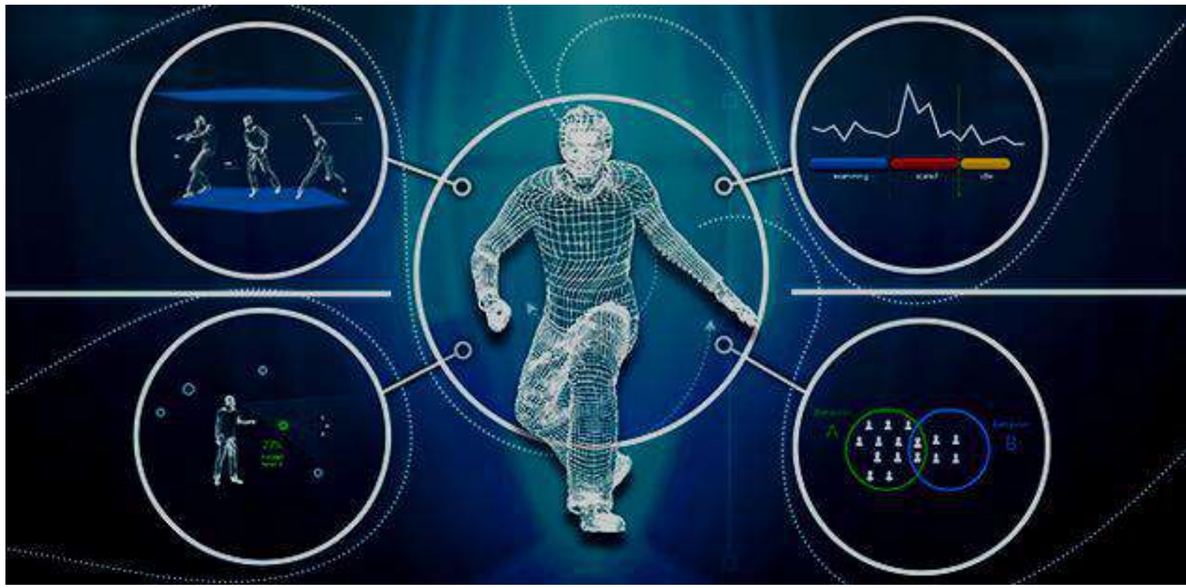
INCLUDING web-based platform will serve as point of access where it would be possible to:

- Request access to the virtual training content
  - The federation evaluates/grants access to partners
  - The partner will be responsible for acquiring the VR setup (all the support is given by the federation in terms of equipment and setup)
- Login based on user roles:
  - Trainer/Manager:
    - define the exercises to be available to his trainees
    - View the data analytics of the trainees' sessions
  - Trainee:
    - Access to the virtual training environments
    - View his performance on the virtual training activities

High fidelity multisensory virtual environments

- Standalone VR training scenarios
  - Case scenario being developed with the support of PSP
  - Explorative Learning

- Monitored training scenarios
  - Tools for monitoring training scenarios for performance
  - Control over virtual environment varibales



High fidelity multisensory virtual environments

- Selected scenario: crisis situation with a radiological dispersive device in a public environment
  - Freely explore the virtual environment
  - Manipulate the virtual radiation detector
  - Configure the radiation detector
  - Use the radiation detector to perform radiation readings throughout the virtual environment

High fidelity multisensory virtual environments

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  - Freely explore the virtual environment
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  - Use the radiation detector to perform radiation readings throughout the virtual environment

- Control over training
  - Radiation detector to be used in the training scenario
  - Radioactive source and its properties
  - Shielding of the radioactive source and its properties

High fidelity multisensory virtual environments

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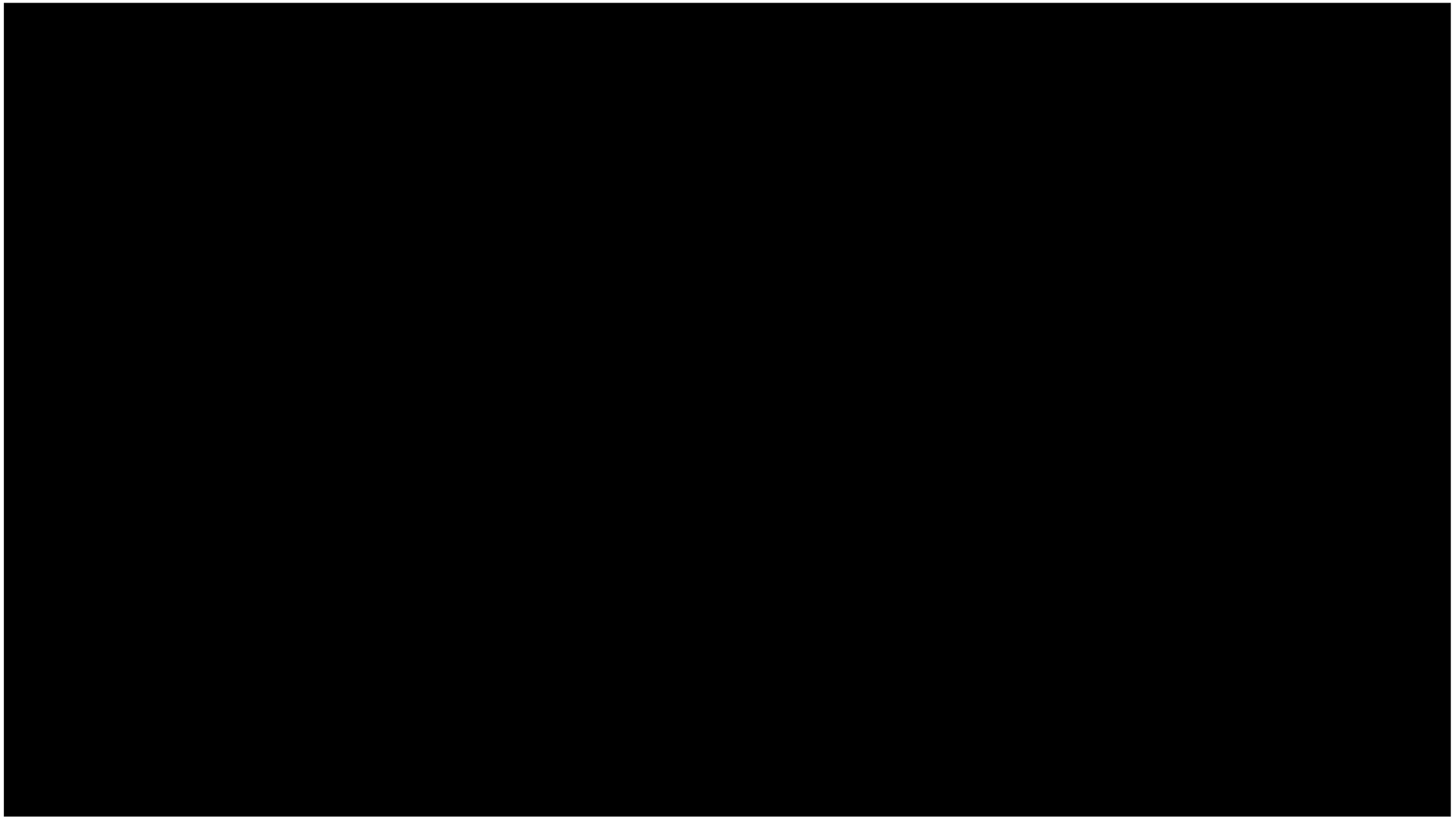
- Control over training
  - Radiation detector to be used in the training scenario
  - Radioactive source and its properties
  - Shielding of the radioactive source and its properties

- Monitored training scenarios
  - Follow the trainees' actions in the virtual environment
  - Manipulate variables of the training scenario to challenge the trainees (e.g., manipulate the readings of the radiation detector)
  - Record/Replay the virtual training session

Virtual Reality training scenario



Certification - Long term goal

- **Authoring tools for non-experts**
- **By the correct assessment of:**
  - Procedures
  - Behaviours
  - Decision-making
- **Using only digital tools**

THANK YOU! ☺

Questions?

Immersive Virtual Reality Training for CBRN Scenarios

Miguel Melo

2nd INCLUDING Annual Workshop on the Radiological and Nuclear Training Framework in the European Union

utad INESCTEC massive

Operational aspects of civil-military cooperation in radiological security scenarios on maritime environment

Spyros KOLOVOS – Hellenic Ministry Of Defence (HMOD)

WP5 Leader

A European Commission H2020 Programme. This document is produced by the INCLUDING consortium and the research leading to these results has received funding from the European H2020 programme under grant agreement no 833573

Aim

- **Aim:** **To provide the established framework of civil-military cooperation when dealing with a radiological event in maritime environment (aboard or ashore).**

Operational Procedures

Information for / Announcement of RN Incident (including illegal trafficking)

Police (ashore) / Coastguard (coastline / aboard) conduct risk assessment / verify event

Development of Supporting Management Team

Incident Coordination Element (Representatives from Fire Service, Police, Coastguard, Armed Forces, Health Emergency Center and Atomic Energy Commission).

Element's responsibilities:

Risk Assessment
Hot / Warm / Cold Zones mapping
Strategic and Operational level planning in order to be given directions for tactical one.
Plans implementation
Risk management
Logistics / Information coordination
Protection of population guidance.
Public and Mass Media information.

Operational Procedures

Countering of RN Incident

Development of responding teams in the area under the lead of Fire service CBRN element

Joint CBRN Coy reports its availability and readiness to conduct CBRN operations

It activates Warning & Reporting Center providing valuable information on RN spread by using Hazard Prediction Assessment Capability (HPAC)

Execution of mission in accordance with the established procedures and nature of CBRN incident

Recovery / Mitigation measures

RN Illegal Trafficking aboard

Coastguard provides information for possible / verified illegal trafficking of RN material on a ship

Development of responding teams able to operate and move aboard merchant vessels (especially containerships) / Special training required

Joint CBRN Coy can provide such capabilities (availability to transport necessary equipment by air or sea)

Risk assessment / management are crucial factors for success and safety of operations

In case of Coastguard doesn't possess appropriate vessels to carry CBRN means

Navy can support aboard operations with ships in order to transport CBRN personnel and related equipment by approaching the merchant vessel carrying RN illegal material.

RN Illegal Trafficking at port

Coastguard provides information for possible / verified illegal trafficking of RN material at port

Area conditions / infrastructure / goods information is required.

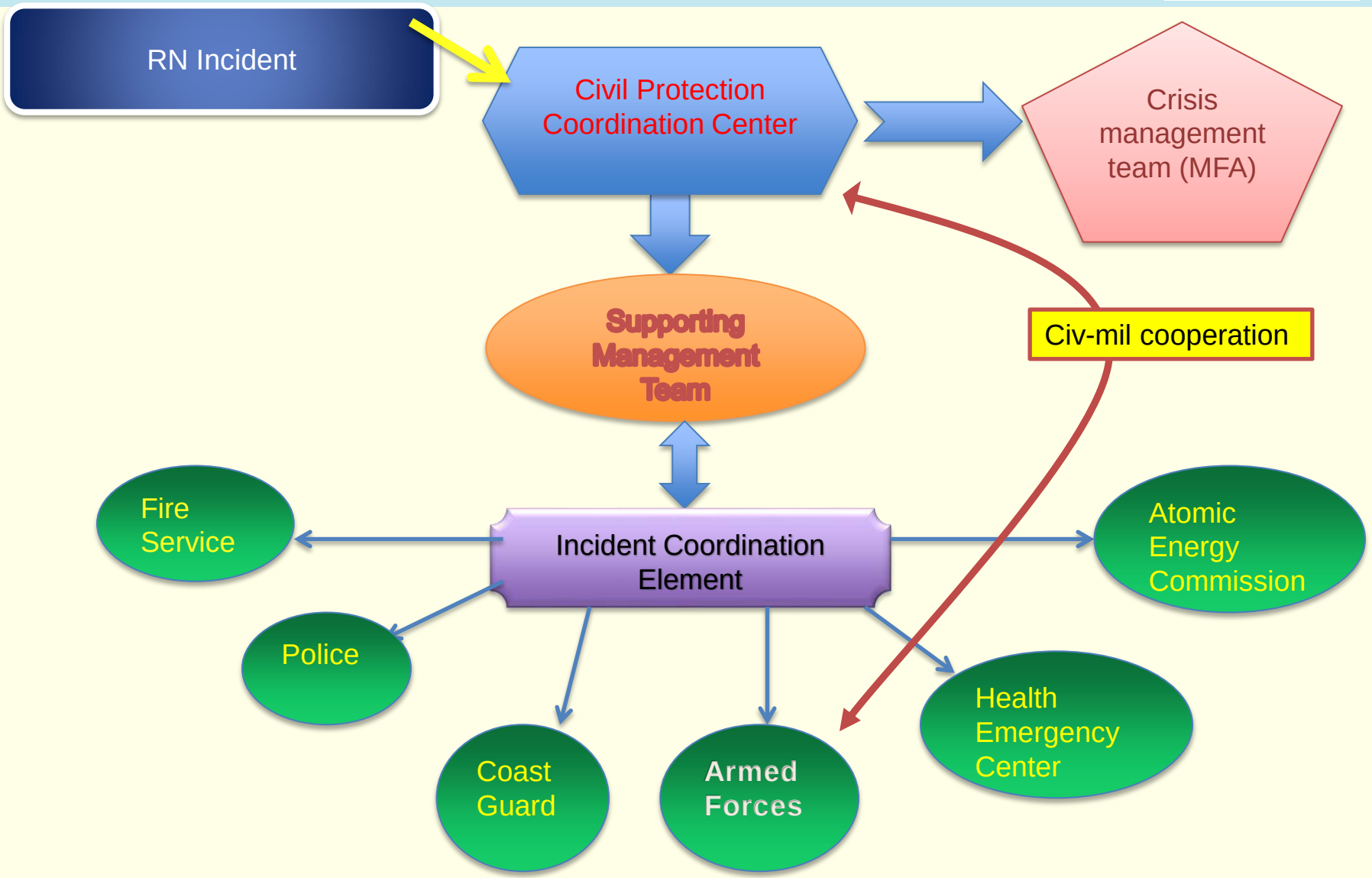
Port authority should support responding teams by providing necessary access / freedom of movement / control of contaminated area to be arranged possible zones

Joint CBRN Coy can move everywhere around country's ports (mainland and islands)

Risk assessment / management are crucial factors for success and safety of operations

Armed Forces can provide available means (by air or sea) to carry CBRN assets to remote mission destinations.

Operational Procedures Diagram



References

- General plan for management of CBRN threats and hazards (General Secretariat for Civil Protection - GRC)

- NATO AJP-3.19 (Allied Joint Doctrine for Civil-Military Cooperation (Nov 2018)

- NATO non-binding guidelines for enhanced civ-mil cooperation to deal with the consequences of large scale CBRN events associated with terrorist attacks

TEKEVER

UAVs in maritime security

Aleksandra Nadziejko, Antonio Brás Monteiro

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THE BIG PICTURE

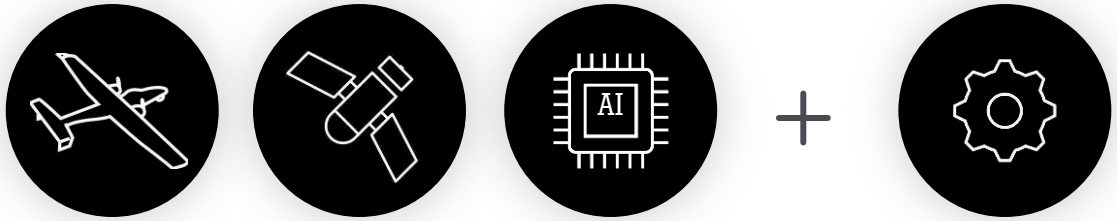
Real time

Intelligence

Wide areas

TEKEVER DELIVERS
ACTIONABLE REAL-TIME INTELLIGENCE
ACROSS ULTRA WIDE AREAS

Drone, satellite and AI Technology



Fully managed services

BORN IN THE IT WORLD, REVOLUTIONIZING AEROSPACE

2001

- Founded by Computer Scientists and Researchers in AI, Machine Learning and Distributed Systems
- Focus on developing intelligent, highly distributed systems
- Bootstrapped from day 1

2010

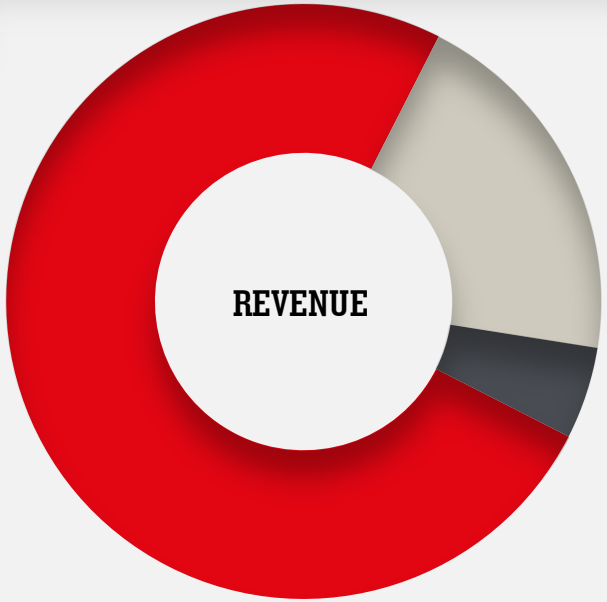
- Team identifies massive opportunity in the UAS market: DRONES
- Drones to become omni-present, and SOFTWARE and DATA-DRIVEN technologies and AGILE methodologies will become a critical success factor

2021

- Leading player in UAS market, and the UAS Business Unit (TEKEVER UAS) represents 75% of total turnover and more than 90% of expected growth
- Additional business lines in Digital Transformation services (TEKEVER Digital) and Satellite Technologies (TEKEVER Space)

TEKEVER UAS

- European market leader in Unmanned Aerial Systems for Maritime Surveillance with growing international footprint
- Owns entire technology stack for UAS, including all structures, electronics and SW
- Cutting edge facilities for scalable production
- Developed Managed Services capability, and has now 40+ UAS operators ready to deploy worldwide
- Team in Portugal and the UK, with 130+ Engineers, Operators and Technicians



TEKEVER DIGITAL

- Offers Digital Transformation services, leveraged by expertise in AI/ML, UX/UI and Mobile Tech
- Strong customer base in Banking, Utilities, Healthcare and Government
- 50+ SW Engineers, Designers and Data Scientists

TEKEVER SPACE

- Focus on Software Defined Radio, as enabler for Inter-Satellite Links, Synthetic Aperture Radars and Signal Intelligence
- Owns entire tech stack for SDR, ISL, SAR and SIGINT products

TEKEVER UAS BUSINESS

UNPARALLELED COVERAGE OF THE COMPLETE VALUE CHAIN

TEKEVER covers a large portion of the UAS value chain, from creating base technology to providing advanced AI-based analytics. Having this wide scope, in an emerging and still un-commoditized market, enables product and service differentiation, rapid adaptability to changing market conditions, and high profitability.

- **Internal development** of sub-systems and sensors that enable strategic advantage
- Enable **innovative product** /service design
- Continuous **make/buy analysis** assures competitiveness

- **Mission-driven** product design
- **Service and user experience** design methodology
- **Control over sub-systems** and production chain enables creation of revolutionary products

- Products can be **sold or offered as-a-Service**
- Control over entire **customer experience**
- **Operations team** is customer in-residence, focused on continuous product improvement

Components & Materials → Sub-systems & Payloads → Branding & Market Intelligence → Product Design & System Integration → Production & Testing → Operation & Maintenance → Data Exploitation & Mission Intelligence → **Intervention**

- **Focus on brand awareness.** TEKEVER is already highly recognized brand in Maritime UAS
- Constant participation in R&D **programs and discussion forums** informs market intelligence

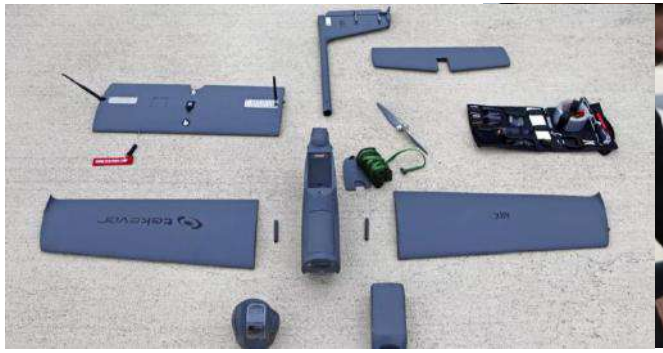
- Total **control over manufacturing,** assembly and testing processes
- **Cutting edge** facilities and equipment
- **Scalable processes,** supporting dynamic targets

- Intelligent **onboard and on-ground tools** for real-time and historical data processing
- **AI/ML-powered data-centre** assures the right person gets the right information at the right moment

TEKEVER platforms

TEK AR4:

- Easy to use, transport and maintain
- Wingspan x length: 2.1 x 1.35 m
- MTOW: 4 kg (payload up to 1 kg)
- Cruising speed: 54 km/h
- Endurance up to 2 h



TEK AR3:

- Small Unmanned Aerial System (UAS) with medium endurance (up to 16 hours),
- Wingspan x length: 3.5 x 1.7 m
- MTOW: 23 kg (payload up to 4 kg)
- Recovery: Parachute or net

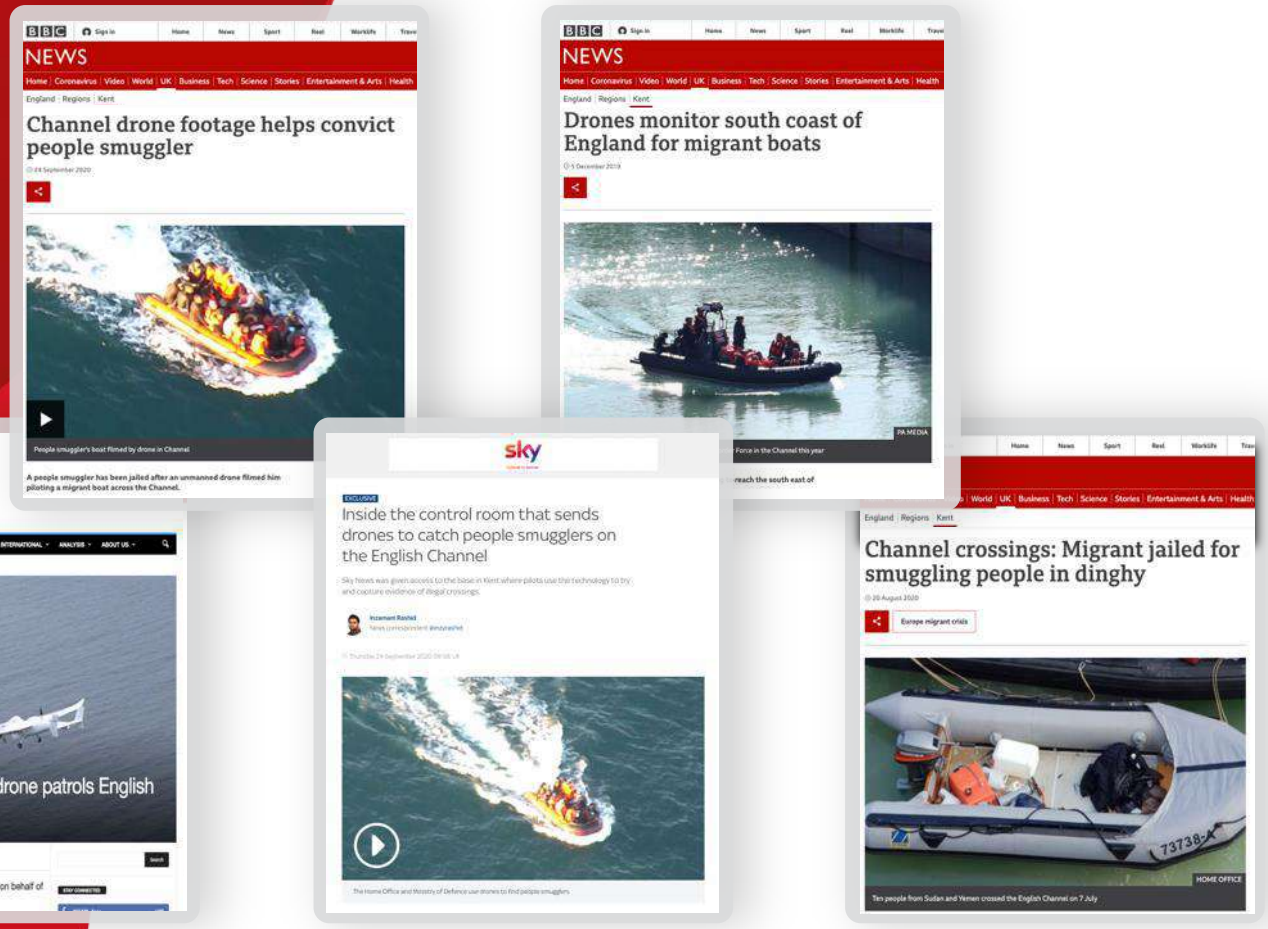
TEK AR5:

- Medium-altitude, medium-endurance fixed wing UAS
- Wingspan x length: 7.30 x 4 [m]
- MTOW – up to 180 kg
- Service ceiling: 3 900 m
- Cruise Speed 100 km/h

CASE STUDY

UAS-AS-A-SERVICE IN THE BRITISH CHANNEL

The Home Office of the United Kingdom uses TEKEVER's UAS-as-a-Service as the key asset
to survey the British Channel and help prevent Illegal Migration and Illegal Fishing activities.



OPERATIONAL RESULTS

have far exceeded initial expectations

500 +
Fishing vessels inspected

135 +
Illegal migrant vessels detected

2000 +
migrants rescued

6 +
smugglers convicted using evidence gathered by TEKEVER (never possible before)


sky news
skynews.com
ED POSITIVE FOR COVID-19
VIRUS PANDEMIC: FROM TODAY ALL PUBS, BARS AND RESTAURANTS IN ENGLA
sky news

From maritime security to CBRN

TEKEVER provides expertise on Unmanned Aerial Systems

The team has operational experience in Surveillance, Search and Rescue missions…

Proposal for UAV requirements to be used by first responders in radiological threat scenarios in INCLUDING (in accordance with Gap 516 – Low-cost drones capable of flying low in CBRN scenarios):

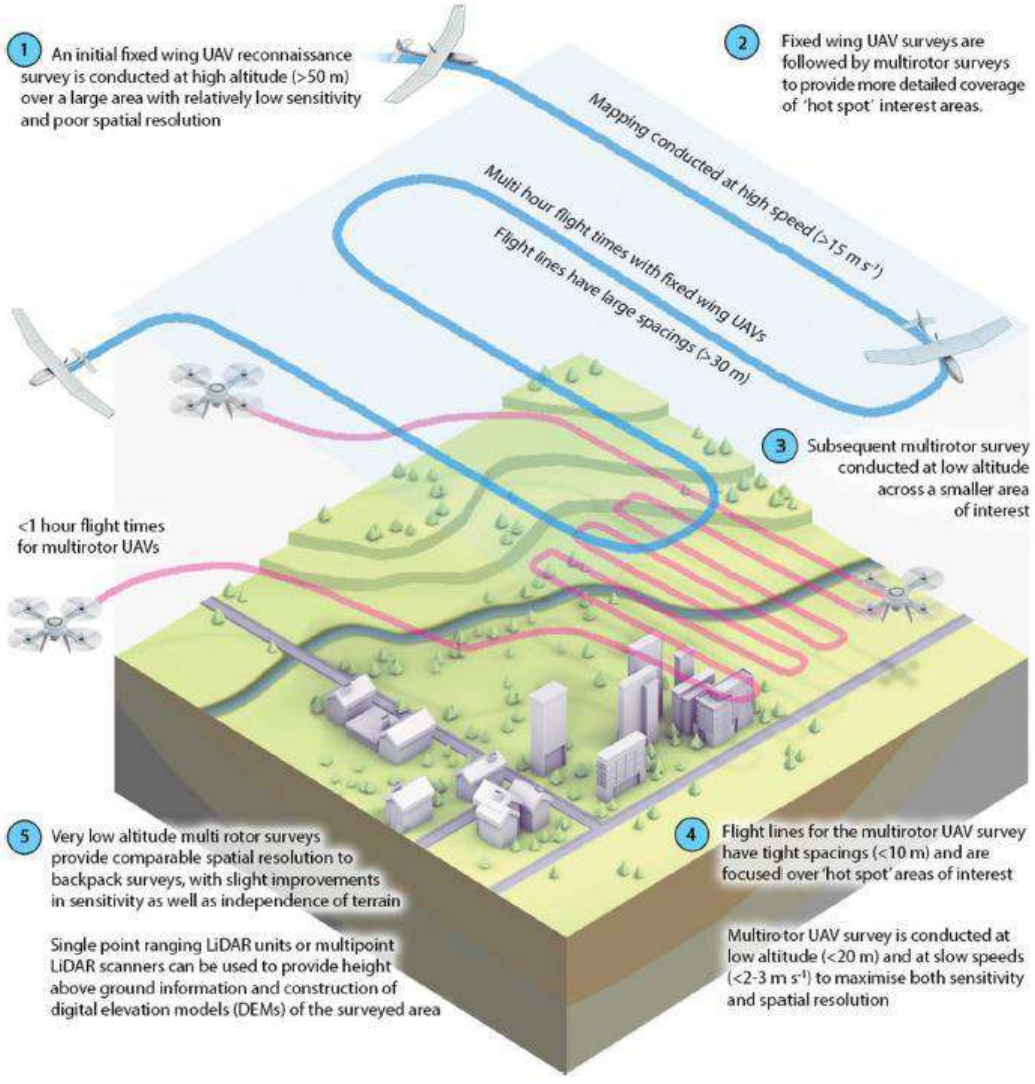
- reliability in operation and easy control because most probably they will be used by non experienced pilot,
- off-the-shelf product with "acceptable" price,
- capability of automatic flight using waypoints along pre-defined path,
- availability of emergency mechanisms in UAV Autopilot assuring safe operation/landing, in case comms link failure or mechanical/electrical failure,
- EO & IR camera as standard payload,
- possibility to integrate the radiological sensors,
- (near) real-time transfer of sensor measurements,
- visibility of the radiological measurements on the Ground Control Station (or similar system) allowing quick situation assessment,

UAVs in CBRN

Depending on mission objectives different type of UAV should be used

Fixed-wing aircraft will provide quick overview on the large area in a matter of minutes

Multirotor aircraft can fly lower and provide more precise measurements, but at the cost of time and endurance



Fixed-wing vs multirotor

Fixed-wing

Scenarios: Outdoor with significant radiation leak that causes radiation spread in vertical

Overall situational awareness
Support to first responders in decision-making regarding evacuation
Search and Rescue
Radioactive plume (aerosol) tracking

Trade-offs:
Low precision radiation survey (according to literature even 30% loss),
Not possible to operate in urban zones

Multirotor

Scenarios: Outdoor & Indoor that require precise navigation and/or precise radiation measurements

Indoor scenarios – however, using UGV may be easier
Urban scenarios
Radiation survey
Plume tracking (but with limited endurance)

Trade-offs:
Low platform endurance due to limited payload capacity, requires significant data collection time for larger areas

CBRN considerations

Aleksandra Nadziejko, António Brás Monteiro

" Zero casualty and real time decision are the two key drivers for using land-based and aerial unmanned CBRN systems . . . "

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TEKEVER

INCLUDING ANNUAL WORKSHOP
Nuclear Security in Maritime Infrastructure
Athens (Greece) from 22 to 25 June

NATO DAT PoW DEUSS project
Affordable radiation detection system for UAV application

1st Lt. PhD Francesca FUMIAN
Joint NBC Defence School

PhD. Andrea CHIERICI
University of Rome «Tor Vergata»

CBRN THREAT

Within the different CBRN threats, during last decades the chemical and radiological ones have assumed various forms and there is now a strong concern connected to TIC and TIR incidents and also to intentional use of chemical and radiological agents in improvised devices during asymmetric conflicts.

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ORIGIN OF THE RESEARCH PROJECT

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In consequence of this worry a huge number of *detection equipment* has been developed, both in civil and military world. In parallel, the last decade have seen the development of *Unmanned Aerial Vehicle, both* for military and civil applications, to support and substitute *first responders* in critical environments

The combination with UAV of C/R detectors and sampling features is not already been deeply investigated and could solve a wide range of problems

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RESEARCH PROJECT CONJUNCTURE

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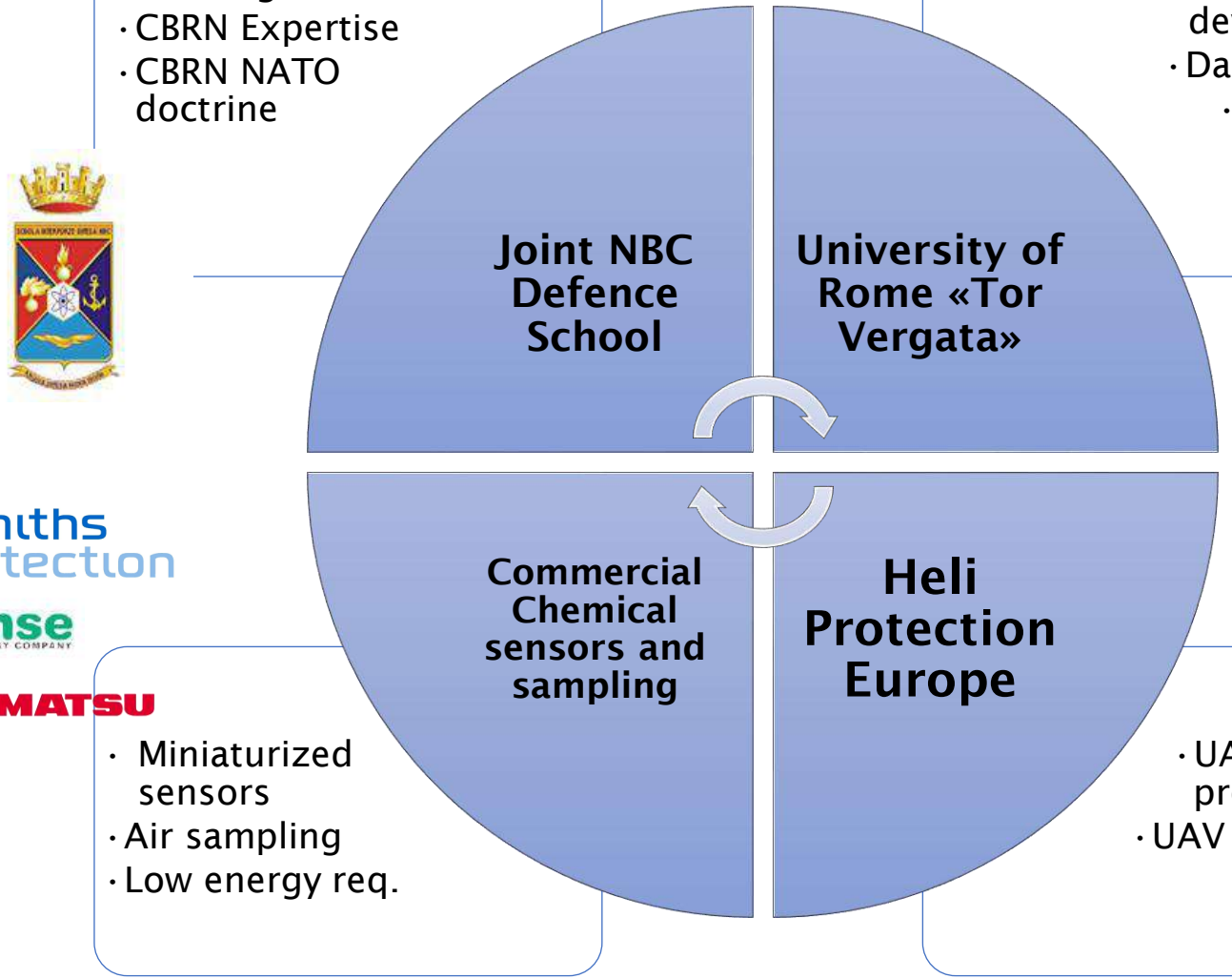
- Training Area
- CBRN Expertise
- CBRN NATO doctrine

- Sensor development
- Data analysis
- Numerical simulation



FIGARO smiths detection alphasense Micod HAMAMATSU

- Miniaturized sensors
- Air sampling
- Low energy req.

- UAV training programmes
- UAV regulation

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RESEARCH PROGRAMME OBJECTIVES:

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- ***Available technologies:***
  A preliminary **market enquiry** for the identification of the **platform** and of the **detection, identification and sampling instruments** has been conducted

  → Obtain an integrated platform with manned detectors and miniaturized sensors with low payload and energy consumption

- ***Test campaign:***
  Cycles of tests to investigate the best **configurations** to combine UAV and detection instrument and sampler

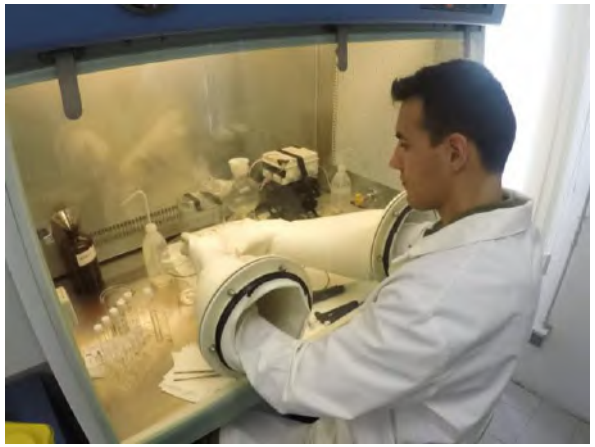
  → Evaluate their interaction and optimize the system

- ***Decontamination of sensitive equipment***
  Standard procedure development for UAV and sensors

  → Accomplish multiple missions without cross-contamination

- ***Scenario based training***
  Flight operation into scenarios reproducing contaminated environment

  → Create UAV pilots trained to fly in critical scenarios



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RN measurements with UAV

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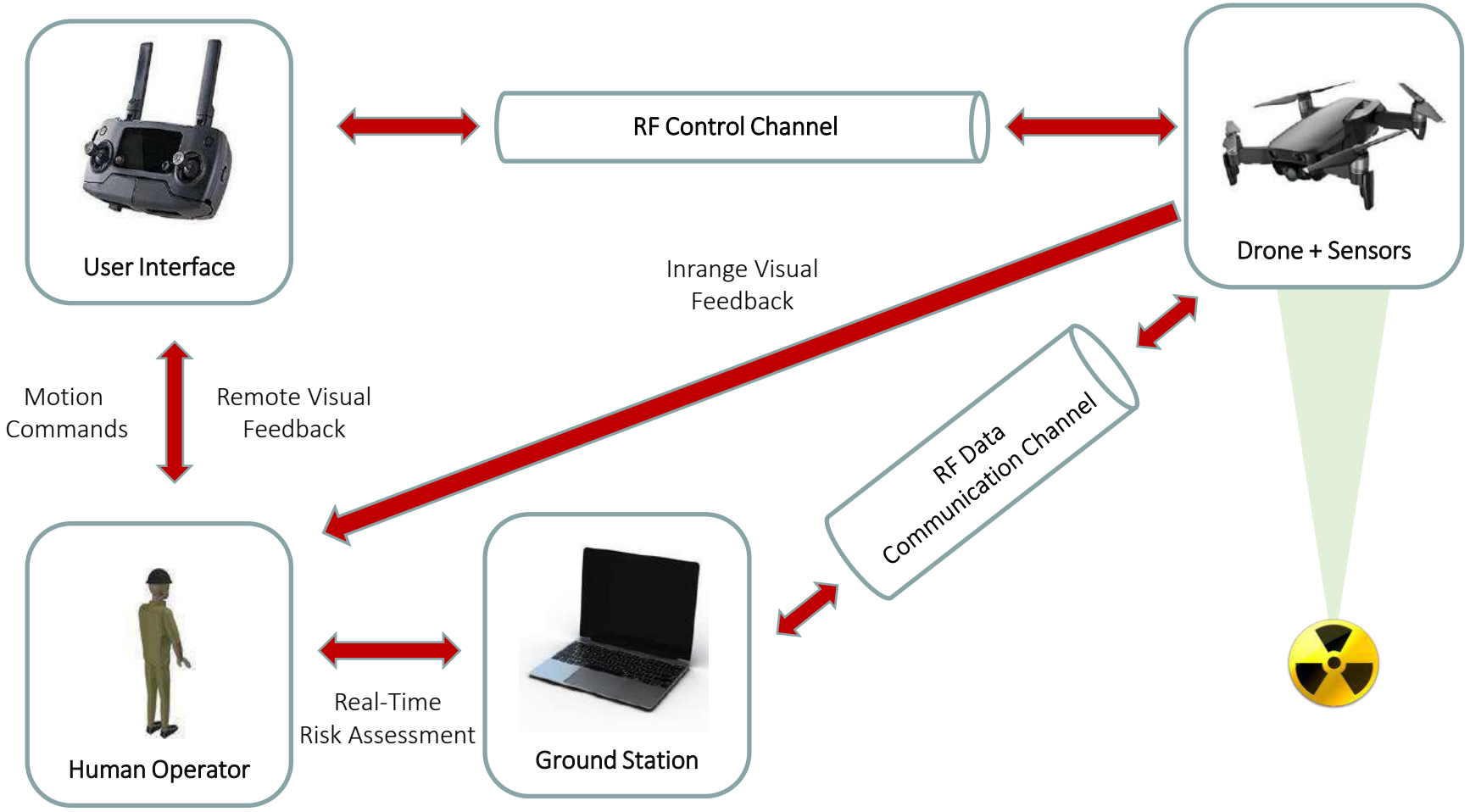
System Overview



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Technical Requirements

Goal → Detection efficiency and coarse energy resolution for a wide range of gamma rays energies: *^{241}Am (60 keV), ^{131}I (368 keV), ^{137}Cs (662 keV) and ^{60}Co (1.17 MeV and 1.33 MeV) etc.*

- Sensitivity (*cpm/uSv/h*);
- Selectivity (*different gamma emitters*)
- Low Weight
- Low Power Consumption
- Interface Compatibility (*in terms of communication protocols and hardware requirements*)
- Real-time data collection, Processing and Transmission
- Compatibility with use in-flight (*limited sensitivity to vibrational and EMI noise*)
- Modularity (*to account for possible components updates over time*)

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Market Survey

Solution	Energy Range	Sensitivity	Flexibility	Reliability	Size and Weight	Power	Cost	Market Availability	Development work
Partially custom (from Micod, Cremat etc.)	Large	High	High	Average	Average	Average	Average	High	Average
MOD501495 (First Sensor)	Average	High	Average	High	Low	Low	Average	Low	Low
GR family CZT based (Kromek)	Large	High	Low	High	Low	Average	High	High	Low
BG51 Si based (Teviso)	Average	Low	Average	High	Low	Low	Low	High	Low
CsI [Tl] and SiPM (Scionix)	Large	High	High	Average	Average	Average	Average	High	Average
Fully custom and inLab made	Large	High	High	Average	Average	Average	Low	High	More than average

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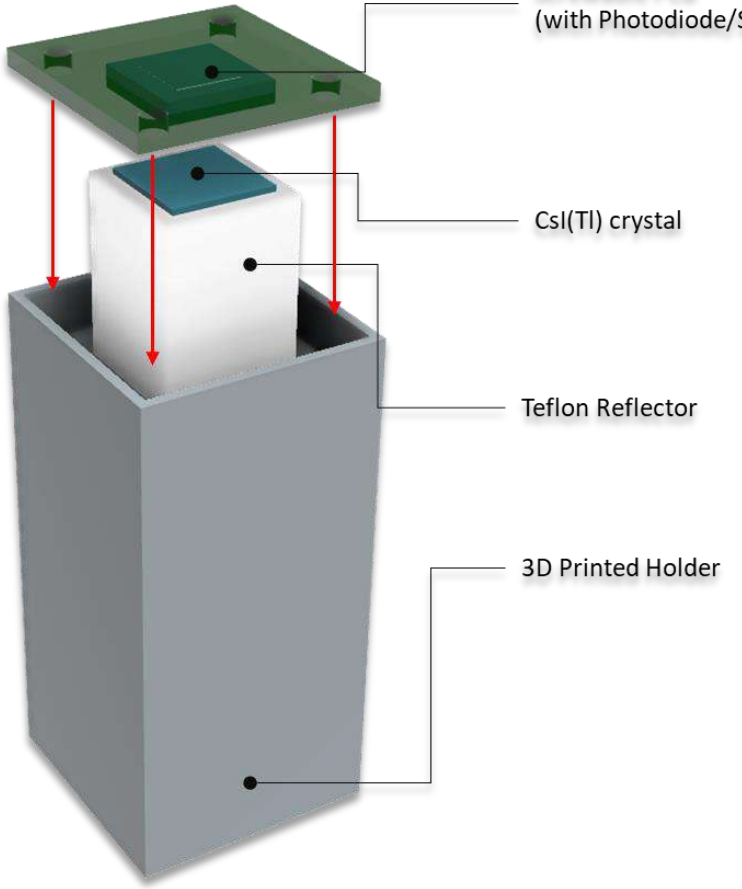
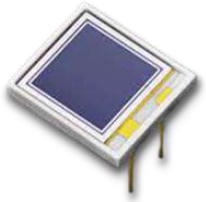
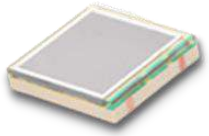
Detector: scintillator & optical readout





S3590 – 10 x 10 mm^2
PIN Photodiode (Hamamatsu)

CsI(Tl) wrapped in Teflon – 40 x 10 x 10 mm^3
(Epic Crystal)



S13360-6050PE – 6 x 6 mm^2
SiPM (Hamamatsu)

Timeline

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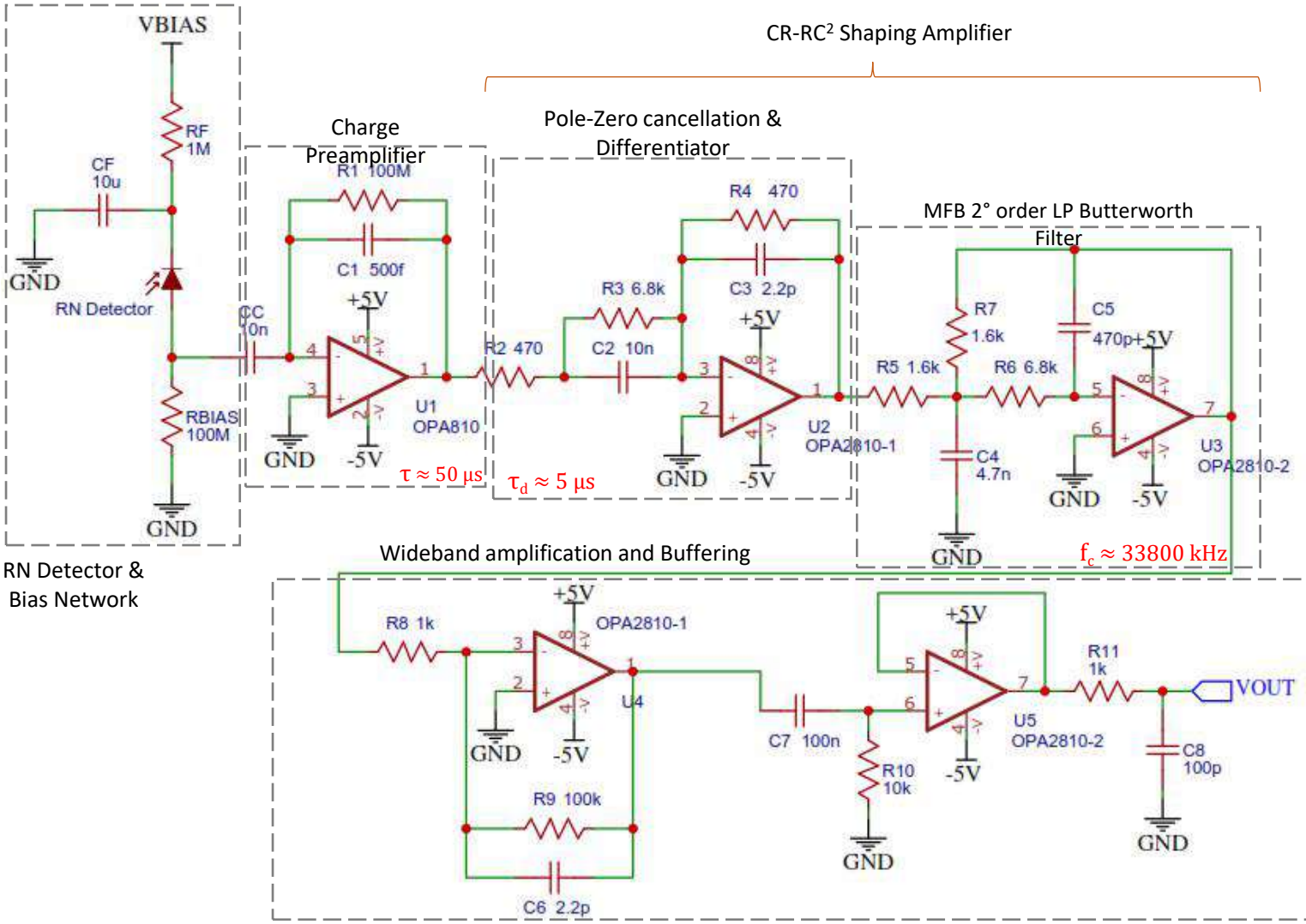
Detection & Preamplification Unit



Size: 66 · 36 mm²

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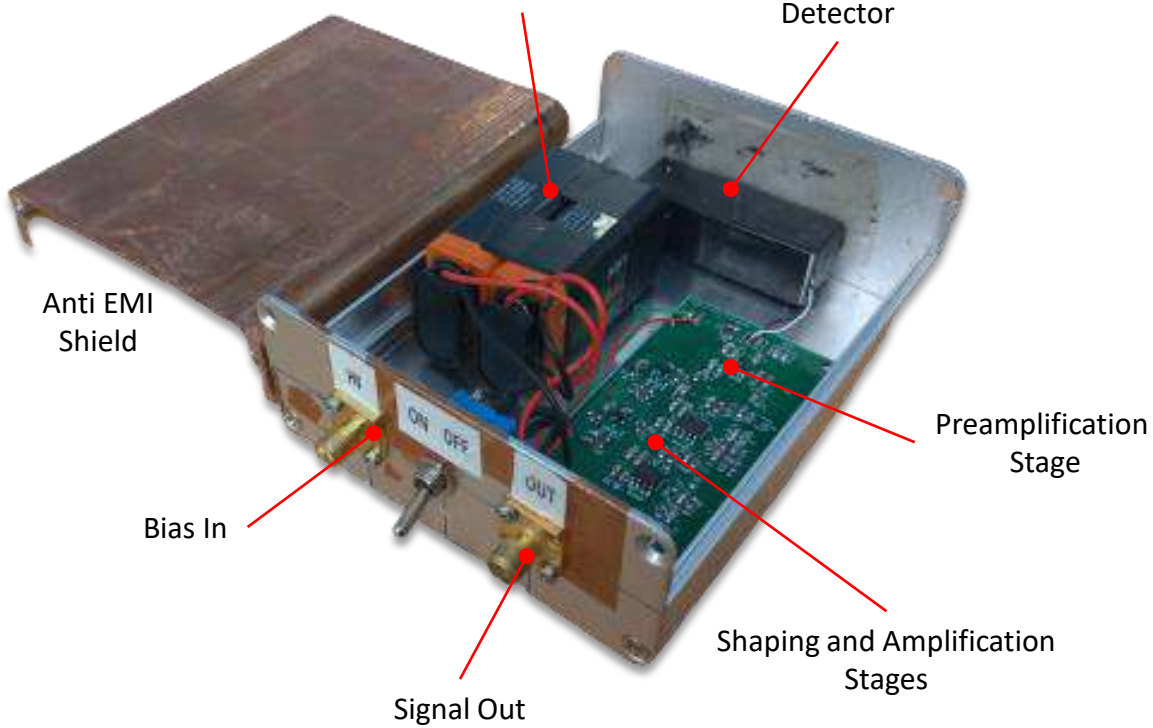
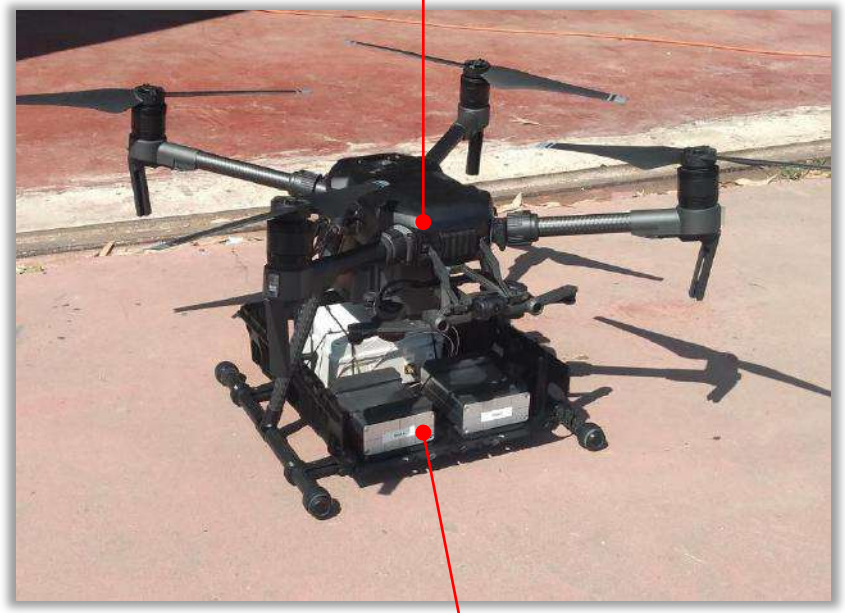
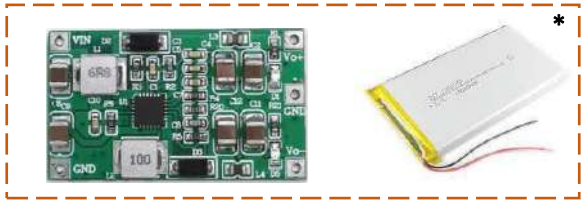
Detection & Preamplification Unit







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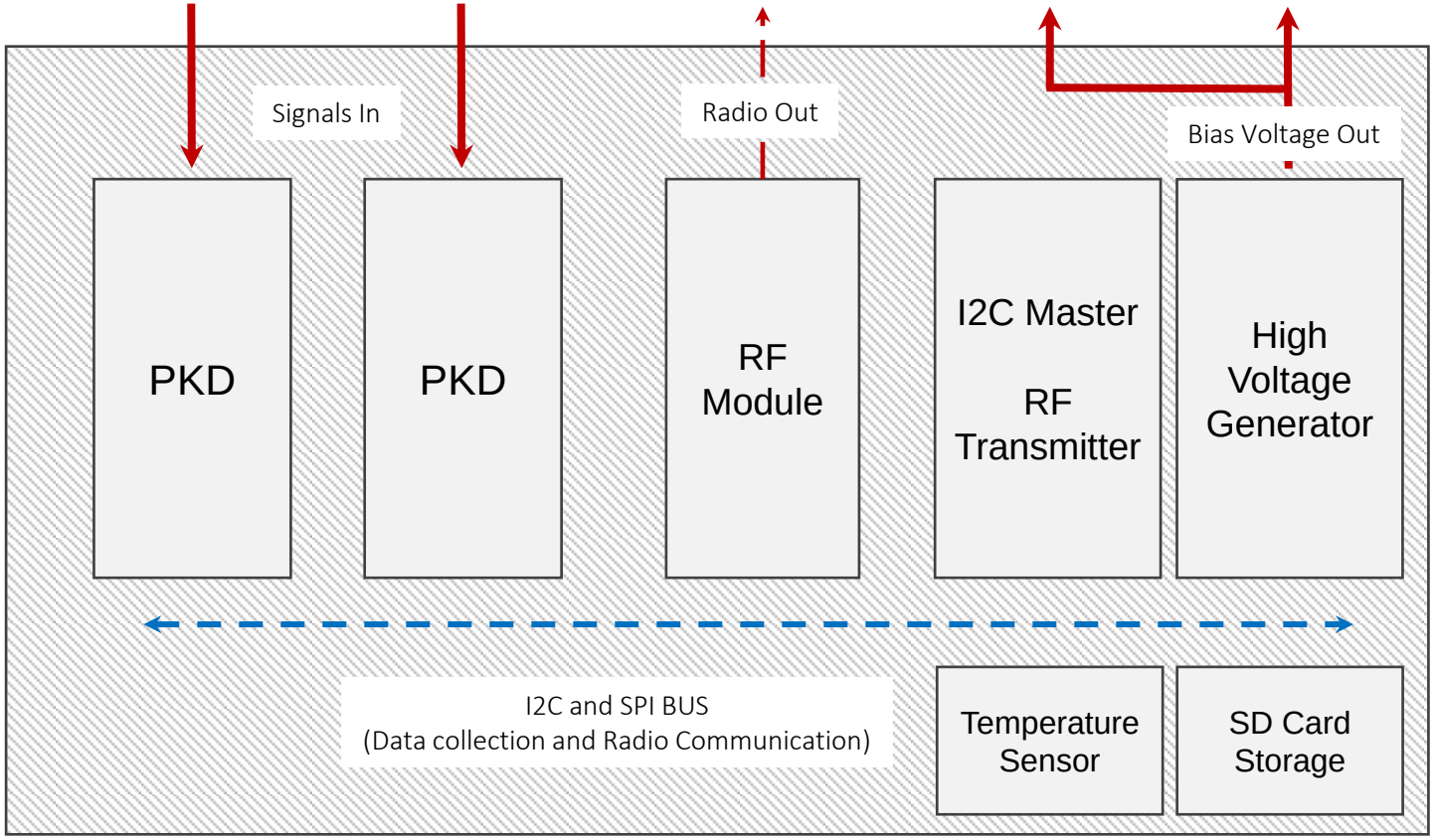
Data Acquisition & Radio Frequency Unit



Features

- Up to 4 detection channels digitized at the same time (2 used in this prototype);
- RN spectra with 256 to 1024 channels resolution;
- Data transferred through RF channel at 2.4 GHz and up to 2 km;
- High voltage generator with temperature compensation available to bias photodiodes, SiPMs or APDs;
- Data can be stored on an on-board SD card (16 GB);

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RN measurements with UAV

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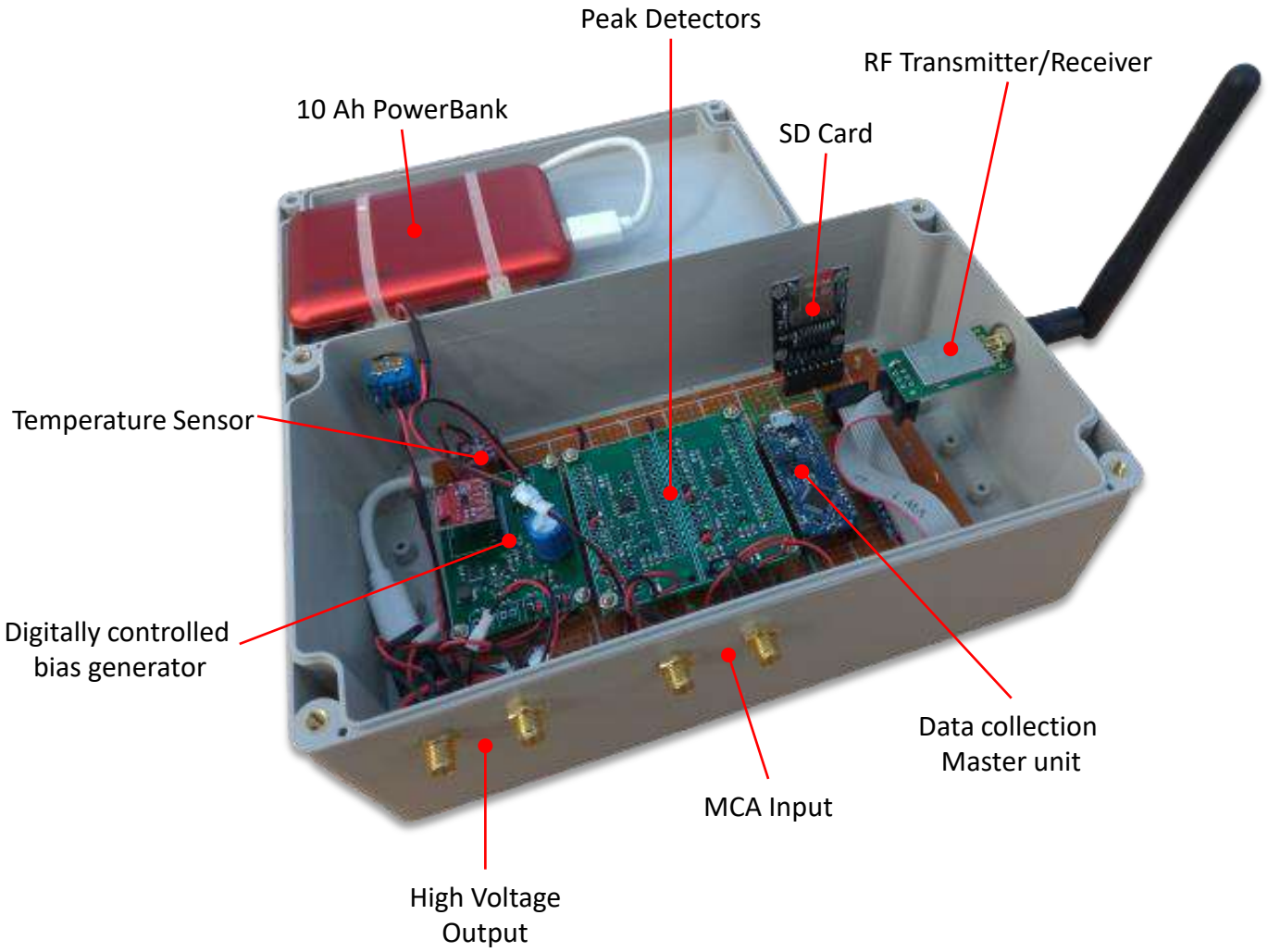
Data Acquisition & Radio Frequency Unit



Parameter	DAQ and RF unit	Detection unit
Weight (g)	400	300
Size (mm^3)	220 x 110 x 80	110 x 80 x 38
Power Consumption (mA)	250	25

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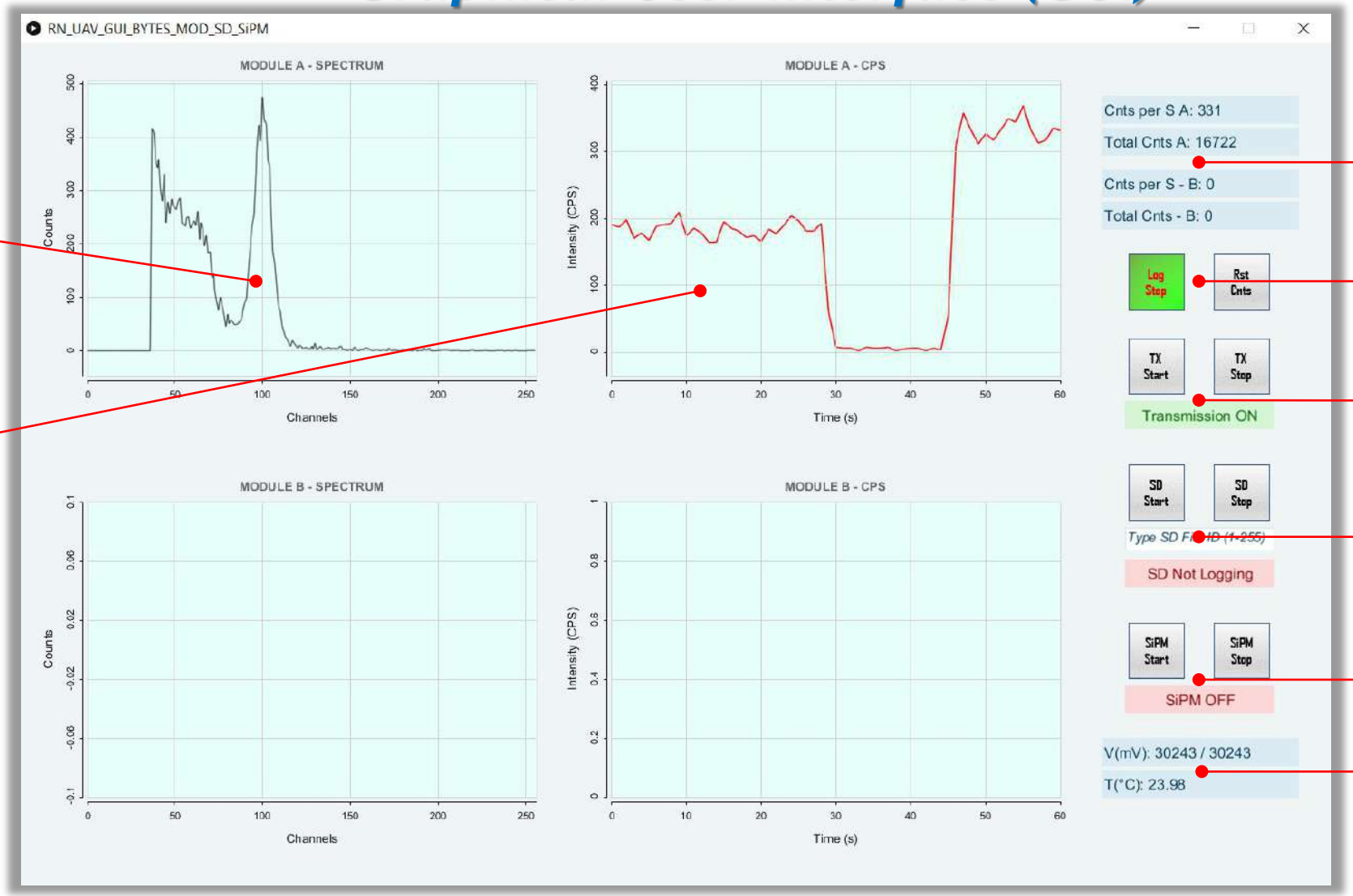
Graphical User Interface (GUI)



^{137}Cs Energy Spectrum

^{137}Cs Source CPS

CPS & Total Counts from last

Data Log (Laptop) & Counts Reset

Start/Stop RN data TX

SD data file creation and Log (on-board)

Bias Voltage ON/OFF

Temperature and current bias voltage

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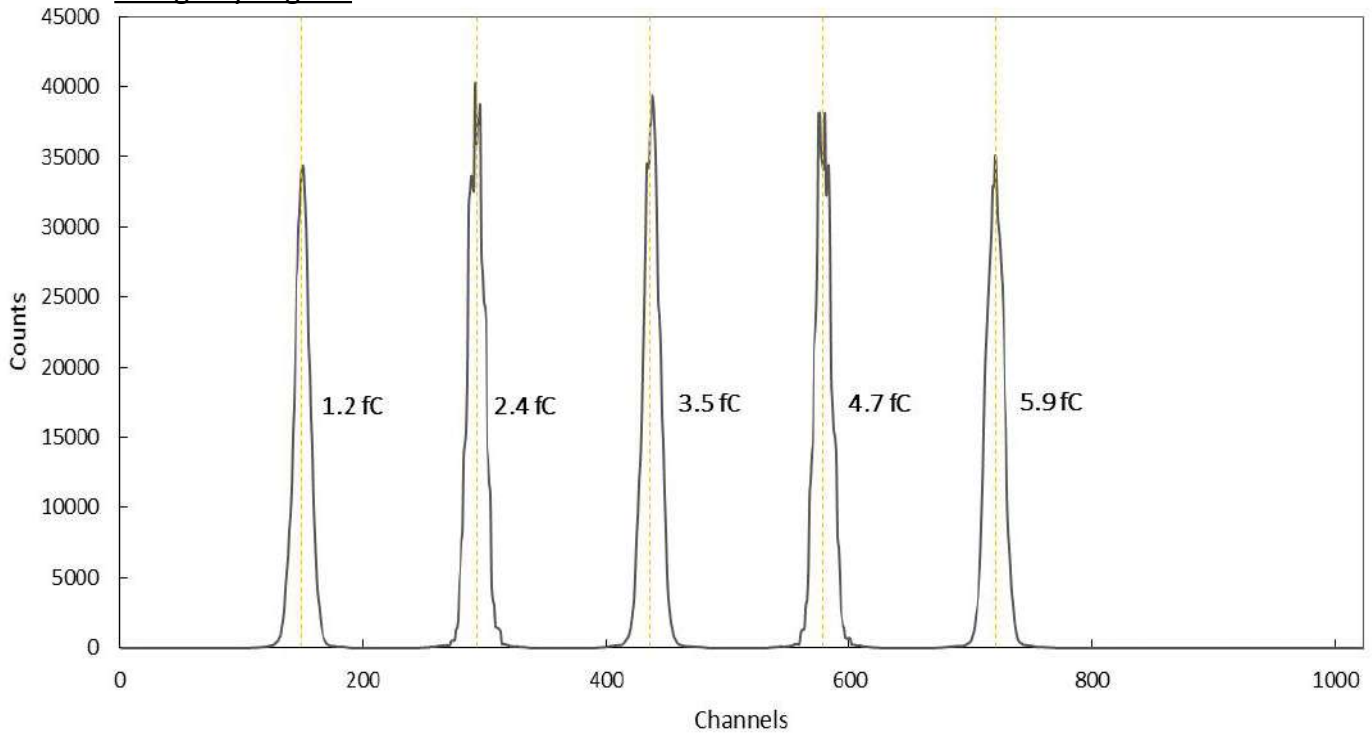
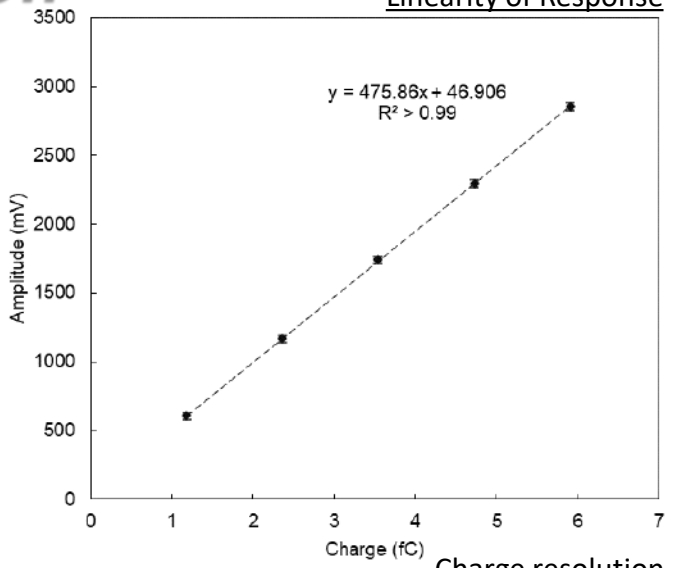
Charge Calibration

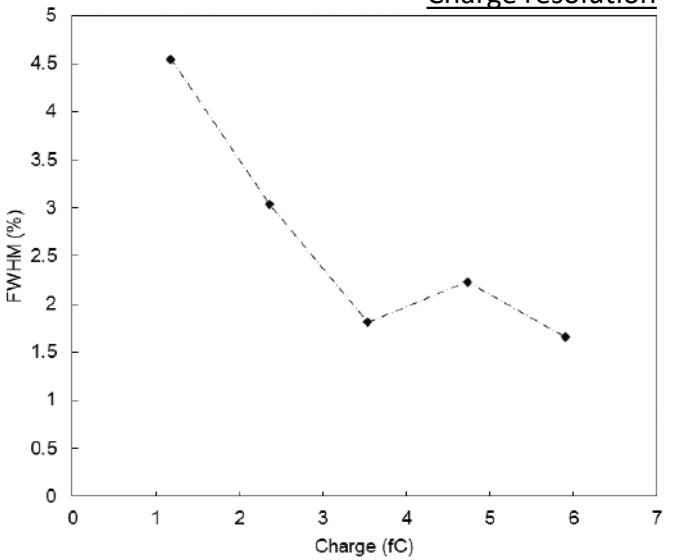
Charge Hystogram



Linearity of Response



Charge resolution



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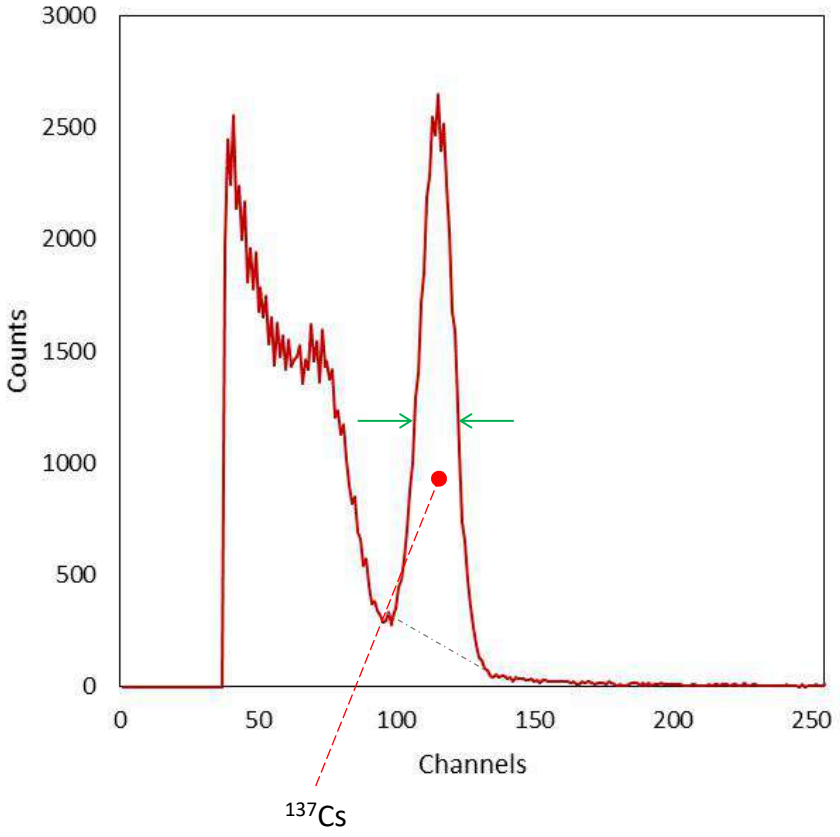
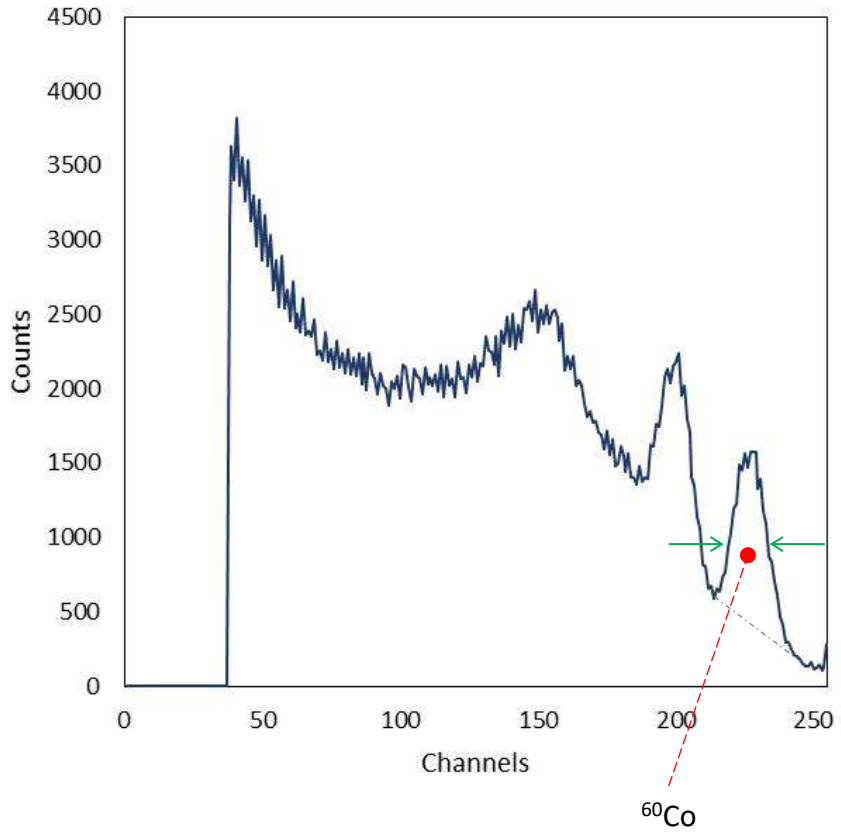
InLab exposure to sealed sources: ^{137}Cs & ^{60}Co

^{137}Cs Spectrum



Photopeak at 662 keV (channel 115)
FWHM ≈ 8.5 %

^{60}Co Spectrum



Photopeak at 1.33 MeV (channel 230)
FWHM ≈ 6.5 %

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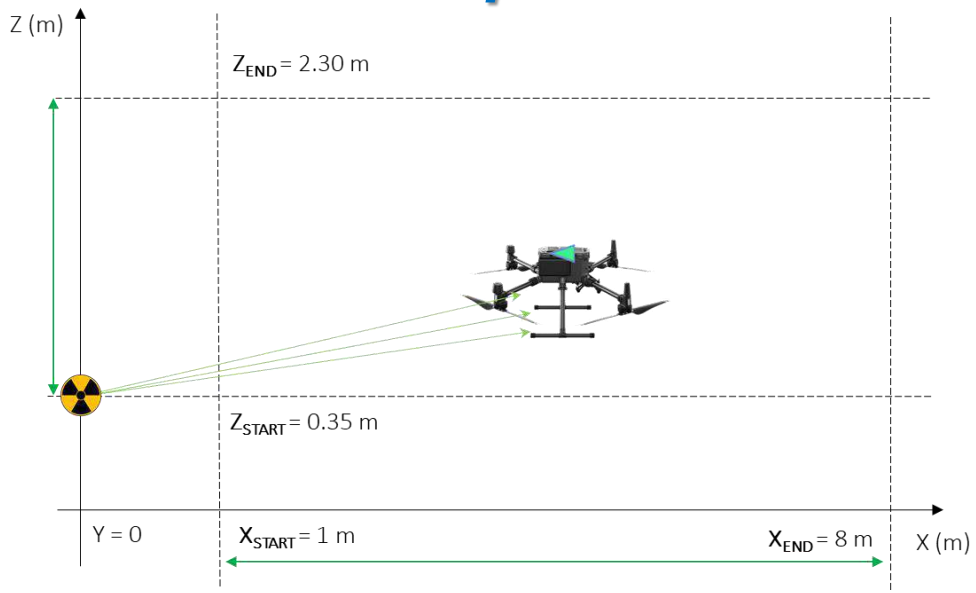
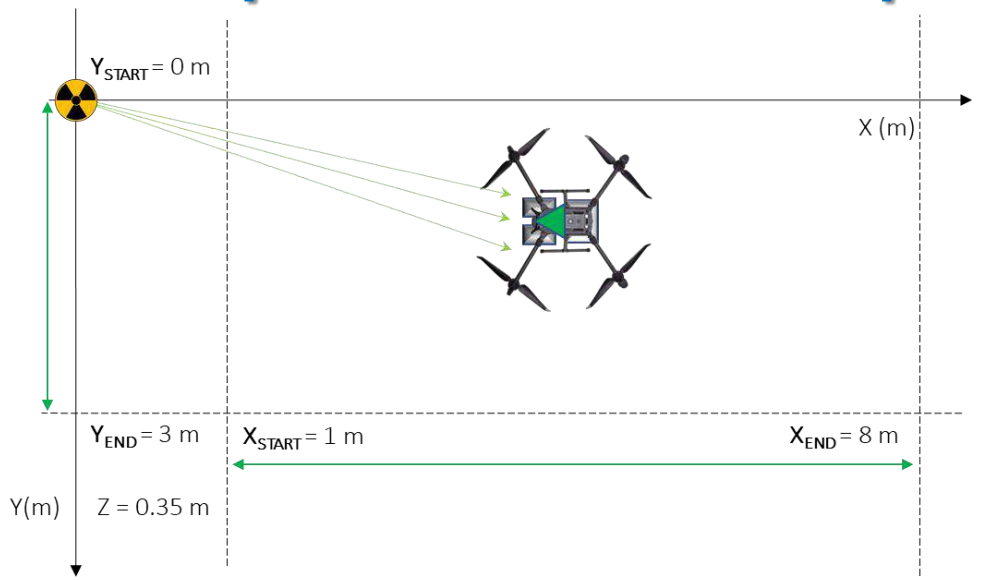
TOR VERGATA UNIVERSITÀ DEGLI STUDI DI ROMA

Exposure to a sealed 500 MBq ^{137}Cs source: setup



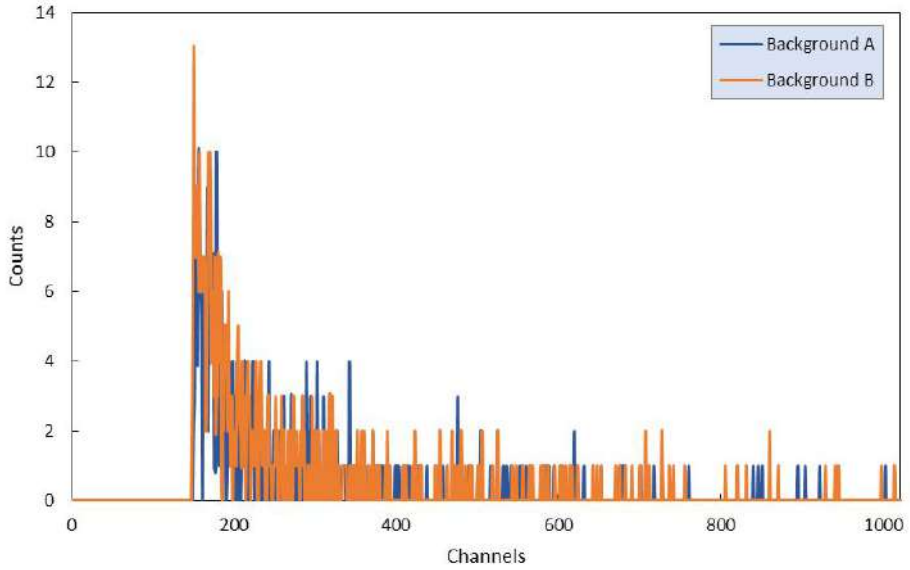


JOINT NBC DEFENCE SCHOOL

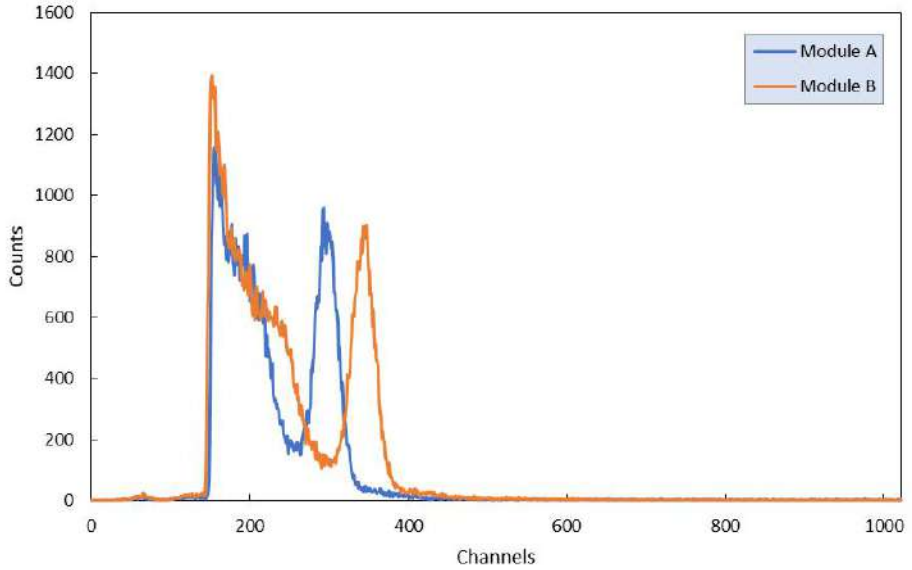
RN measurements with UAV

TOR VERGATA UNIVERSITÀ DEGLI STUDI DI ROMA

Exposure to a sealed 500 MBq ^{137}Cs source: setup



Readout	A	B
CPM	94 ± 10	119 ± 11
CPS	1.6 ± 1.2	2.0 ± 1.4



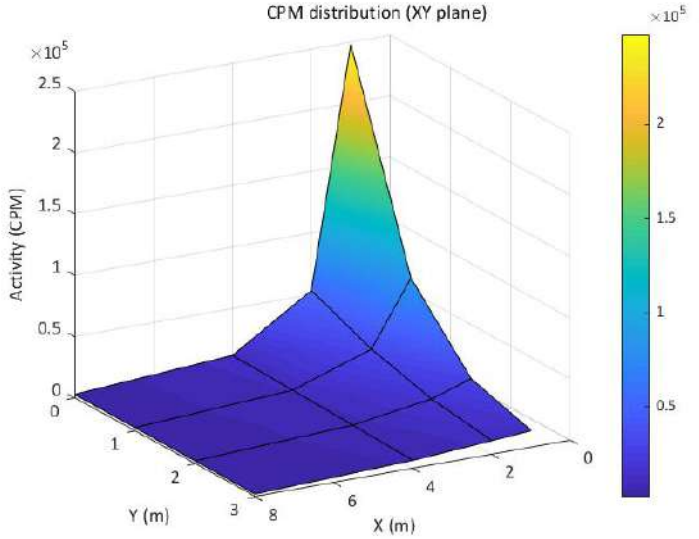
Readout	A	B
CPM	52991 ± 230	65286 ± 256
CPS	883.2 ± 29.7	1088.1 ± 33.0
CPM/µSv/h	3925	4836
CPS/µSv/h	65.4	80.6
LoD_{CPM} (µSv/h)	0.03	0.03
LoD_{CPS} (µSv/h)	0.08	0.08
CF (keV/channel)	2.2	1.9

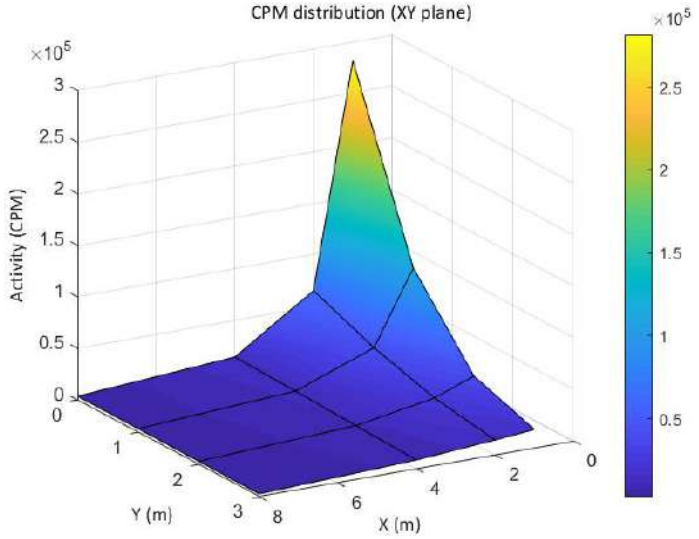
JOINT NBC DEFENCE SCHOOL

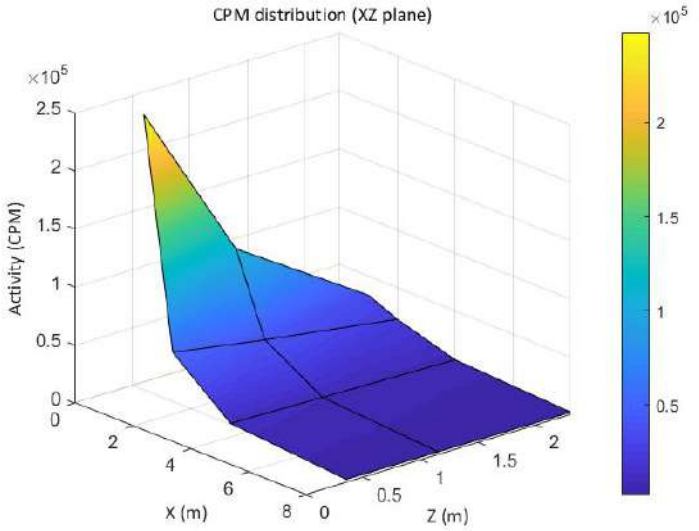
RN measurements with UAV

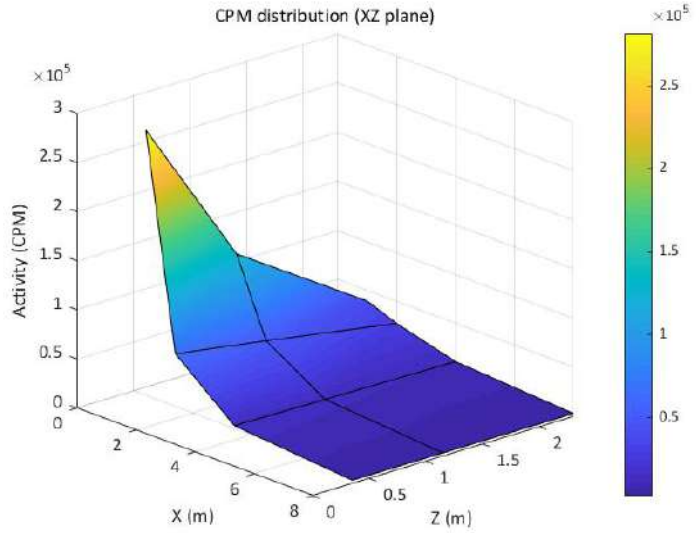
TOR VERGATA UNIVERSITÀ DEGLI STUDI DI ROMA

Exposure to a sealed 500 MBq ^{137}Cs source: setup









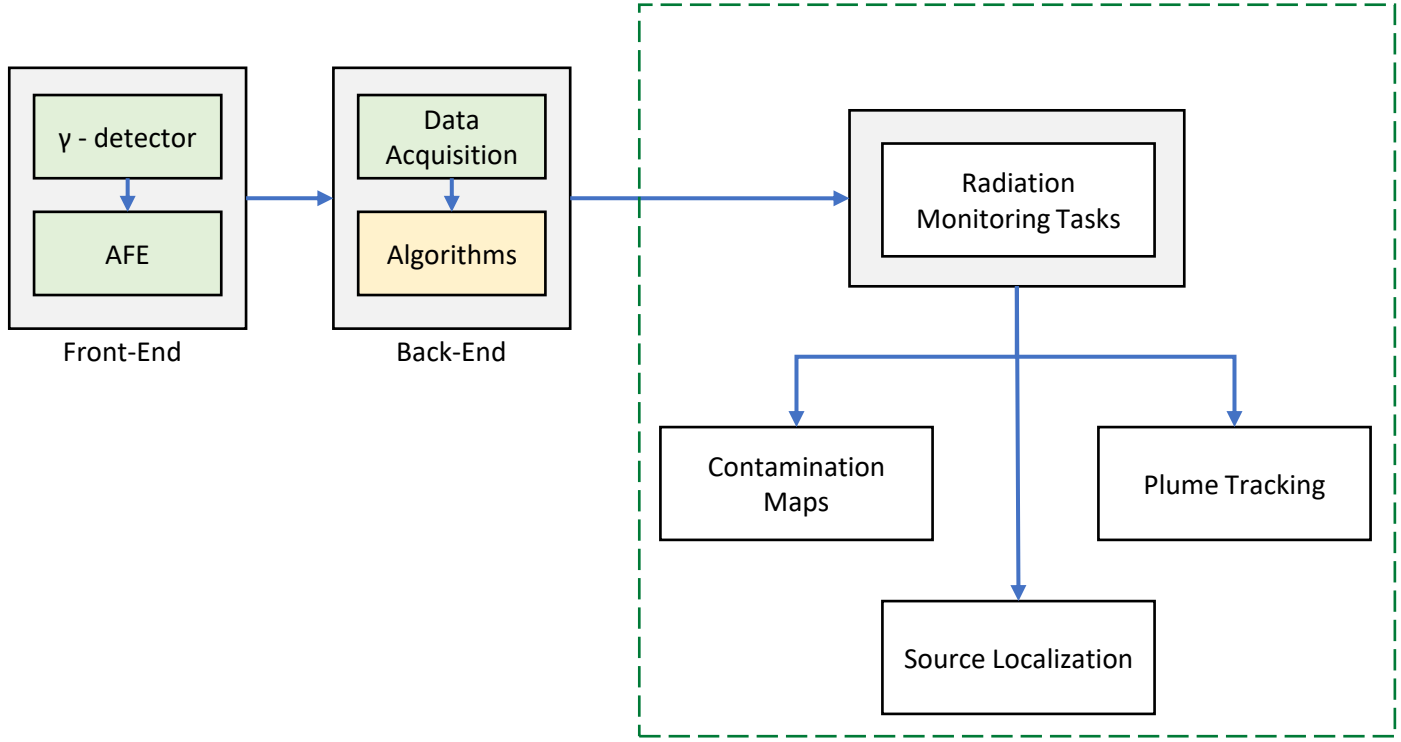
Conclusions

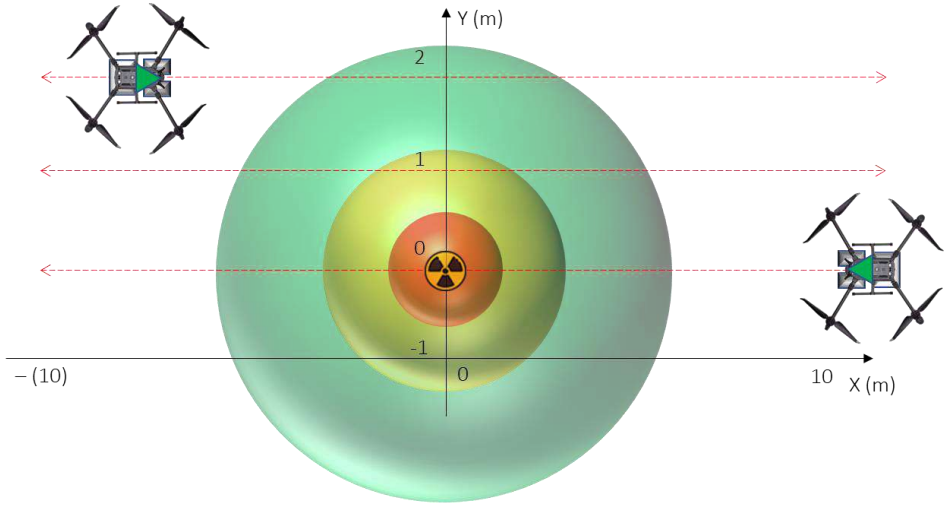
- **What has been done**
  - A scintillation based detection system for γ-rays has been designed, realized and tested;
  - Up to 4 channels can be acquired at the same time performing spectroscopy in 256 to 1024 channels resolution;
  - RF communication up to 2 km distance (2.4 GHz);
  - On board SD card storage (16 GB);
  - Affordable, with a total weight less than 2 kg and appropriate power consumption to be mounted and used on UAVs.
- **Problems encountered**
  - On flight testing showed PIN photodiode readout too sensitive to vibrational and mechanical noise.
- **Potential solutions**
  - Implementation of an antivibration system to damp impulsive noise;
  - Use of SiPMs to replace PIN photodiodes (lowering the electronic gain of acquisition chain by a 10^6 factor);

RN measurements with UAV

Future Development

- Studies involving a comparison and design aspects of different detectors, their sensitivity to mechanical/vibrational noise and their sensitivity to environmental parameters (such as temperature or humidity);
- Optimization of detectors size and geometry;
- Use the designed gamma detection and spectroscopy systems on an UAV to carry out radiation monitoring tasks.





CAEN SyS

Systems & Spectroscopy Division

CAEN Security Innovation Path 2021

CAEN Company Network

- CAEN company Network is made up of 4 companies
- CAEN S.p.A. (Costruzioni Apparecchiature Elettroniche Nucleari) was founded in 1979 as a spin-off of INFN Pisa
- World leader serving the Fundamental Physics experimental community and the Nuclear Instrumentation Industry
- Spin-off activities:
- RFID (2003),
- CAENels (2010),
- CAENqS (2012),
- CAEN SyS (2016) – CAEN S.p.A. Division in 2019

Total Employees: ~150

CAEN Expertise

CAEN has been in close collaboration with the world major research laboratories, designing electronics for:

- High Energy Physics
- Astrophysics
- Neutrino Physics
- Dark Matter Investigation
- Nuclear Physics
- Material Science
- Medical Applications
- Homeland Security
- Industrial Applications

CAEN SyS
Systems & Spectroscopy Division

Our Mission

To provide our customers with innovative radiation detection instrumentation and systems, adding operational benefit and enhancing safety and security.

The CAEN Group towards the industrial nuclear field, developing nuclear measuring systems and solutions in the areas of Fuel Cycle, Reactors, Safeguards and Security applications

CAEN SyS key customers

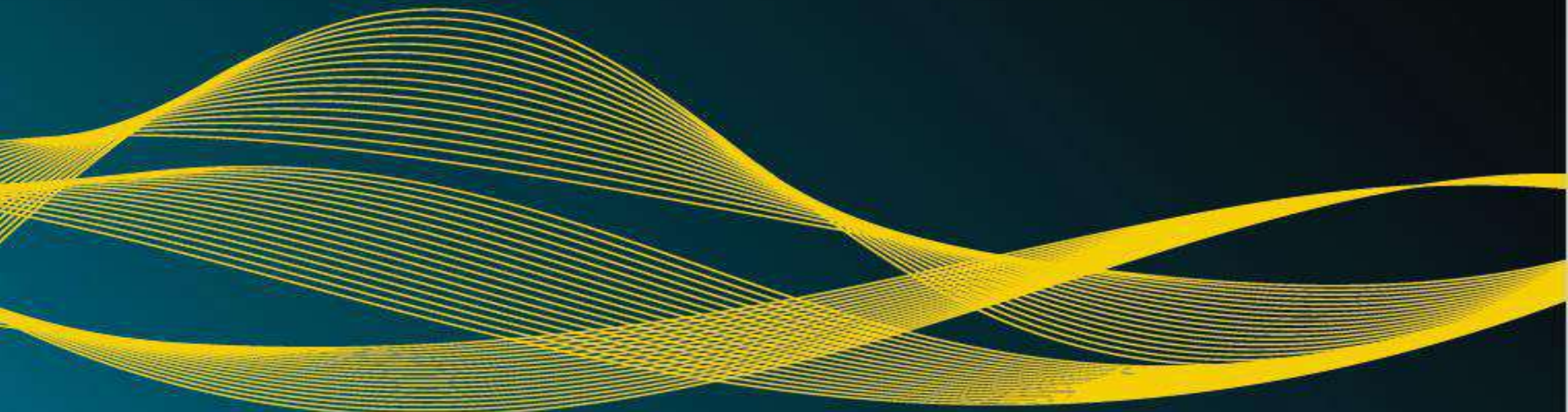
PRODUCTS OVERVIEW

CONTRACTS and REFERENCES

PROJECTS

GAMON Platform

Global Measurement Platform for Nuclear Safety and Security



GAMON Platform

A VIEW INSIDE

The GAMON platform allows to choose between different spectroscopic or dosimetry systems with temperature compensation of the energy spectra and high-rate compensation.

These systems are designed for different use cases depending on their enclosure type (underwater, vehicle mountable, IP68…) and can be easily combined in a network configuration to be deployed in radioprotection or emergency scenarios.

GAMON Platform Objectives

- Maximize public security response capability, rapid assess of risk and action in the case of accident or terroristic threat
- Easy management of ongoing in-field procedures and prompt intervention time
- Airborne, land and underwater ionizing radiation monitoring systems
- Smart systems to be interconnected into a sensor network
- Cloud database application for visualization and analysis

CAEN SyS
Systems & Spectroscopy Division

GAMON Platform

A VIEW INSIDE

STATIC ENVIRONMENTAL NETWORK

GAMON-S

GAMON-D

GAMON-Diver

Radiation measuring stations for environmental monitoring network and continuous survey

DYNAMIC MONITORING NETWORK

GAMON-Drone

GAMON-Mobile

GAMON-Pack

Mobile measuring units for first emergency response, prompt intervention and homeland security

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GAMON Platform

STATIC ENVIRONMENTAL NETWORK

Radiation measuring stations for environmental monitoring network and continuous survey

On the DASHBOARD you have a general overview, through quick glance, of:

- The state of health of the system
- The acquisition currently running
  - Current dose rate (μSv/h)
  - Current scintillator count rate (cps)
- The data trend of the last 10 minutes
- The spectrum anomalies to identify the contaminants
- The weather conditions

GAMON Platform

DYNAMIC MONITORING NETWORK

Mobile measuring units for first emergency response, prompt intervention and homeland security

On the DASHBOARD you have a general overview, through quick glance, of:

- The current position of the systems
- The hot spots detected along the track
- The acquisition currently running
  - Current dose rate (µSv/h)
  - Current scintillator count rate (cps)
  - Current neutron count rate (cps)
- The real-time identification results
- The spectrum anomalies to identify the contaminants
- The data trend of the last 30 seconds
- The heat-map generated by the probes

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GAMON mobile performances

SNIPER-GN system

The most performant GAMMA and NEUTRON isotope identifier for Special Nuclear Material

What is SNIPER-GN ?

A Transportable Radiation Detection System for Homeland Security

SNIPER-GN overview

GAMMA SPECTROSCOPY

It's equipped with mid-high resolution (<3,5% @662 keV) gamma detector

It allows the peaks search in the spectrum to identify gamma nuclides

Extended gamma library (with NORM, Industrial, medical and SNM)

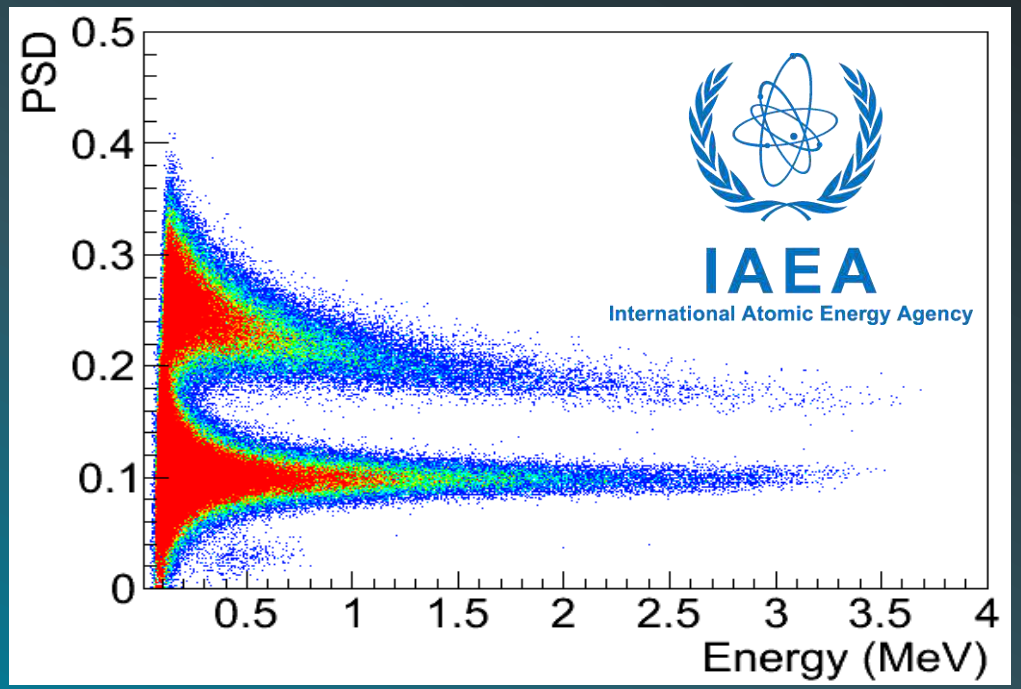
Gamma peak search is used also in neutron source identification algorithm
→ enhances the SNM identification
→ Allows enrichment level estimation

SNIPER-GN overview

GAMMA/NEUTRON COUNTING

High-efficiency gamma/neutron detector enhances the detection distance

Real time gamma/neutron discrimination**



** based on the same Pulse Shape Discrimination (PSD) algorithm tested and implemented by CAEN for the IAEA Fast Neutron Collar Monitor (fresh fuel verification)

SNIPER-GN overview

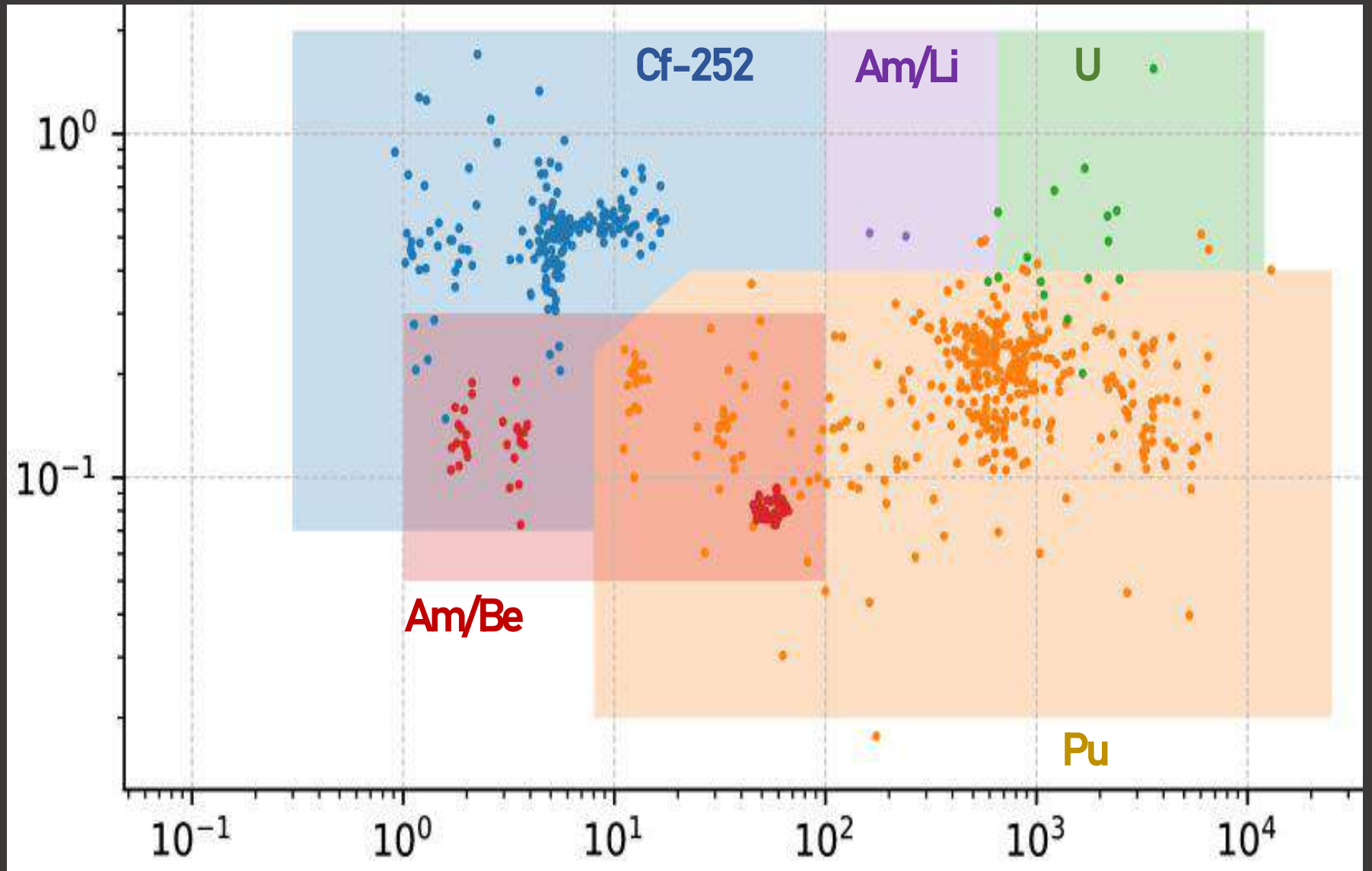
GAMMA/NEUTRON COUNTING

High-efficiency gamma/neutron detector enhances the detection distance

Real time gamma/neutron discrimination**

Neutron source identification with discrimination between fissile material (Cf-252), alpha-n (Am/Be and Am/Li) sources, Plutonium and Uranium

SNIPER-GN overview



NEUTRON source identification patented algorithm results:

Each point is an identification measurement in a different condition:

- Naked sources
- Shieldes sources
- Masked sources

If the color of the point matches with the color of the area, the Identification is correct

Am/Be (red) area has a 3rd parameter to distinguish it from Cf and Pu

Software Functionalities

SNIPER-GN software runs on a tablet connected via Wi-Fi to the device

The software allows to detect, identify and localize radioactive materials such as SNM and RDD

COUNTING

Real-time gamma and neutron rates and background level

SEARCHING

gamma and neutron counting trends and alarm thresholds in the last seconds

MAPPING

Real-time position visualized on the map and hot-spot visualization

ID REPORT

Alarm report with spectroscopic info, spectrum, list of identified isotopes and general info

ID Report

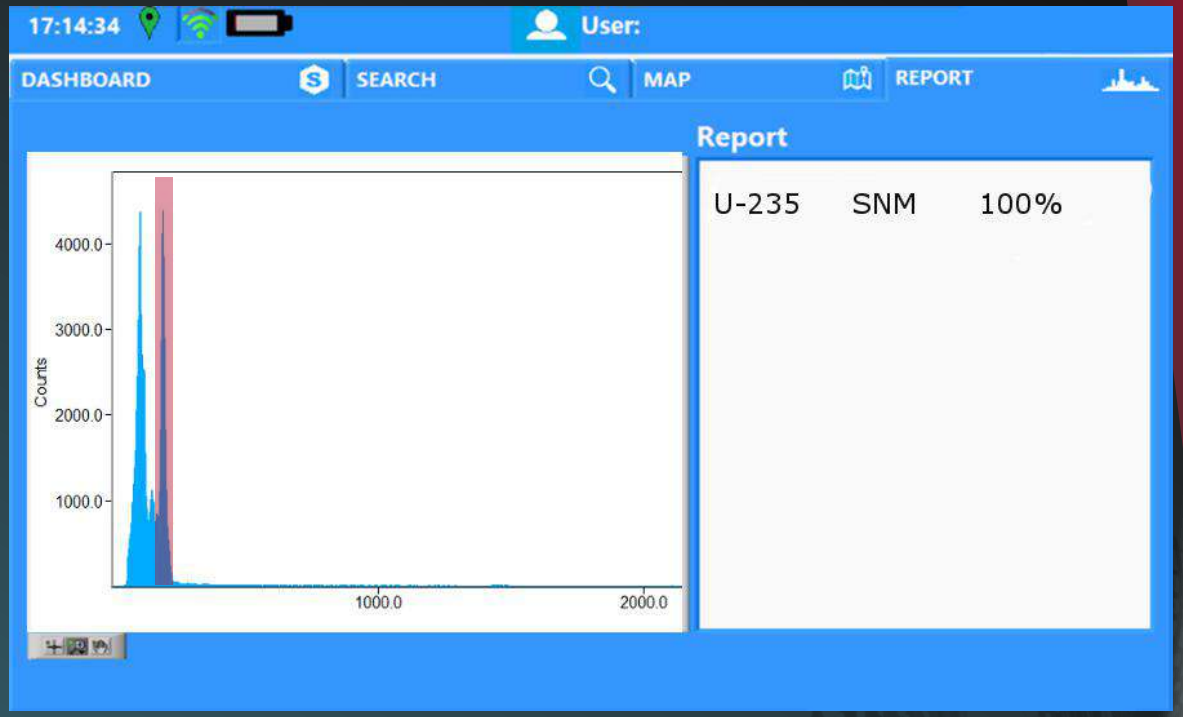
IDENTIFICATION MEASUREMENT

1 min acquisition (standard requirements) for the identification of the isotopes through peak search

REPORT

automatically generated including spectrum (.spe), identified isotopes, GPS, date, hour, user ...ecc

Also neutron source are identified with discrimination between fissile material (Cf-252), alpha-n (Am/Be and Am/Li) sources, Plutonium and Uranium



ID Report – 6 gamma sources example

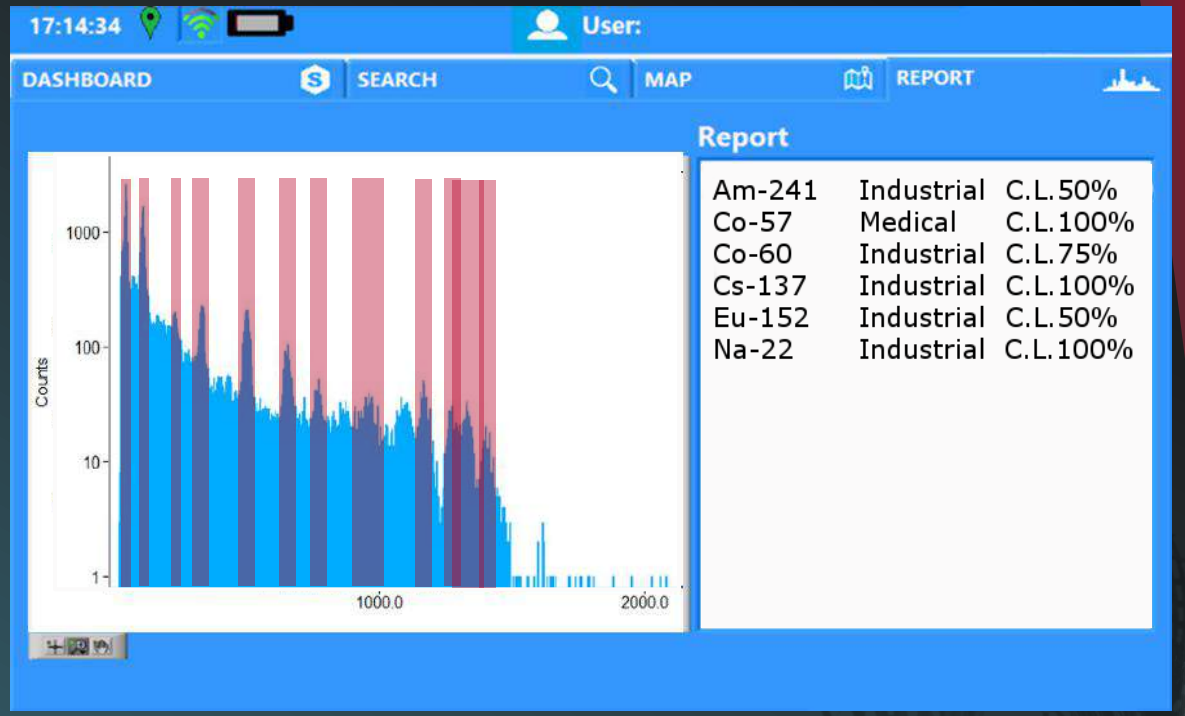
IDENTIFICATION MEASUREMENT

1 min acquisition (standard requirements) for the identification of the isotopes through peak search

REPORT

automatically generated including spectrum (.spe), identified isotopes, GPS, date, hour, user ...ecc

Also neutron source are identified with discrimination between fissile material (Cf-252), alpha-n (Am/Be and Am/Li) sources, Plutonium and Uranium



SNIPER-GN Performances

IEC 62327 – 2017 (EU)

Hand Held Instruments for the Detection and Identification of Radionuclides

- 1 s for gamma alarm (500 nSv/h above bkg, moving at 0,5 m/s @ 1m)
- 2 s for neutron alarm (^{252}Cf 20.000 n/s @25 cm)
- 1 min or less for identification of isotope

ANSI N42.34 – 2015 (USA)

Hand Held Instruments for the Detection and Identification of Radionuclides

- 1 s for gamma alarm (100 nSv/h above bkg , moving at 0,5 m/s @ 1m)
- 1 s for neutron alarm (^{252}Cf 20.000 n/s @25 cm)
- 2 min or less for identification of isotope

ANSI N42.53 – 2013 (USA)

Backpack Based Radiation Detection Systems Used for Homeland Security

- gamma alarm (4 ± 5%) photons/(cm^{2}s) moving at 1,2 m/s @ 1m)
- 2 s for neutron alarm (^{252}Cf 20.000 n/s) moving at 1,2 m/s @1,5 m
- 1 min or anything stated by the manufacturer to ID isotopes (at an exposure rate of 5 µR /h 20%)

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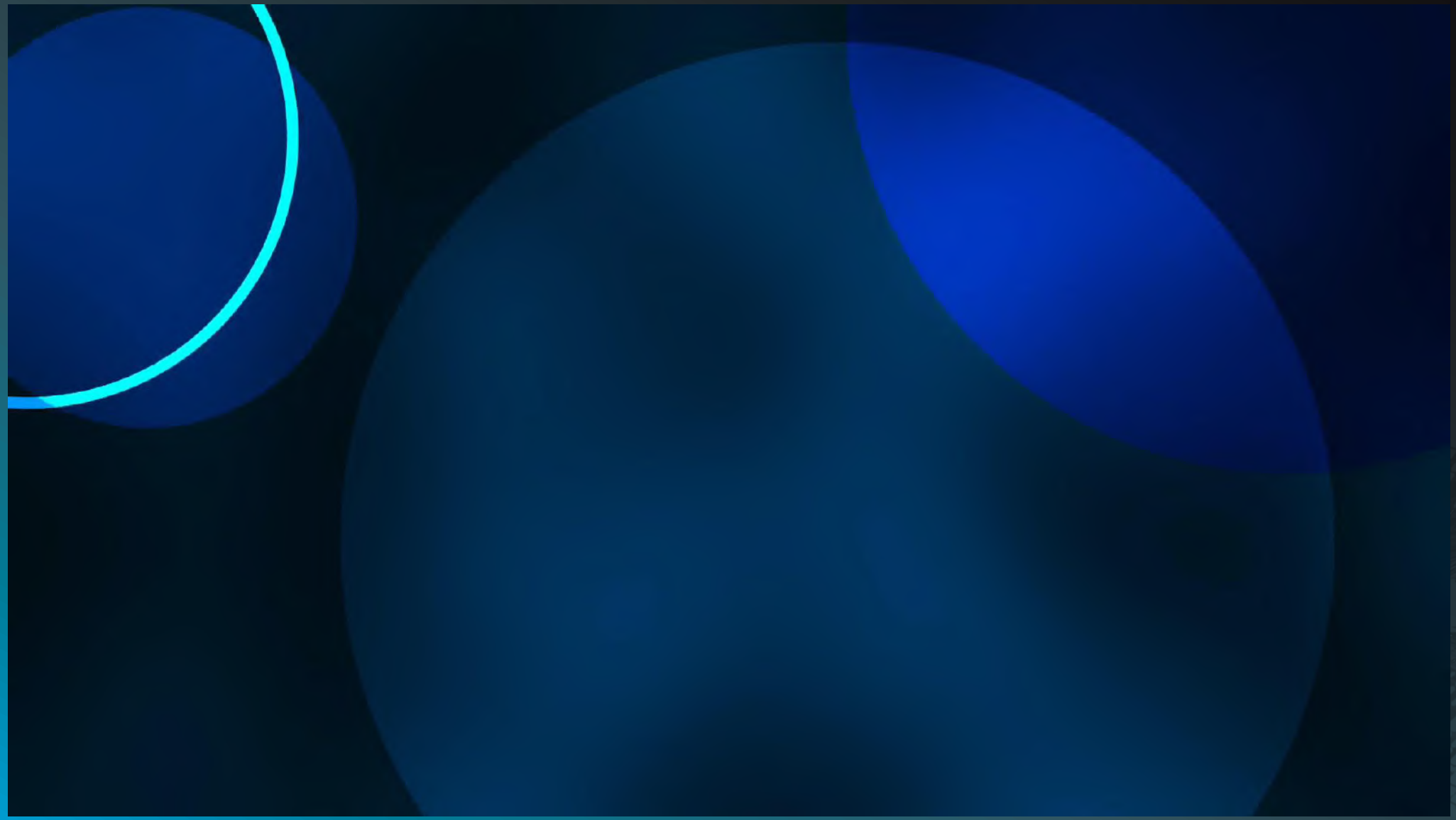
SNIPER-GN performances



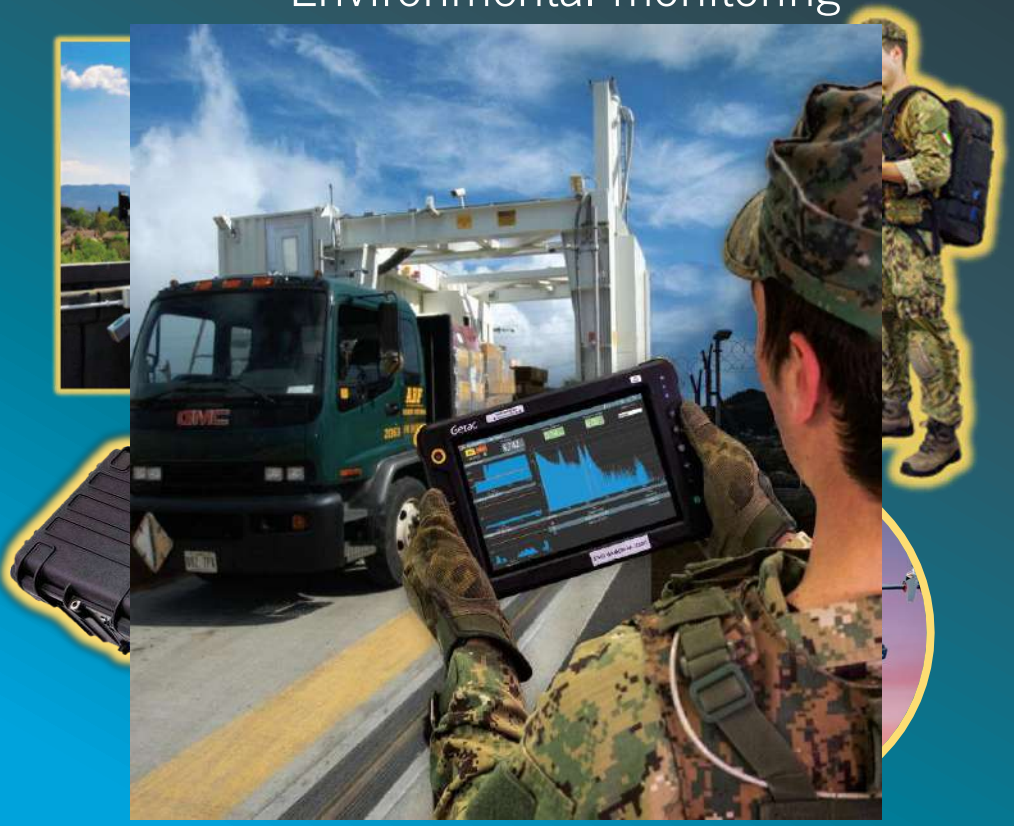
The Harbor scenario

The harbor is considered a sensitive infrastructure where the illegal trafficking of material is one of the relevant issues

It was demonstrated in different campaigns (eg. Megaports 2011) that is impossible to have a radiological control of 100% of the managed containers and without interfering with the normal logistics procedures

The monitoring network

- **Multisensor grid in the harbor area** used to increase the radiological efficiency limiting the interferences with the logistics procedure
- **Radiological coverage of the harbor area** to increase the security also for non RPM scanned containers
  - RPM or fixed stations
  - Environmental monitoring



Contracts and References

Contracts and References

NAVARM Tender

- 3 x GAMON-Mobile with 40 cps/nv neutron sensitivity

- 3 x SNIPER-GN with special IP65 case

Contracts and References

ISIN Tender

- 8 x GAMON-S
- 9 x GAMON-D
- Installation and calibration
- Network monitoring software upgrade

Contracts and References

IAEA Tender

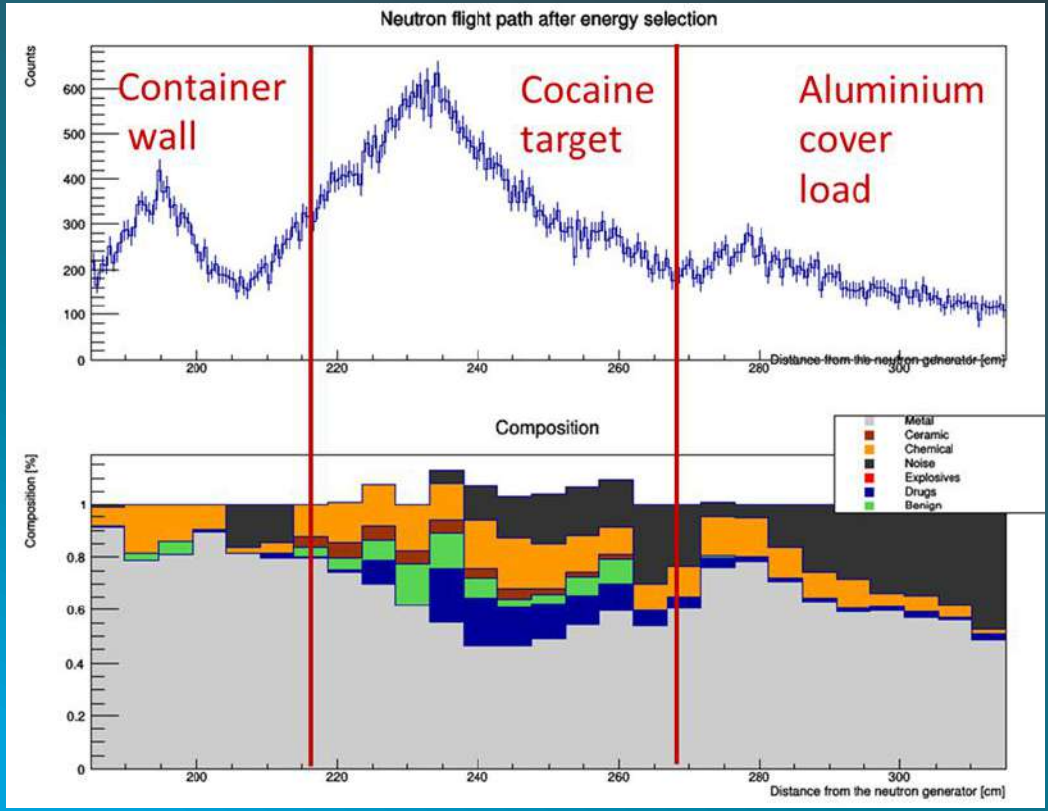
- Blanket purchase agreement for 72 GAMON-Diver

Projects

SilentBorder

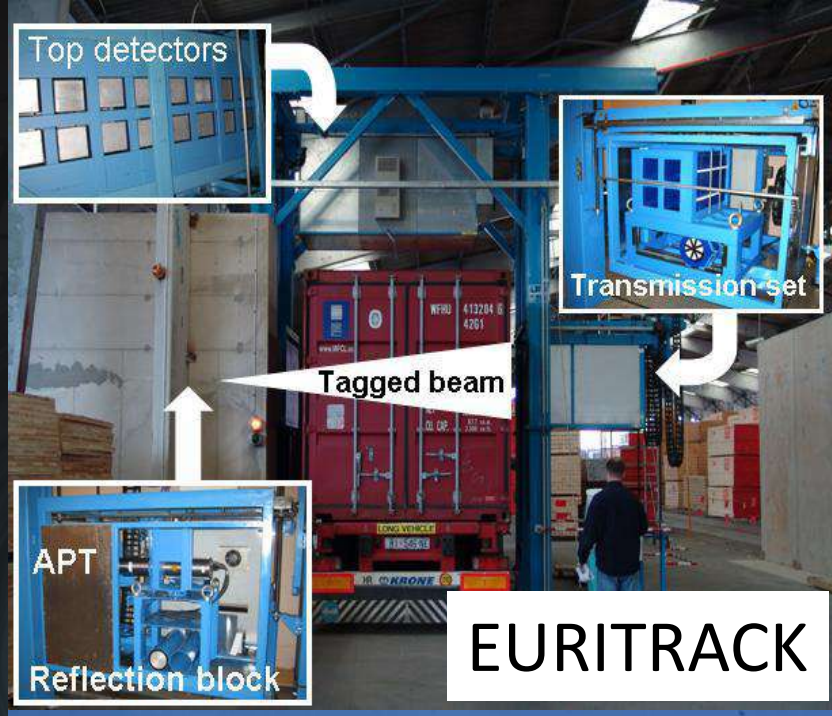
From EURITRACK to C-BORD achievement

- Rapidly relocatable -> no large fixed portal
- Compact shielding -> no fixed concrete walls required
- Limited restricted area
- 20 times better sensitivity than the previous EU project EURITRACK (From **100** kg TNT to **4** kg C4 in 10 min in metallic or organic cargo)



One of the tests during field trials in Rotterdam (NL):

20 kg cocaine target hidden in an aluminium cover load
(DRUGS in blue)



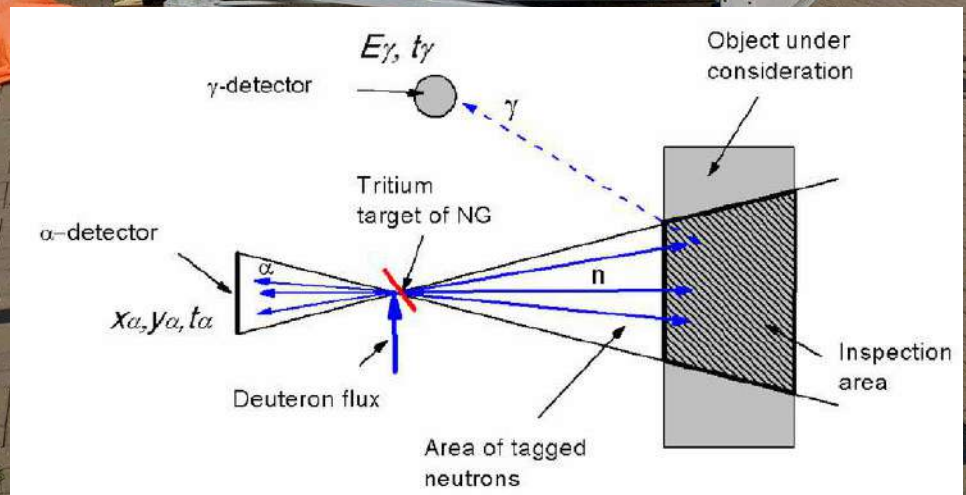
TNIS Tagged Neutron Ispection System

- TNIS is a second line inspection system
- Voxel position from X-ray scan
- Inspection time: 20 minutes
  - 10 minutes irradiation
  - Alignment and software analysis

System	Element Detected	Scanning Ability
TNIS	**N,C,O**	**3-Dimensional**
X-ray radiography	Density	No depth information
Dual energy X-ray systems	Average Z of materials	2-Dimentional projection of hydrogenous materials
Thermal Neutron Analysis	N	Poor localization of threat
Vapor Detector	Vapor Pressure of explosives	None

With the TNIS two classification problems are addressed :

- ✓ four-class problem – organic, metallic, ceramic and chemical weapons
- ✓ among the organic products, three-class problem – drug, explosive and benign



EU Horizon 2020 Research & Innovation action: SU-BES02 – 2020
Technologies to enhance border and external security Grant Number: 883 424
Start Date and duration: 36 months from 1 October 2020
Consortium: 16 partners from 8 countries

Entrance

EfficieNT Risk-bAsed iNspection of freight Crossing bordErs without disrupting business

- Raison d'être
  - Development and validation of a **comprehensive user-based toolbox for risk-based non-intrusive inspection** (NII) of cross-border **freight movements**, with particular focus on the EU borders
  - Enhancement of **border security practitioners' capabilities** to protect society against a **wide range** of dangerous and illicit materials with **minimum disruption of cross-border flow of goods**
- Building on previous H2020 research

ENTRANCE will further develop and integrate C-BORD NII technologies :

X-RAYS

TNIS

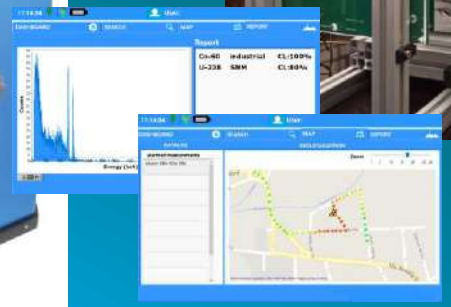
RPM

Silent Border

EU Horizon 2020 Research & Innovation action: SU-BES02 – 2020 Disruptive technologies for non-intrusive identification Grant Number: 883 424
Start Date and duration: 48 months from “May 2021”
Consortium: 10 partners from 8 countries

Cosmic Ray Tomograph for Identification of Hazardous and Illegal Goods hidden in Trucks and Sea Containers

- Raison d’être
  - Widely used technologies for scanning vehicles are gamma-ray and X-ray radiographies, but new ones are required for overcoming current shortcomings. Cosmic-ray tomography (CRT) is considered as beyond the state-of-the-art technology in cargo screening. Cosmic-ray muons are highly penetrating, with energies about 10,000 times the energy of typical X-ray and practically non-absorbable.
  - Bridging the security gap for fast and safe inspection of large number of cargos by developing a Multi-Functional Passive Detection System. Which capability is based on high accuracy sensors for particle tracking in combination with beyond state-of-the art tomographic reconstruction and material classification algorithms.



TULLI TULL·CUSTOMS
CAEN Tools for Discovery
MAKSU- JA TOLLIAMET
The University Of Sheffield.
SGS
DLR Deutsches Zentrum für Luft- und Raumfahrt
UCLouvain
UNIVERSITY OF TARTU
SCAN

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OPERATIONAL ACTIVITIES IN PREVENTING, DETECTING, AND RESPONDING TO A NUCLEAR SECURITY EVENT IN MARITIME INFRASTRUCTURE (MAURITANIA EXPERIENCE)

By
M.M. Mounja – l'Autorité Nationale de Radioprotection de Sureté et de Sécurité Nucléaire ASRN (Mauritania)

www.arsn.mr

Greece, from 22 to 25 June 2021

SUMMARY

- COUNTRY PROFILE
- THE NATIONAL AUTHORITY FOR RADIATION PROTECTION, NUCLEAR SECURITY AND SAFETY (ARSN)
- NS DETECTION ARCHITECTURES
- MARITIME INFRASTRUCTURE
- INSPECTION IN MARITIME INFRASTRUCTURE
- STAKEHOLDERS

COUNTRY PROFILE

Islamic Republic of Mauritania, is a country in the Maghreb region of western Africa.

It is the eleventh largest country in Africa and is bordered by the Atlantic Ocean to the west, Western Sahara in the north, Algeria in the northeast, Mali in the east and southeast, and Senegal in the southwest.

TOTAL AREA: 1,030,700 km²
LAND AREA: 1,030,400 km²
REFERENCE AREA: about twice the size of France
BORDER TOWNS: 5074 km; Algeria 463km, 2237km
Mali, Sénégal 813km, Morocco1561km
Length of coastline: 754 km

THE NATIONAL AUTHORITY FOR RADIATION PROTECTION, NUCLEAR SECURITY AND SAFETY (ARSN)

The ARSN has been created by the Law 2010-09 on Nuclear Energy which was enacted in January 2010.

The ARSN is the national regulatory authority for radiation protection, nuclear safety and security and to implement safeguards.

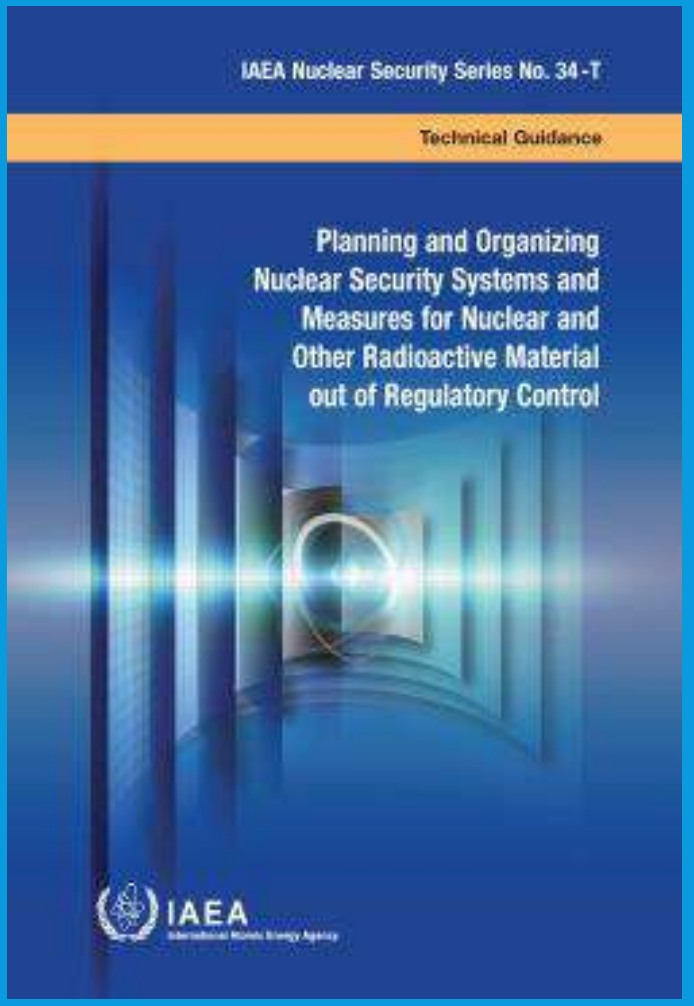
The organization and operation of the ARSN are fixed by Decree 2010-082 dated 31 March 2010 that the Authority attaches directly to the Prime Minister. The Authority Chairman is appointed by order of the Prime Minister on 7 September 2010.

NS DETECTION ARCHITECTURES

The entire world needs for improved capability to detect illicit trafficking of nuclear and other radioactive materials and devices.

A nuclear detection architecture is composed of a comprehensive set of detection systems and associated resources and infrastructure.

Integrating national nuclear detection architectures into a larger framework of regional and international architectures may further improve national capabilities.



MARITIME INFRASTRUCTURE (COMMERCIAL PORTS, FISHING PORTS AND PLATFORMS)

Mauritania, at the present time has two ports (Nouakchott and Nouadhibou), having two jetties for iron ore and petroleum in Nouadhibou.
Two artesian fishing ports are nearly being built, one of which is nearly completed. The two most important ports: The Autonomous Port of Nouadhibou and The Autonomous Port of Nouakchott, are governed by Decrees of creation and organisation in establishments.

The port currently represents could be used for gypsum and copper exports, and for traffic to the Republic of Mali and landlocked countries.

Port Autonome de Nouakchott
« Dit Port de l'Amitié » (PAN-PA)

STAKEHOLDERS

In the framework of the cooperation project between Mauritania and IAEA our stakeholders at the borders point were provided with hand-held radiation detectors

- Ministry of Defence (The Army, Coastguard and the Gendarmerie);
- Ministry of the Interior (National Police);
- Ministry of Finance (Customs);
- Ministry of Transport

INSPECTION OF SOURCES IMPORTED BY MINING COMPANIES STORED IN THE PORTS

Many companies working in the field of oil extraction and logistical support companies import radioactive sources for use in exploration operations and even in welding pipes.

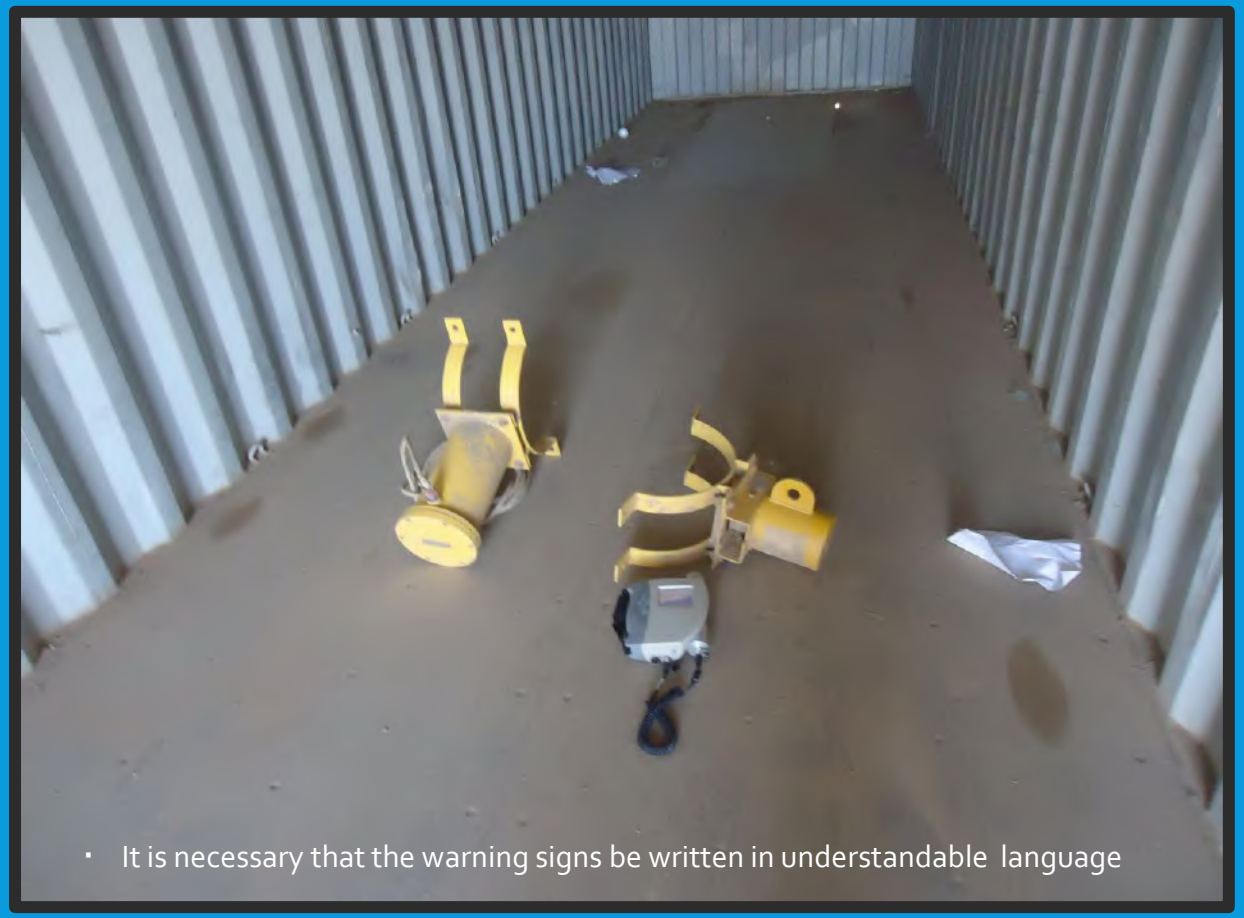
They store them in the port until they are transported to the platforms and be used there. Then they return to the port again.

Radioactive sources keep moving between the port and the platform at sea.

These radioactive sources that are stored in the port are subject to strict physical protection measures.

PHYSICAL PROTECTION MEASURES

PHYSICAL PROTECTION MEASURES



- It is necessary that the warning signs be written in understandable language

INSPECTION OPERATIONAL ASPECTS

PROCEDURES

Checking the authorization

Preparing the detailed inspection checklist

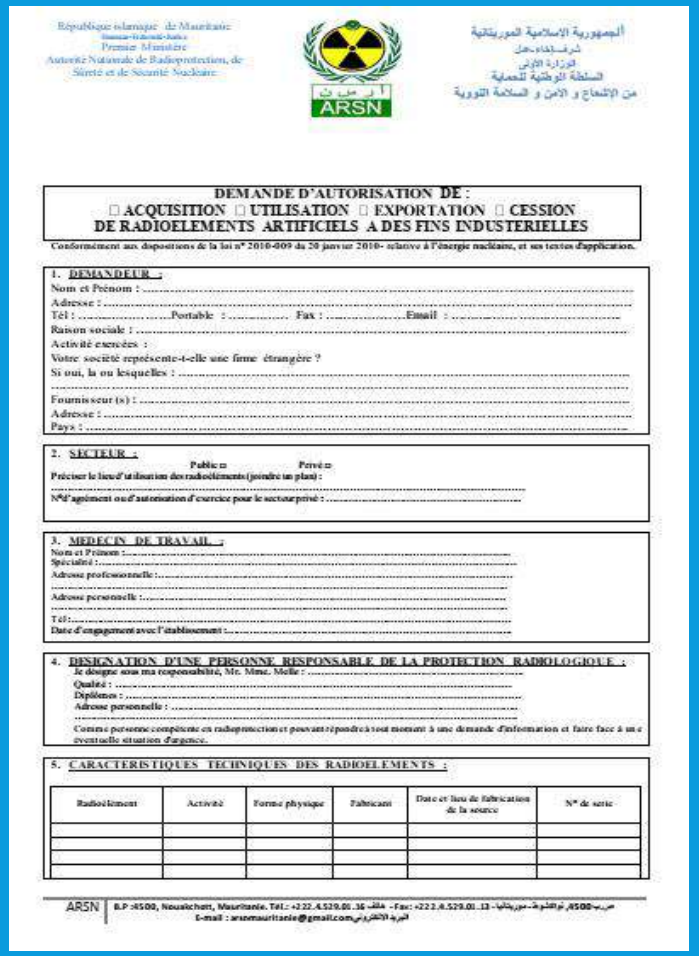
Order de mission

Suspicious access at the site

RESUME DE RAPPORT D'INSPECTION DE RADIOGRAPHIE INDUSTRIELLE

NUMERO D'AUTORISATION	
Nom du titulaire	
Addresse (location du site inspecté)	
Telephone	
Responsible de radio protection	
Représentant du titulaire pour l'inspection	
Date de la dernière inspection	___/___/___
Date de la présente inspection	___/___/___
Type of Inspection Pre-authorization	☐
Routine	☐
Reactionnelle	☐
inopinée	☐
Date de la prochaine inspection	___/___/___
Normale	☐
Réduite	☐
Etendue	☐
Justifier le choix du type d'inspection	
Résumé des résultants et des actions à faire	
Pas de non conformité détectée	☐
Non conformité	☐
devenir de la ou des non conformités antérieures	☐
Inspecteur (1) signature Date	
Inspecteur (2) signature Date	
Supervisor's signature	
Report approuvé par	**oui** ☐ non ☐ si non commenter si non s if No

Commentaires (à signer et dater)



DEMANDE D'AUTORISATION DE :
☐ ACQUISITION ☐ UTILISATION ☐ EXPORTATION ☐ CESSION
DE RADIOELEMENTS ARTIFICIELS A DES FINS INDUSTERIELLES

Conformément aux dispositions de la loi n° 2010-009 du 20 janvier 2010- relative à l'énergie nucléaire, et ses textes d'application.

1. DEMANDEUR :
Nom et Prénom :
Adresse :
Tél : Portable : Fax : Email :
Raison sociale :
Activité exercées :
Votre société représente-t-elle une firme étrangère ?
Si oui, la ou lesquelles :
Fournisseur (s) :
Adresse :
Pays :

2. SECTEUR :
Public ☐ Privé ☐
Préciser le lieu d'utilisation des radioéléments (joindre un plan) :
N°d'agrément ou d'autorisation d'exercice pour le secteur privé :

3. MEDECIN DE TRAVAIL :
Nom et Prénom :
Spécialité :
Adresse professionnelle :
Adresse personnelle :
Tél:
Date d'engagement avec l'établissement :

4. DESIGNATION D'UNE PERSONNE RESPONSABLE DE LA PROTECTION RADIOLOGIQUE :
Je désigne sous ma responsabilité, Mr, Mme, Melle :
Qualité :
Diplômes :
Adresse personnelle :
Comme personne compétente en radioprotection et pouvant répondre à tout moment à une demande d'information et faire face à une éventuelle situation d'urgence.

5. CARACTERISTIQUES TECHNIQUES DES RADIOELEMENTS :

Radioélément	Activité	Forme physique	Fabricant	Date et lieu de fabrication de la source	N° de série

ARSN B.P :4500, Nouakchott, Mauritanie. Tél.: +222.4.529.01.36 -Fax: +222.4.529.01.13-
E-mail : arsnmauritanie@gmail.com

HUMAN RESOURCES, LOGISTIQUE AND EQUIPMENT'S

In the end, we must always remember that

IF YOU FAIL TO PLAN YOU PLAN TO FAIL

شكرا

Ευχαριστώ

Thank you

Grazie

Merci

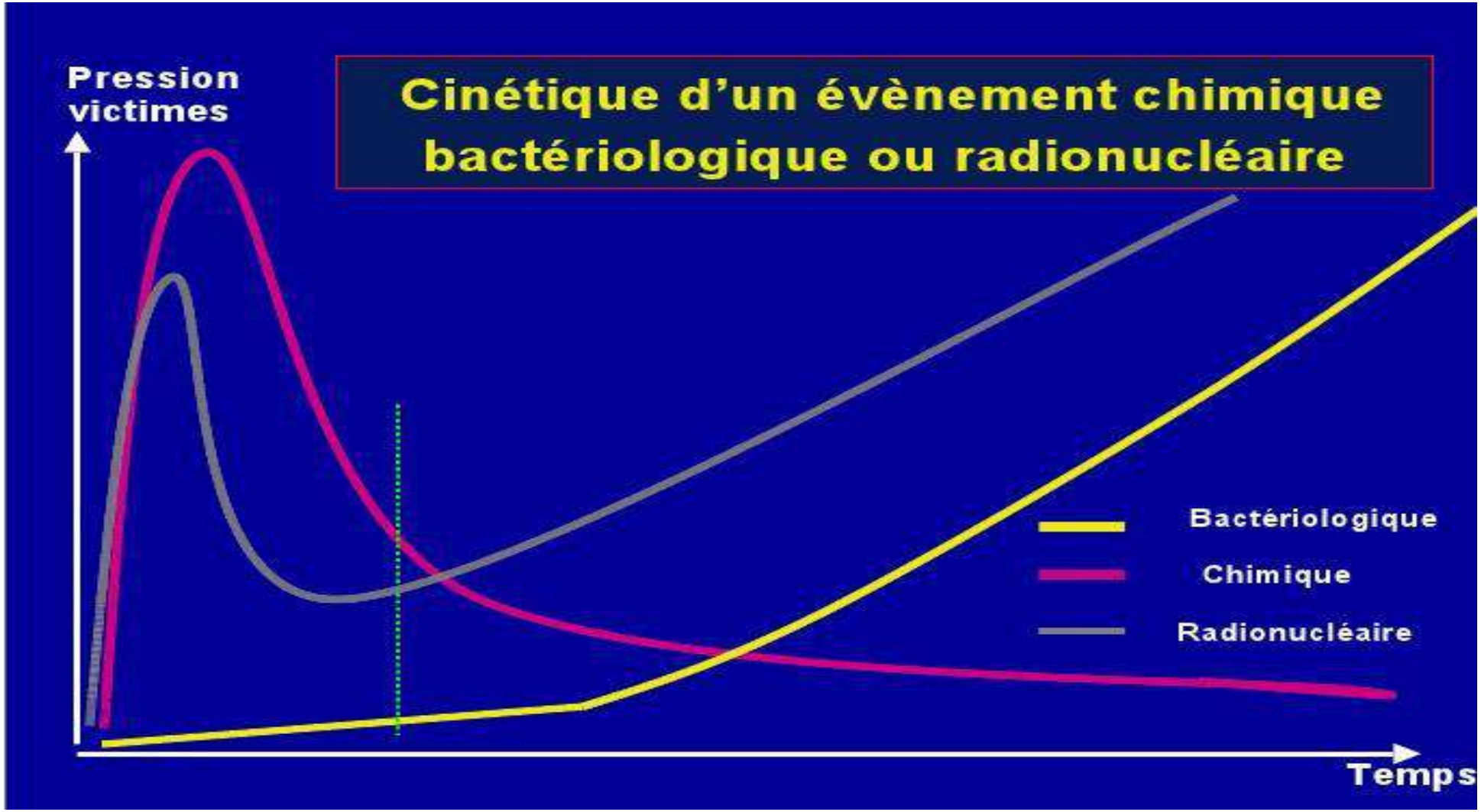
Ačiū

H2020 TERRIFFIC PROJECT : Develop an automated toolbox for First Responders assessment of RN situations

DE LA RECHERCHE À L'INDUSTRIE

June 24th 2021

V. Schoepff, Y. Moline, A. Dabat-Blondeau, G. Amoyal, J.M. Bourbotte, J-P. Poli, W. Husson, M. Imbault, M. Morenas, M. Gendreau, R. Woo, G. Corre, V. Kondrasovs, F. Carrel


Pression victimes
Cinétique d'un évènement chimique bactériologique ou radionucléaire
Bactériologique
Chimique
Radionucléaire
Temps

CONTEXT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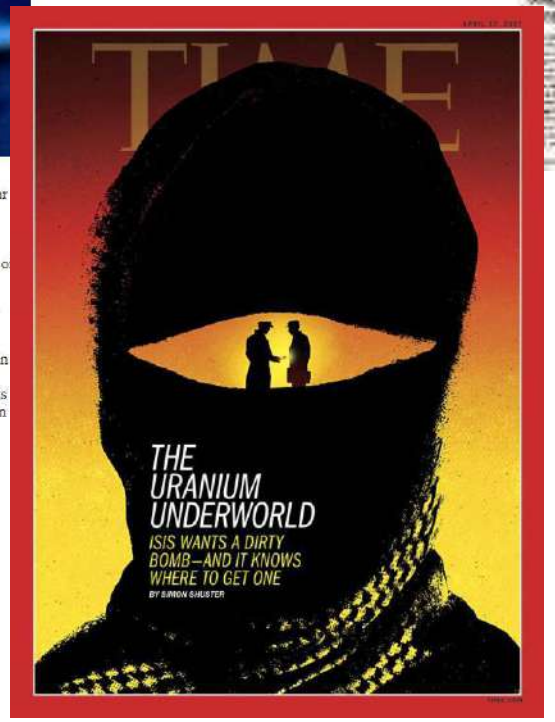
World news
From cocaine to plutonium: mafia clan accused of trafficking nuclear waste
Advertisement
Tom Kington in Rome
Tue 9 Oct 2007 01.55 BST
65
Blue drums displaying radioactive sign. David Woodfall/David Woodfall
Authorities in Italy are investigating a mafia clan accused of trafficking nuclear waste and trying to make plutonium.
The 'Ndrangheta mafia, which gained notoriety in August for its blood feud killings of six men in Germany, is alleged to have made illegal shipments of radioactive waste to Somalia, as well as seeking the "clandestine production" o other nuclear material.
Two of the Calabrian clan's members are being investigated, along with eight former employees of the state energy research agency Enea.
The eight are suspected of paying the mobsters to take waste off their hands in the 1980s and 1990s. At the time they were based at the agency's centre at Rotondella, a town in Basilicata province in the toe of Italy, which today treats "special" and "hazardous" waste. At other centres. Enea studies nuclear fusion


TIME
THE URANIUM UNDERWORLD
ISIS WANTS A DIRTY BOMB—AND IT KNOWS WHERE TO GET ONE
BY SIMON SHUSTER


Le Monde
300
SCIENCE & MEDECINE
Espion russe : Theresa May accuse Moscou et envisage des représailles
HUBERT DE GIVENCHY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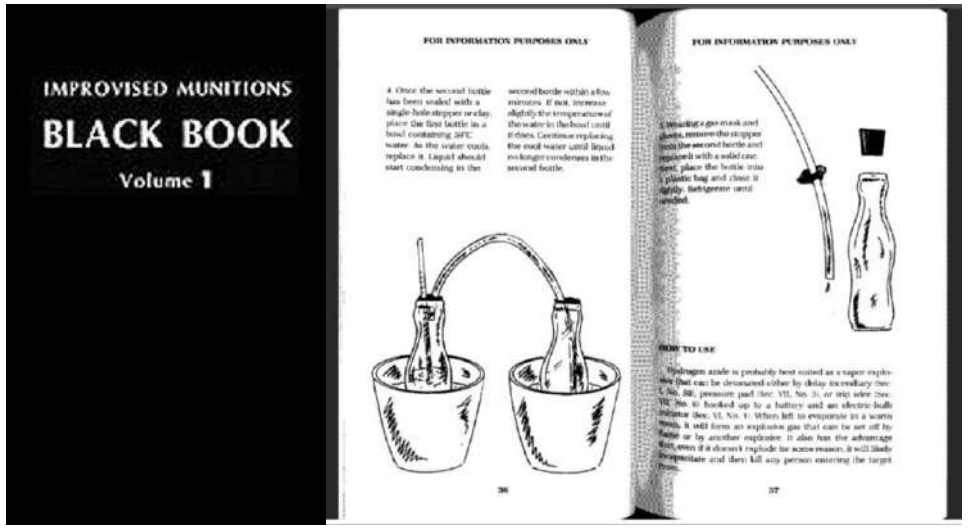
GREENDALE SCHOOL
FRANKLIN PARK NJ 08852
SENATOR DASCHLE
509 HART SENATE OFFICE BUILDING
WASHINGTON DC 20510


IMPROVISED MUNITIONS
BLACK BOOK
Volume 1
FOR INFORMATION PURPOSES ONLY
FOR INFORMATION PURPOSES ONLY

- **Is it easy to find a source?**
  1. From military, civil, industrial, medical & research facilities

- **Key point:**
  1. ≈ 8 millions of sources in 50 first countries that use sources
  2. 1993 – 2016: ≈ 3000 lost or stolen sources
  3. 270 cases of illicit traffic (enriched U: 12, Pu: 2, PuBe: 4)
  4. 900 unsolved cases

- **Security of nuclear and other radioactive material requests:**
  1. Earlier detection (at the entry point) with:
     - «low cost» equipment and robust (minimal maintenance)
  2. The ability to detect and differentiate gamma and neutron with:
     - Low false alarms & quickly remove innocent alerts

Thermonuclear Devices

Stolen Nuclear Weapons

Dirty Bomb or Radiological Dispersal Device (RDD)

Radiological attack

Ismailovski Parc, Moscou, 1995

IDENTIFICATION

- **An identification (classification) process is necessary to confirm the threat after a potential detection :**
  1. Radionuclides emit gamma rays (photons)
  2. Fissile materials emit neutrons and gamma rays
  3. Natural and legitimate radionuclides (background)

>60 Natural, medical and industrial legitimate nuclides

- K40 concrete; banana and potatoes 150 Bq/kg, Tea 770bq/Bg, Soya 440 Bq/kg
- Argon (stones)
- ^{241}Am (smoke detectors)
- Radon (gas) (stones)
- Radium 226 ^{241}Am (lightening rodes)
- Thorium (60-70ies camera lenses, soldering bars)

Ex:

30 tons of soya → 13.2 Mbq

1g U238 → 12434 bq

high chemical toxicity if ingerted (max acceptable 0.6µg/kg body weight per day)

TERRIFFIC
ACCELERATED CBRNE RESPONSE

PROJECT PRESENTATION

- European H2020 Project for **NRBC Security Research:**

Tools for early and **E**ffective **R**ecognition in cb**R**ne **I**ncidents and providing **F**irst responders **F**aster **I**nformation and enabling better management of the **C**ontrol zone

Development of an **integrated tool for fast radiological caracterization of an accidental or terrorist scene** by first responders (firefighter)

- **Duration 36 (+6) mois** – Started 01/05/2018 – ~~End 30/04/2021~~ **31/10/2021**

- **Budget :** 3,5 M€

FRANCE

list cea tech

nexter SYSTEMS

aeraccess airborne engineering research

TL & ASSOCIES

ÉCOLE CENTRALE LYON

SWITZERLAND

arktis RADIATION DETECTORS

DANEMARK

BRUHN NEWTECH LIFE SAVING SOFTWARE SOLUTIONS

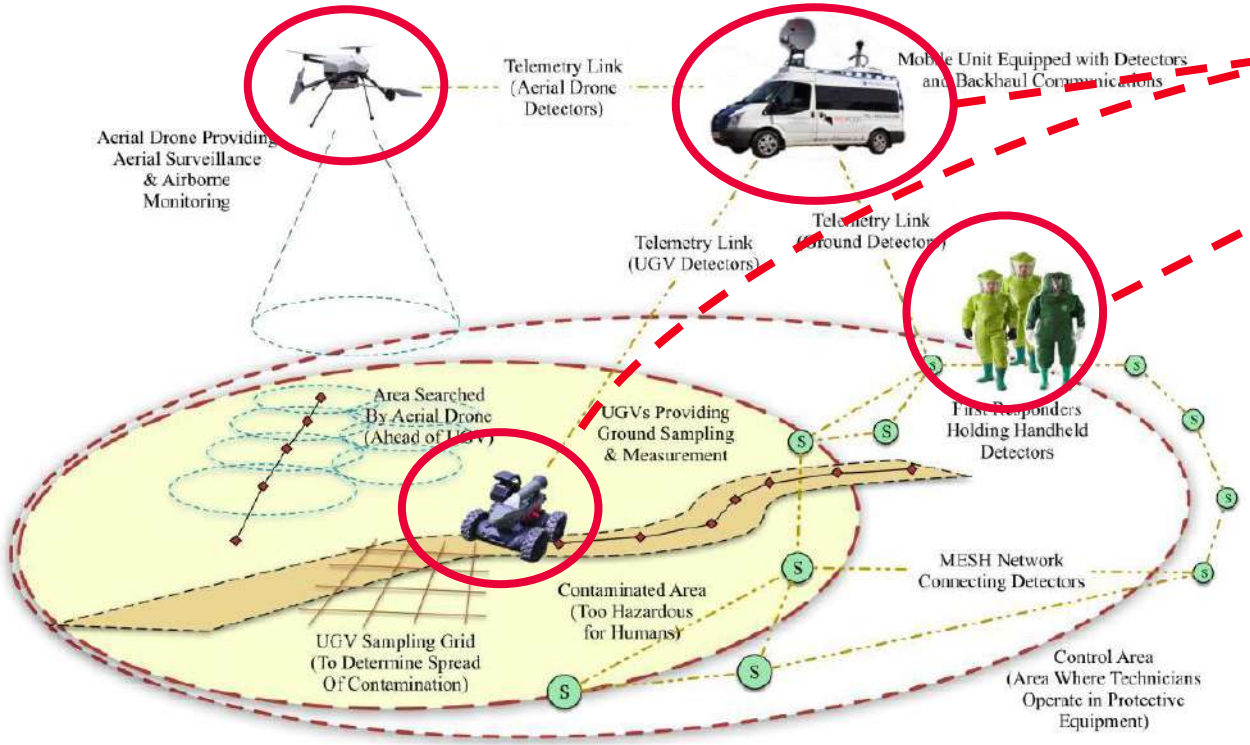
SLOVAKIA

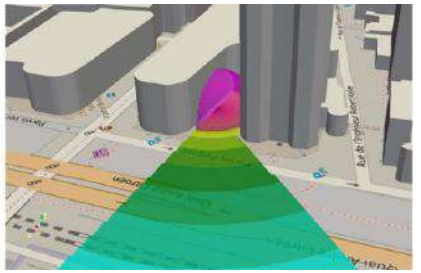
ISEM INSTITUTE INTERNATIONAL SECURITY AND EMERGENCY MANAGEMENT INSTITUTE

LUXEMBOURG

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

PROJECT OBJECTIVES





- **Plastic gamma detector** and **Gamma caméra** on **Drone / Robot**
- **Beta/Gamma contamination** probe
- Van with **neutrons detectors**

- Mesurements sent to **control center**
- **Dispersion** modelised and predicted
- **Augmented reality** reconstruction

BETA CONTAMINATION PROBE IN GAMMA BACKGROUND

- **System's Particularities:**

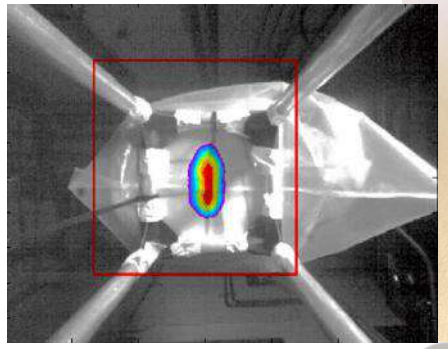
1. Based on an **organic scintillator** and specific algorithms and electronics for beta/gamma **discrimination**.
2. Measures **gammas** and **betas** in **separate channels**.

3. **Rejection of gamma channels** during beta measurement **in high and fluctuating gamma background**.
4. **MESH communication** module and **GNSS geolocation**.

- **SYSTEM IN TERRIFFIC ENVIRONNEMENT:**

1. **Continuous and geolocated measurement** of **gamma** radiation level.
2. Beta measurement and popping contamination alarm.

MINIATURIZED GAMMA CAMERA MOUNTED ON UGV/UAV



- **System's Particularities:**

1. **Nanopix** miniaturized gamma imager **(10 x 7 x 5 cm3).**
2. **Reduced weight** for robotic platform embedment (440 g).
3. Homemade electronics (**intelligence** close to sensor, motors for **remote control**, enhanced **power consumption** – PoE).
4. Coded mask collimator for **background suppression**.

- **SYSTEM IN TERRIFFIC ENVIRONNEMENT:**

1. Automated accurate localization of hot spots **in a few seconds/minutes.**
2. Ability to **discriminate sources separated by 6°** in a **50° Field of View** on the whole range of energies of interest**.**

ON-SITE TRIALS WITH SAVOY FIREFIGHTERS

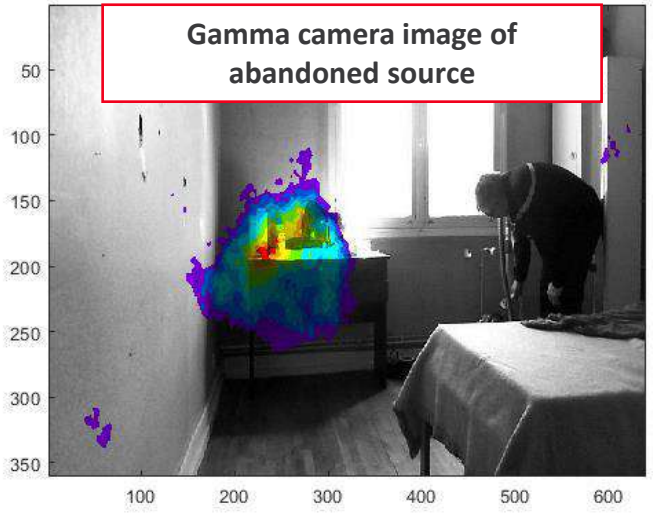
TERRIFFIC
ACCELERATED CBRNE RESPONSE

Deployment of UGV

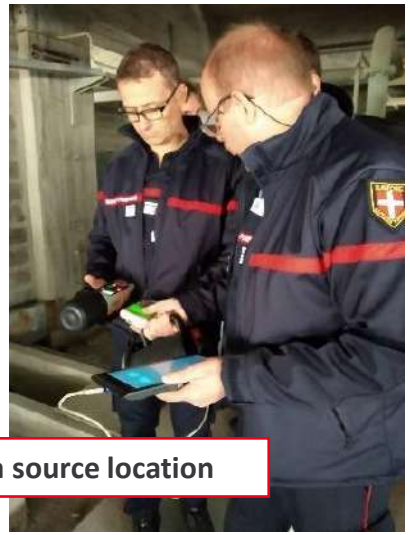
First trials in Chambery
April 2019

Inside contaminated building
+
Outside abandoned factory
with sealed sources

Gamma camera image of abandoned source



Quick gamma source location

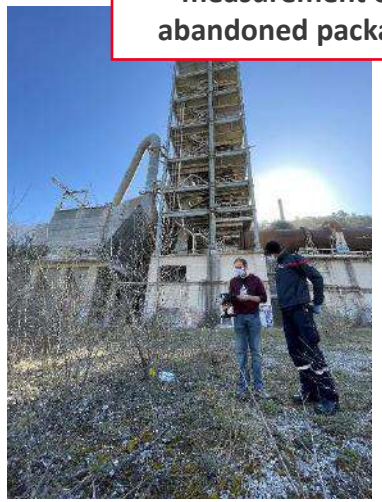


Beta and gamma contamination measurements

ON-SITE TRIALS WITH SAVOY FIREFIGHTERS

TERRIFFIC
ACCELERATED CBRNE RESPONSE

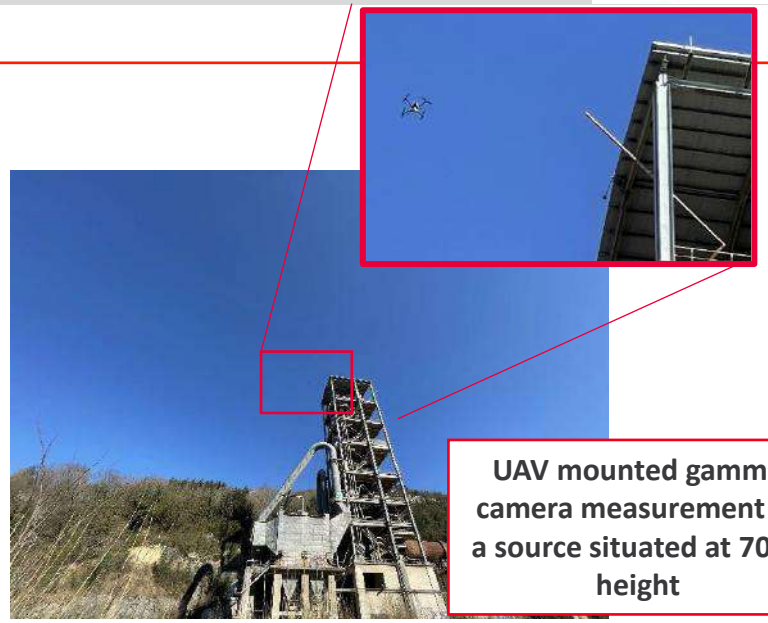
Contamination measurement of abandoned package



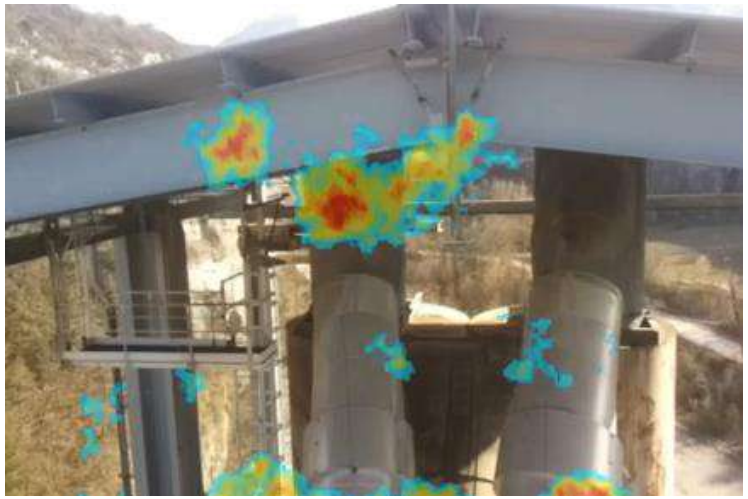
Second trials in Chambery March 2021

Mobile C2 van

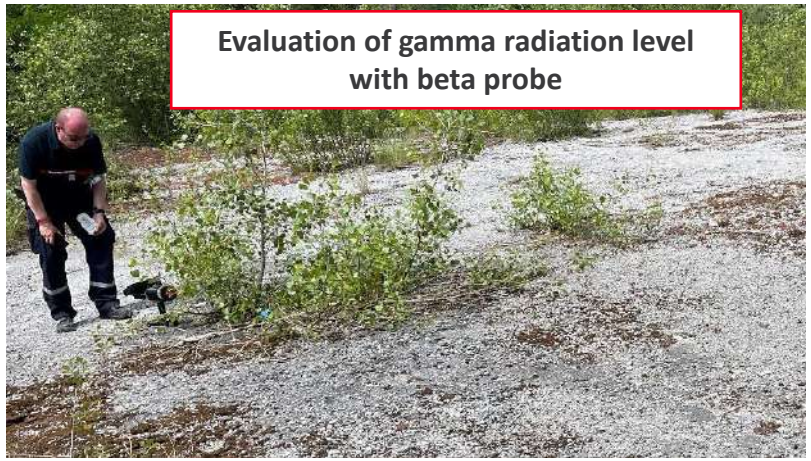
UGV mounted gamma camera inspection of hidden source



UAV mounted gamma camera measurement of a source situated at 70 m height



ON-SITE TRIALS WITH SAVOY FIREFIGHTERS



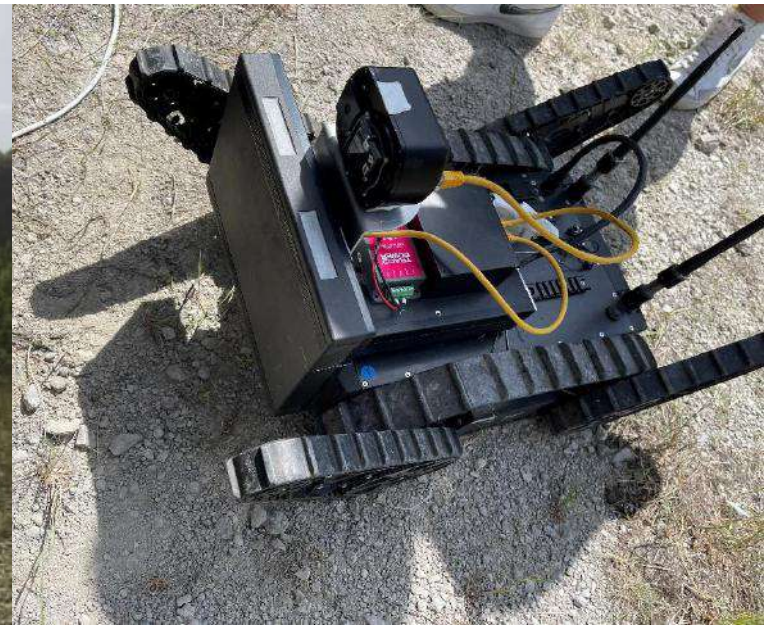
Evaluation of gamma radiation level with beta probe

Third trials in Chambery
June 2021

UGV embedded gamma camera and SiPR measurements of lost sealed source

Contamination measurement of abandoned package

Integration of gamma camera on UAV



CONCLUSION AND PERSPECTIVES

CONCLUSION

- Development of integrated additional capabilities for first responders' assessment of a radiological scene:
  1. UAV/UGV embedded **gamma camera** and **SiPR**;
  2. **Neutron detection** for boundaries evaluation;
  3. **Handheld beta contamination probe** allowing gamma radiation level mapping;
  4. **Centralization on C2 (supervisor)**and **calculation of dispersion** via Plume modelling
  5. Transcription of measurements in **augmented reality**.

PERSPECTIVES

- **Final trials in September 2021 in France and Slovakia**
- **Public workshop to be hold in September 2021**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n° 786729


TERRIFFIC
ACCELERATED CBRNE RESPONSE

Joint Action 22/06 Athens

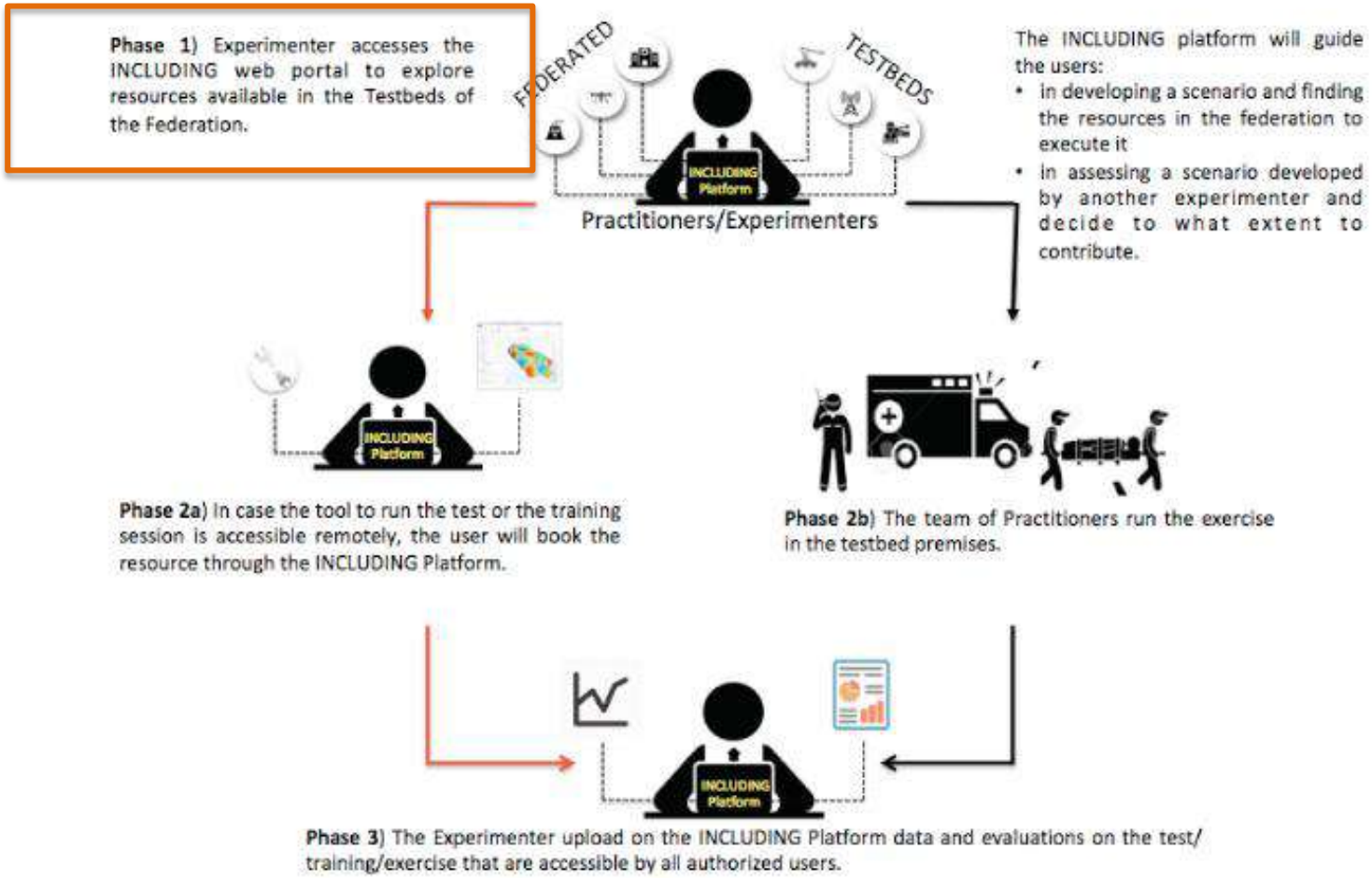
Stathes Hadjiefthymiades

National and Kapodistrian University of Athens

A European Commission H2020 Programme. This document is produced by the INCLUDING consortium and the research leading to these results has received funding from the European H2020 programme under grant agreement no 833573

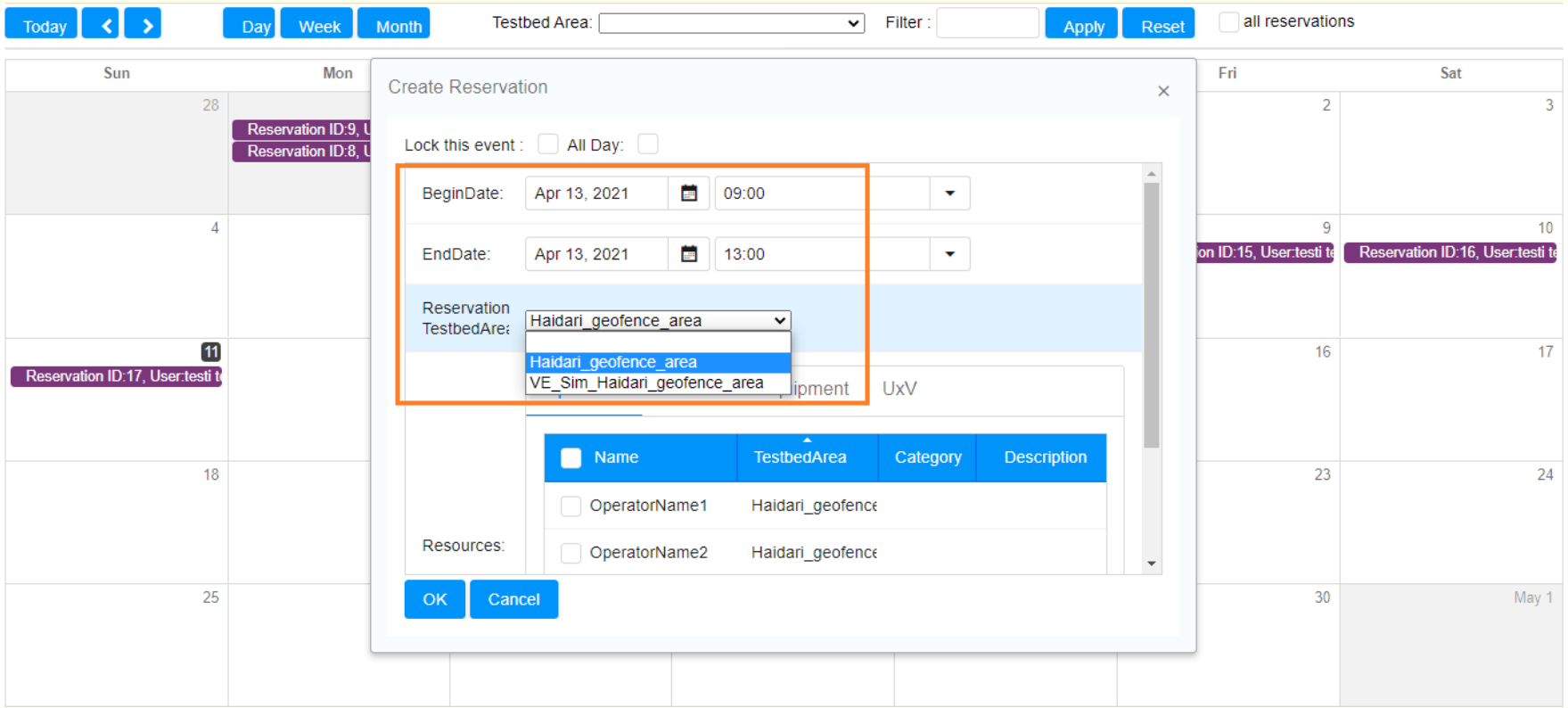
Step 1. Remotely book resources for a Drill Exercise

- Web Platform
  - http://outlander5.di.uoa.gr:8080/WebPortal



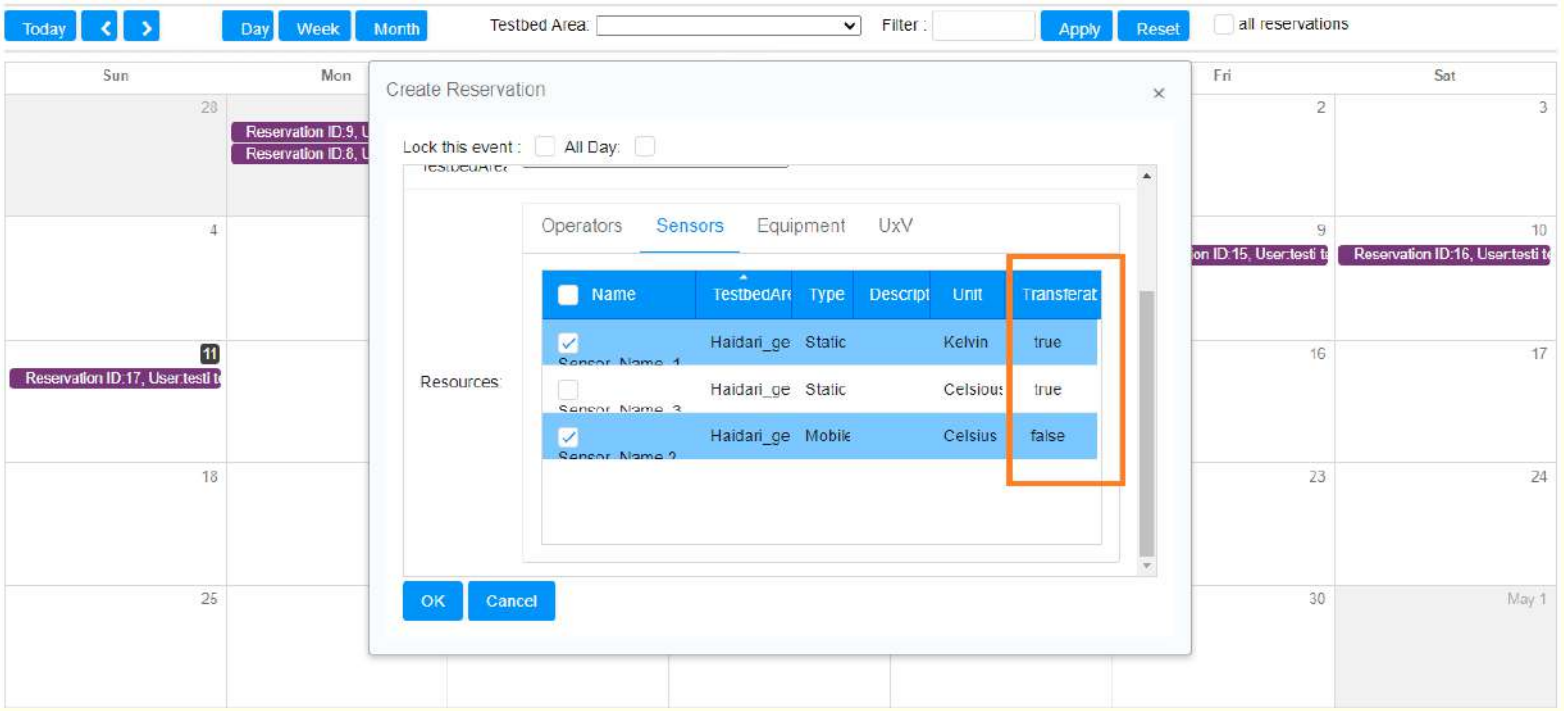
Step 1. Remotely book resources for a Drill Exercise

- Booking Tool
  1. Selection of a Testbed



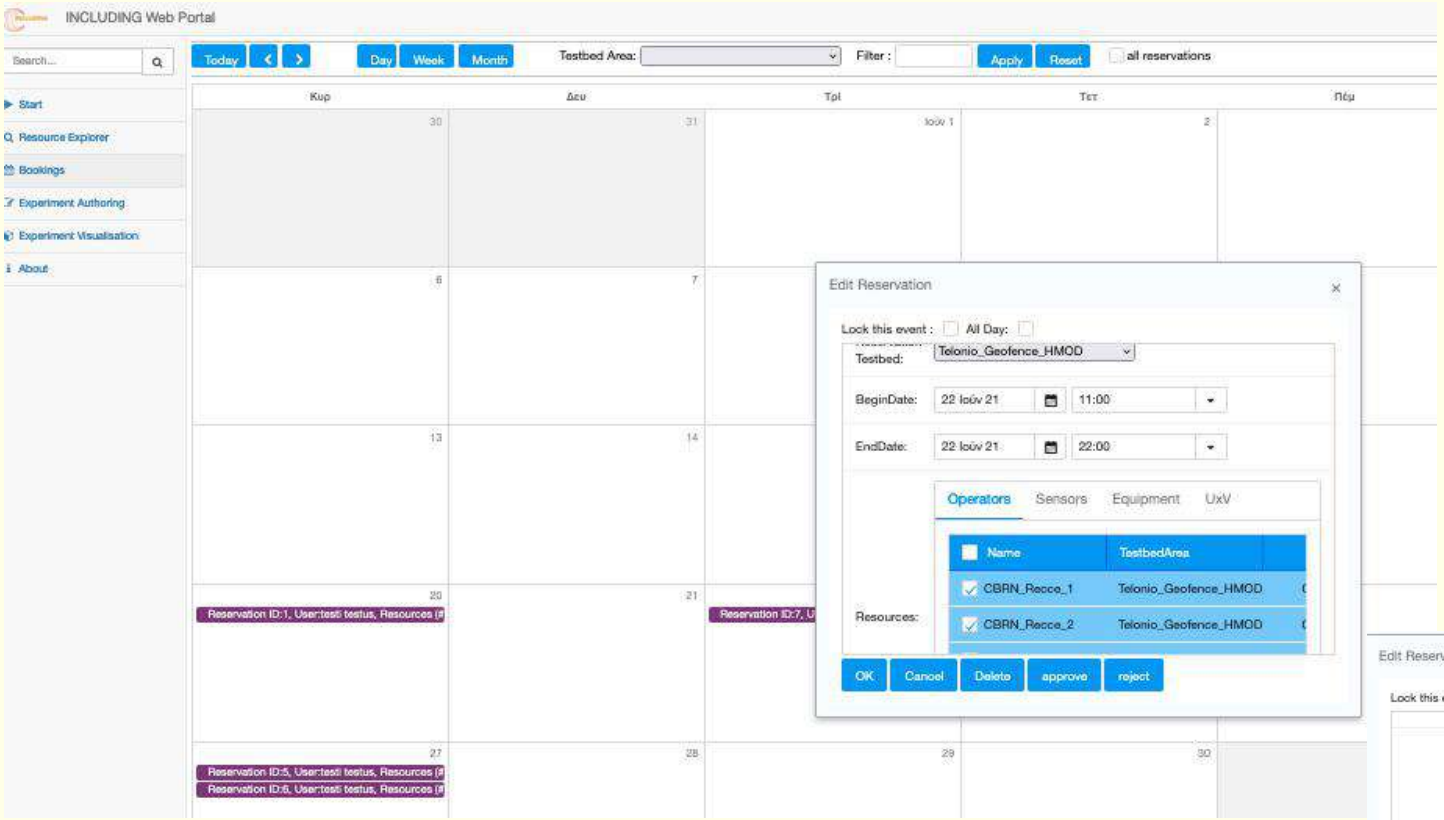
Step 1. Remotely book resources for a Drill Exercise

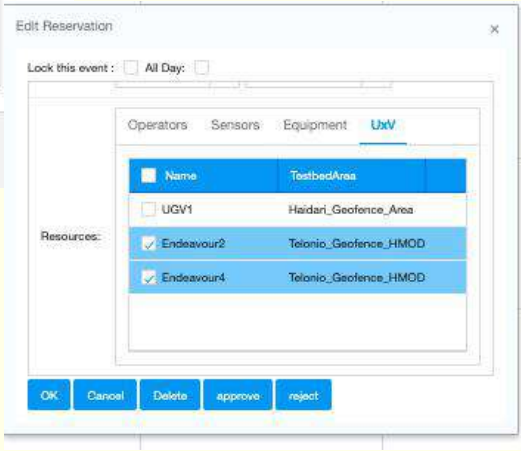
- Booking Tool
  1. Selection of a Testbed
  2. Selection of the fixed Infrastructure from the Testbed
  3. Selection of Mobile Resources from Other testbeds



Step 1. Remotely book resources for a Drill Exercise

Booking Tool: Reserve Operators, UxVs and Sensor used





Step 2. Develop a scenario for in field exercises

Phase 1) Experimenter accesses the INCLUDING web portal to explore resources available in the Testbeds of the Federation.

The INCLUDING platform will guide the users:

- in developing a scenario and finding the resources in the federation to execute it
- in assessing a scenario developed by another experimenter and decide to what extent to contribute.

Phase 2a) In case the tool to run the test or the training session is accessible remotely, the user will book the resource through the INCLUDING Platform.

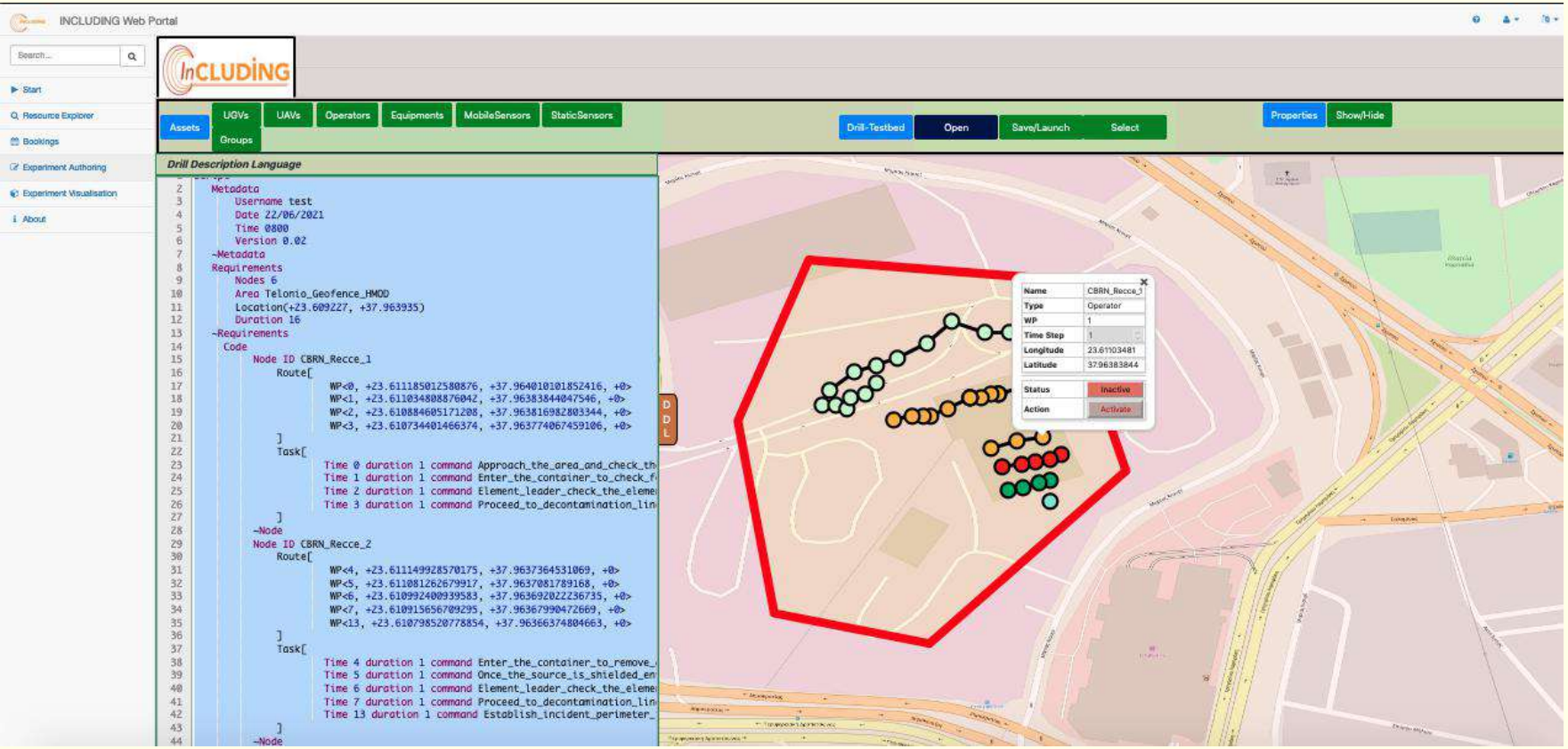
Phase 2b) The team of Practitioners run the exercise in the testbed premises.

Phase 3) The Experimenter upload on the INCLUDING Platform data and evaluations on the test/ training/exercise that are accessible by all authorized users.

Drill Authoring Tool

In the script were described:

- Tasks for 5 operators teams
- Operation for one UGV and its embedded sensor



Drill Authoring Tool

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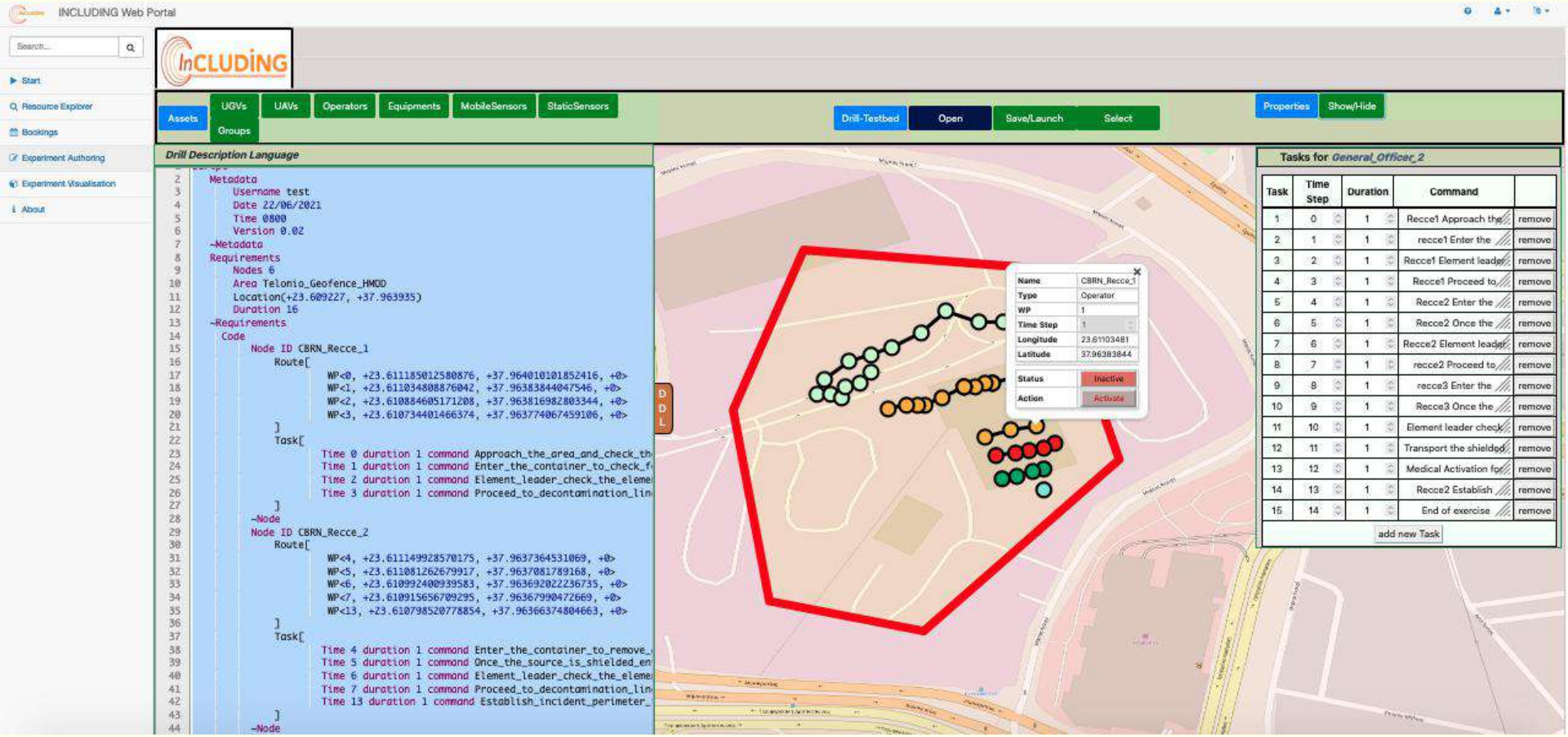
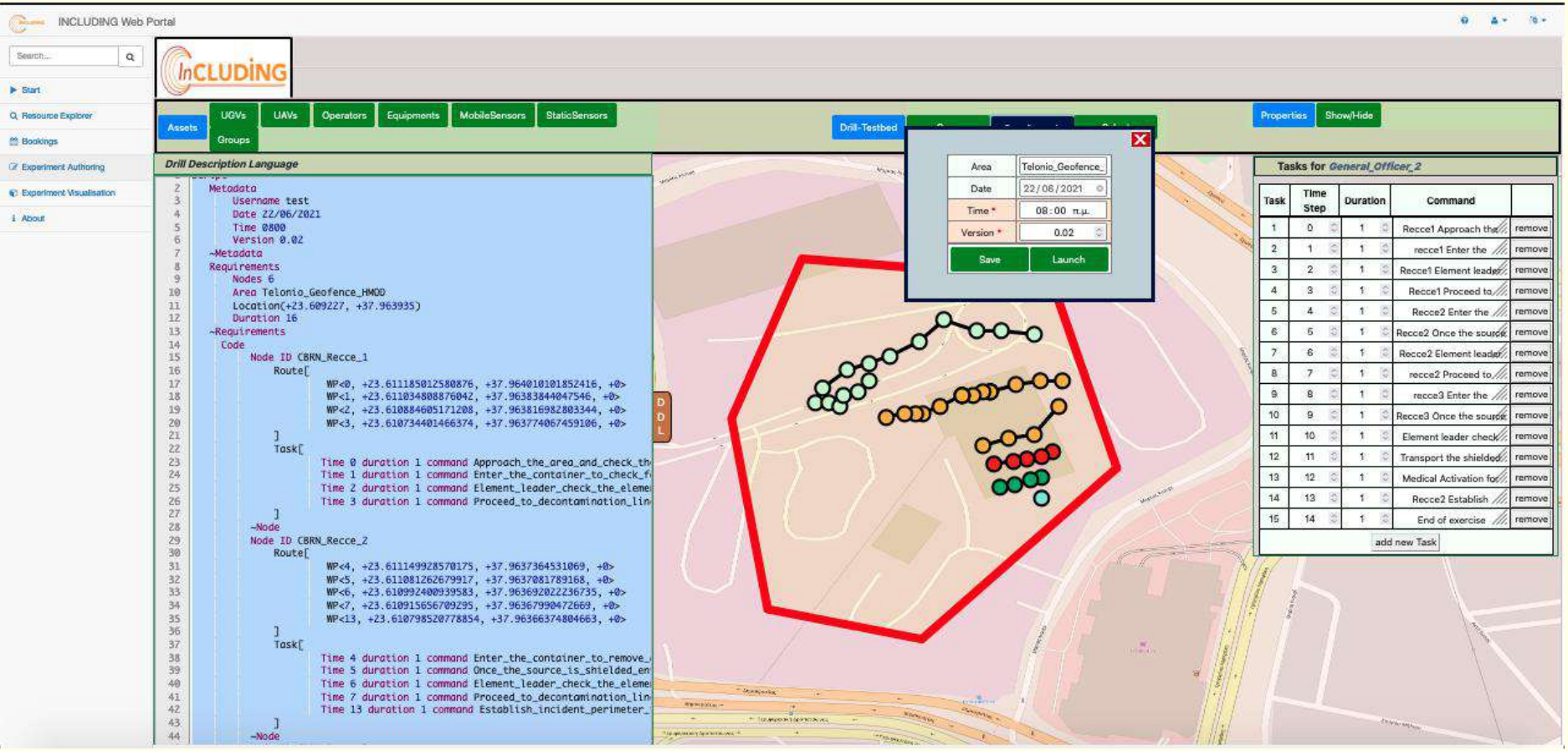
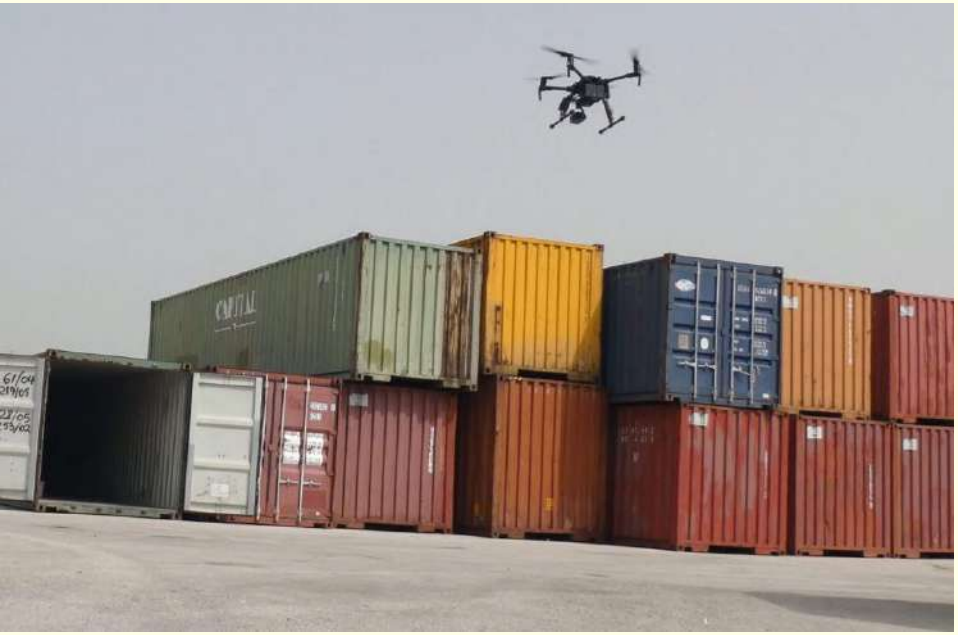


Drill Authoring Tool

Launching of the Drill

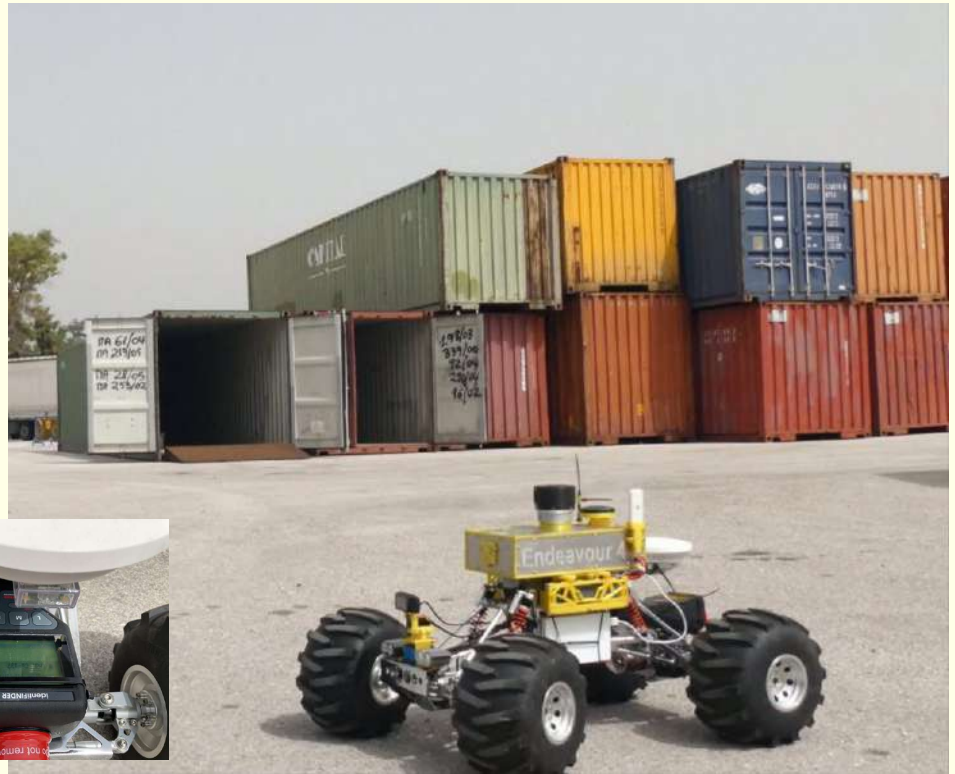


Integration of sensors on UXvs



Drone

- Gamma Probe – IMS
- Raspberry Pi – Wifi Connection

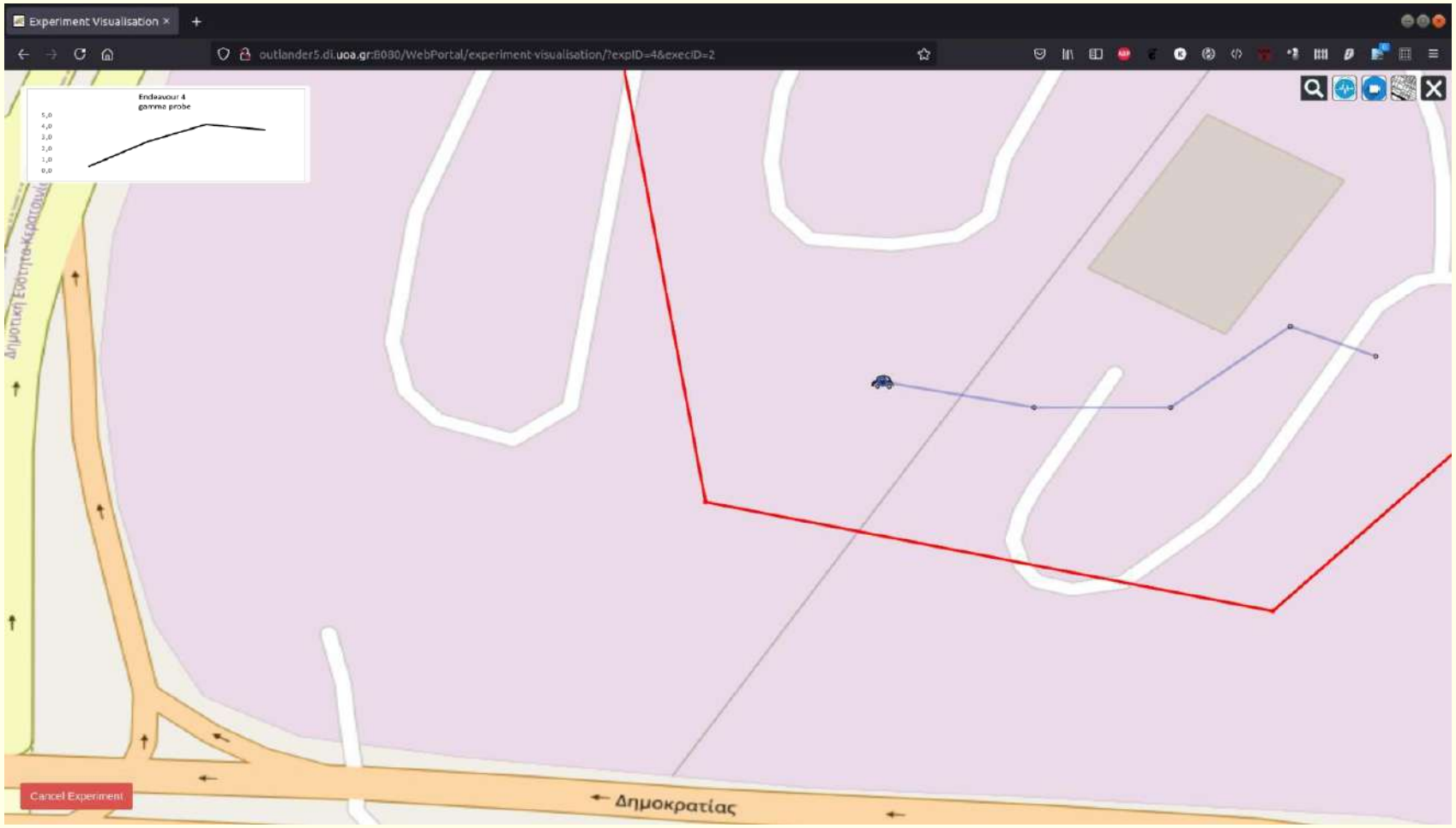


UGV

- Raspberry Pi Camera (Real Time Video)
- Raspberry Pi
- Source Identifier

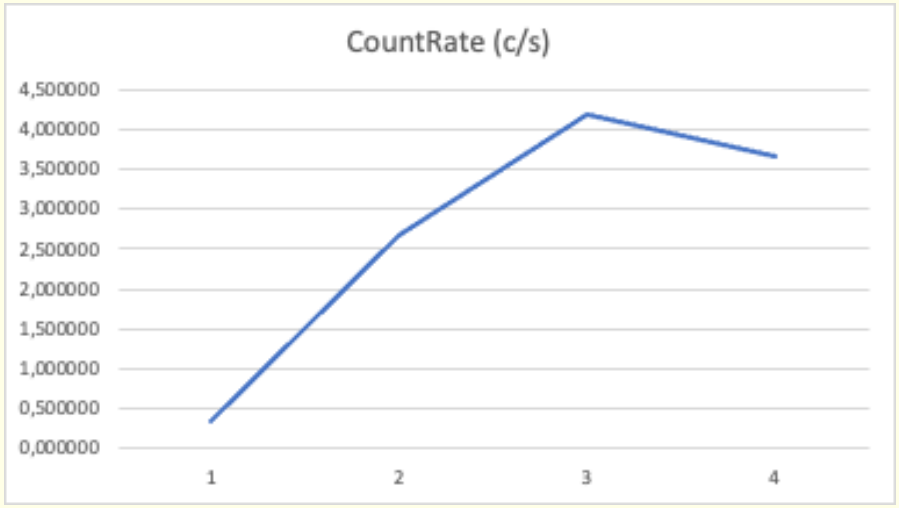
Step 3. Run real scenario, simulator and serious gaming

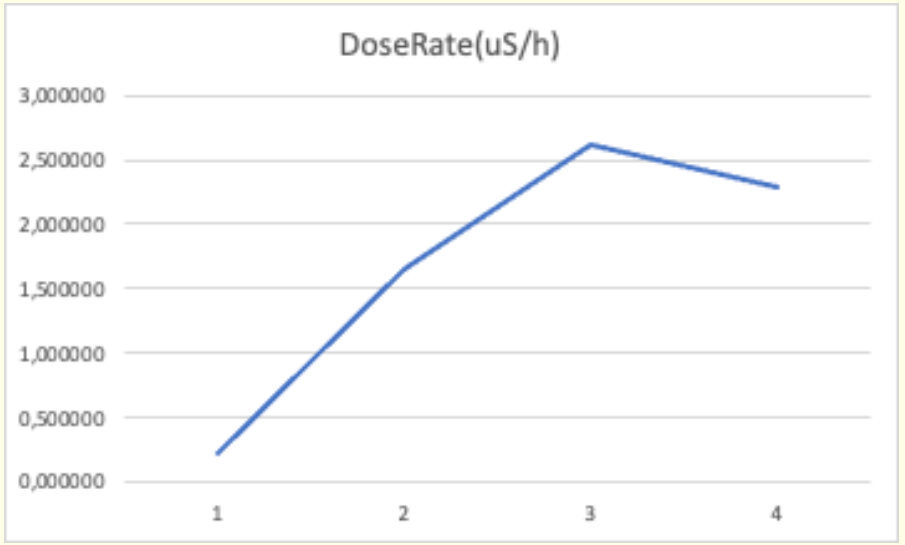
Measurements of gamma probe in Including Visualization tool



Step 3. Run real scenario, simulator and serious gaming

Gamma Probe measurements coming in the Web Platform – Including message bus





Step 3. Run real scenario, simulator and serious gaming

Live streaming from UGV integrated on UGV

Step 3. Run real scenario, simulator and serious gaming

Live streaming from UGV integrated on UGV

100 µrem/h

328 µrem/h

Step 3. Run real scenario, simulator and serious gaming

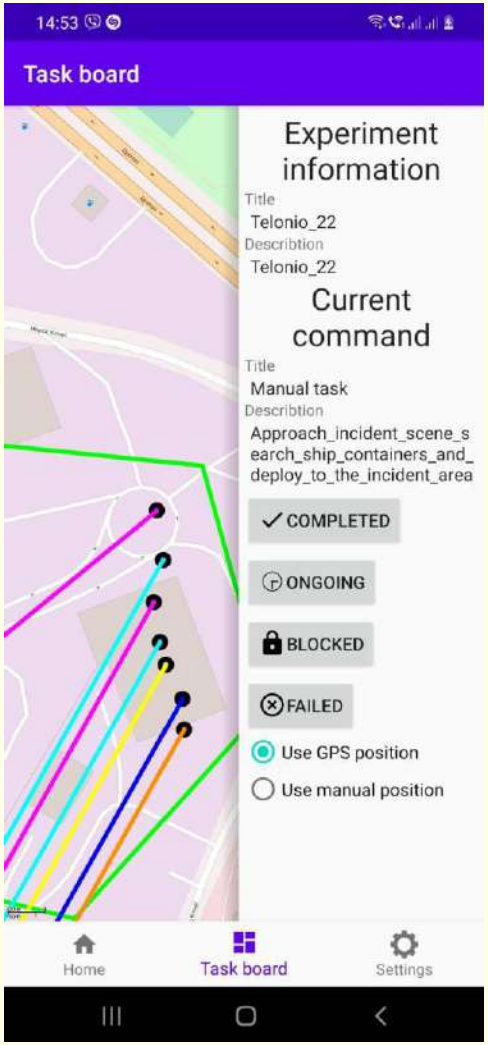
UGV identifier live streaming

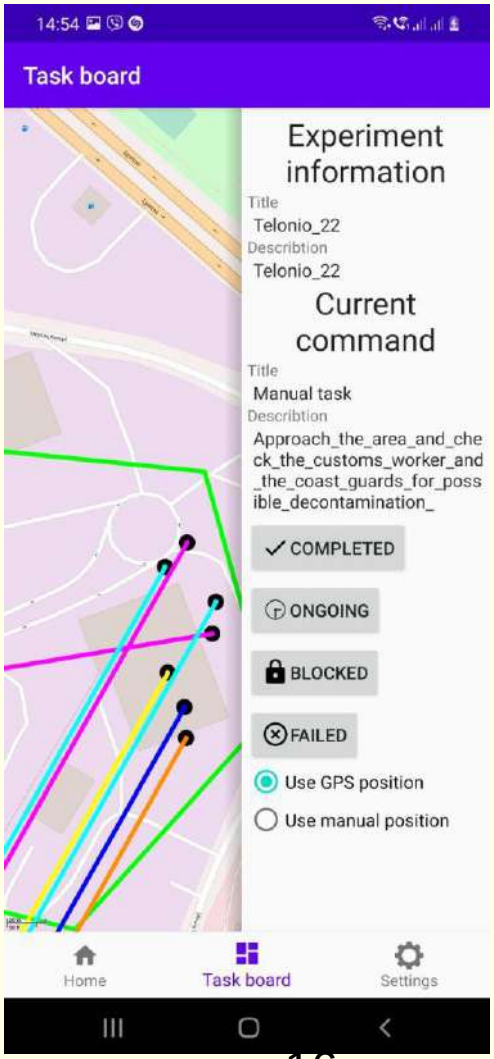
Identifier was close to source in order to make the identification

Cs 137

Visualization Tool – App

Tasks sent to operators during the Joint Action. 4 options to define the status of the task (Ongoing, completed, blocked and failed)





Discussion

Videos

- UGV
  - https://www.dropbox.com/s/9itiu7ulpdk8rzc/IMG_3280.MOV?dl=0
  - https://www.dropbox.com/s/tx6ndwean3i3zb1/IMG_3287.MOV?dl=0
- UAV
  - https://www.dropbox.com/s/w4o2oo1np0p46l8/IMG_3272.MOV?dl=0

Centre for Energy Research

C-BORD Technologies Testing at BCPs

[1]Károly Bodor, [1]András Kovács, [1]Péter Völgyesi, [2]András Bartha & the **C-BORD team**
[1]*Centre for Energy Research (EK), Nuclear Security Department, Hungary*
[2]*National Tax and Customs Administration, Hungary*

National Tax and Customs Administration

C-BORD

Effective Container Inspection at BORDer Control Points

Content

- Purpose of C-BORD tests
- Locations of C-BORD tests
- Tests at the landborder crossing place in Röszke, Hungary
- Used radioactive sources, threat and simulant materials
- Licensing procedures
- Field tests at Röszke BCP (RPMs and Sniffer)
- Field tests at Röszke BCP (improved X-ray scanning)
- Field tests at Gdansk port
- Field tests at Rotterdam port
- Summary
- FOSTER – Radiological training facility at EK

Purpose of the BCP tests

The purpose of the C-BORD project was to develop and test new technologies and devices under real conditions in real cases.

First line C-BORD technologies developed:

- Passive neutron & gamma detection technologies:
  - modular or relocatable RPM (Symetrica, CEA-LIST);

- Improved X-ray scanning technologies:
  - HCVM-T mobile (trailer) X-ray scanner (SmithsD);

- Evaporation based technologies:
  - Sniffer (University of Manchester);
  - Itemiser DX (explosive and narcotics) and GDA 2 (gas) (Bonn-Rhein-Sieg University);

Second line C-BORD technologies developed:

- Tagged Neutron Inspection System (mobile) (University of Padova);

- Photofission (CEA-LIST); 10 MeV LINAC is needed

Test Locations

- **Hungary, Röszke, M5 highway/ E75, A1:**
  - modular or relocatable RPM;
  - mobile X-ray scanner;
  - evaporation based technologies;

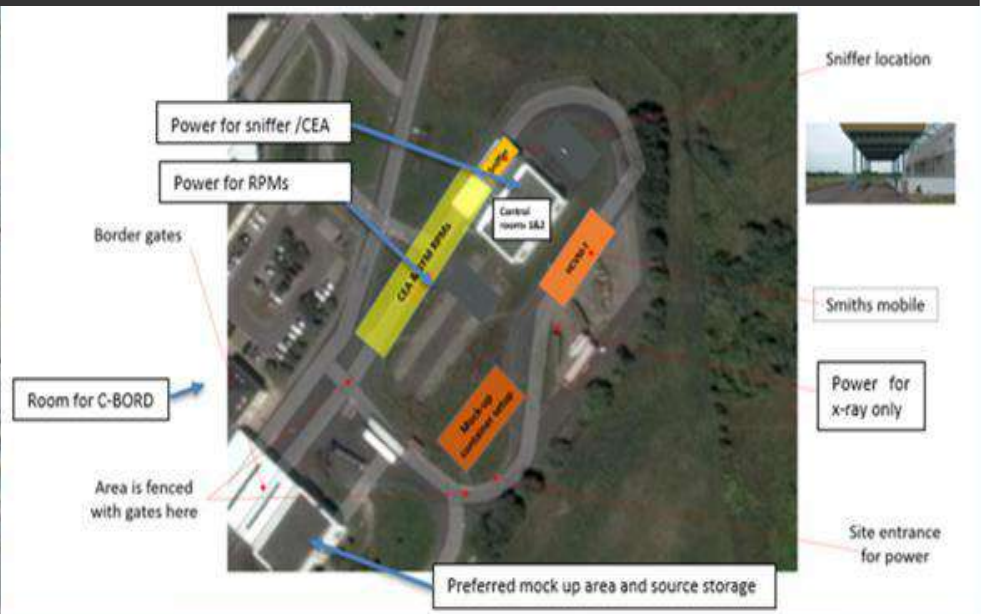
- **Poland, Gdansk, harbour:**
  - modular or relocatable RPM;
  - mobile X-ray scanner;
  - evaporation based technologies;

- **The Netherlands, Rotterdam, harbour:**
  - modular or relocatable RPM;
  - mobile X-ray scanner;
  - evaporation based technologies;
  - tagged neutron inspection system;
  - photofission; at Rotterdam LINAC is available

C-BORD tests at Röszke landborder crossing place, Hungary

The first field validation exercise of the C-BORD project was made in Hungary at Röszke BCP (Border Control Point) test site (landborder). The Röszke BCP is one of the largest BCP of the country and it is part of the Schengen zone, at the Hungarian-Serbian (EU – non-EU) border. Border security belongs to the Hungarian National Tax and Customs Administration (NTCA) and to the Hungarian Police. The exercise was organized by the Hungarian National Tax and Customs Administration in cooperation with EK.

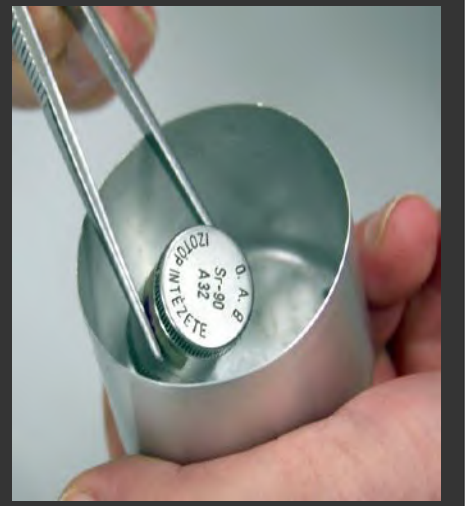
Röszke BCP in Hungary



The Röszke BCP and the test site

Test Materials: Radioactive sources, threat and simulant materials

- The radioactive sources (17 pieces) were delivered by EK.
- Medical, industrial, natural, category „5”, calibration, long-short lived sources.
- Nuclear materials were also involved.
- The transportation was done with the Mobile Laboratory of the EK.
- Simulant and threat materials: explosives and narcotics.



Licensing of the test site BCPs

- Before the testing EK applied for licenses for the Hungarian Atomic Energy Authority (HAEA). The licenses included the transportation and storage of the radioactive sources, the physical protection of the site, the radiation protection (RP) ordinance, the recommended prolongation work time of the sources and the RP training.
- Before the testing a radiation protection safety and security training was given to the participants, which was repeated for newcomers later. Participants were supplied with EPDs (Electronical Personal Dosimeter).

Field tests at Röszke – CEA RPM and Symetrica relocatable RPM

The operation team was placed at the middle of the test site in a storage building, equipped for controlling the exercises.

Two vechicles: a canvas truck with mock-up containers and regular commercial trucks.

Mock-up containers were filled with cargo and threat materials.

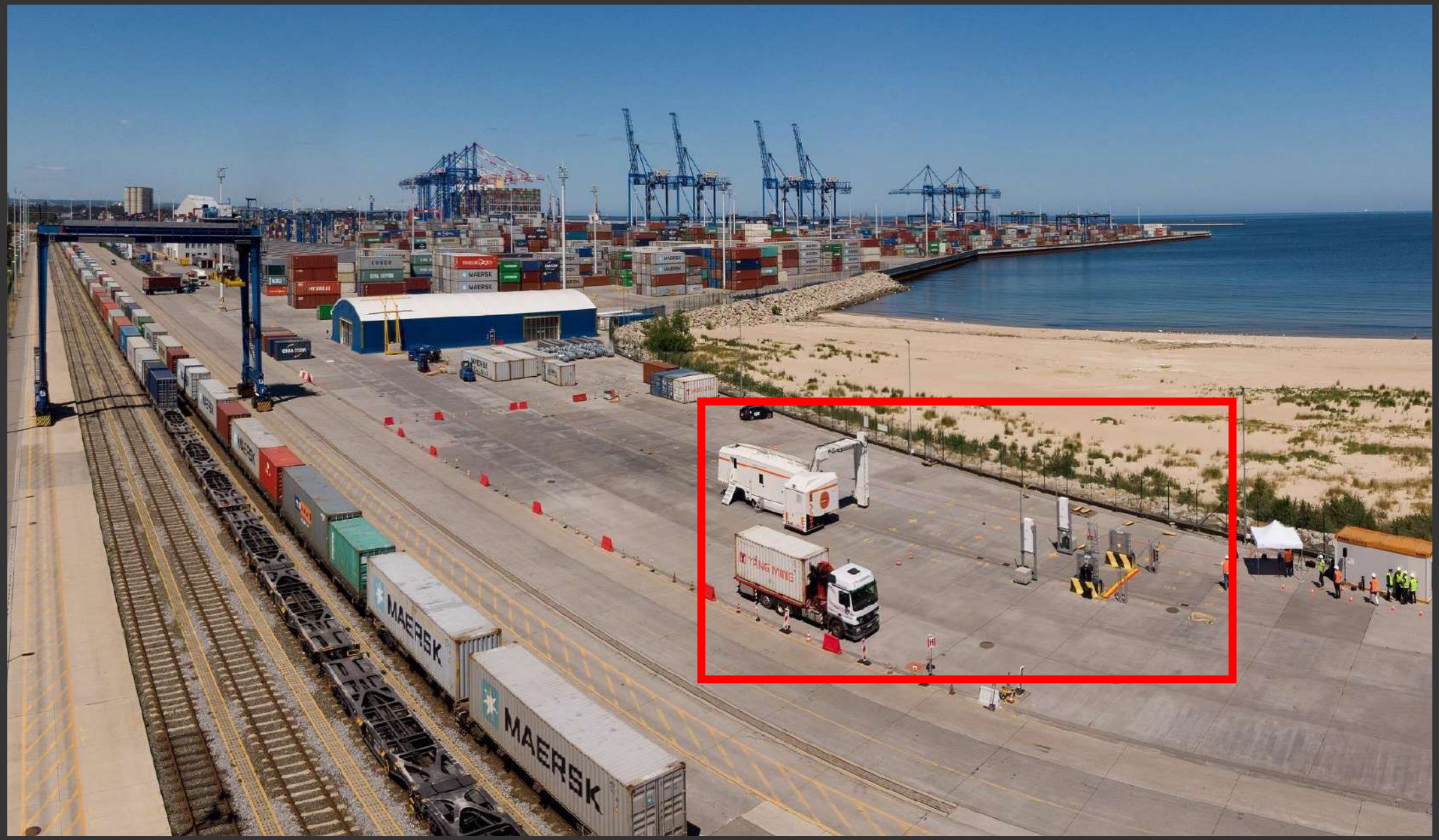
Time duration/run: ~10 minutes.

Velocity of trucks: 5 - 20 km/h.

Test run schedule started with CEA RPM, followed by BRSU test, Symetrica relocatable & mobile detectors and completed with Smith's HVCM-T X-ray with Symetrica mobile RPM integrated in it.

Evaporation based technologies and X-ray scanning test at Röszke

C-BORD tests at Gdansk port



C-BORD tests at Gdansk port

- modular or relocatable RPM;
- mobile X-ray scanner;
- evaporation based technologies;

photo by NCBJ

photo by NCBJ

C-BORD tests at Rotterdam port

- modular or relocatable RPM;
- mobile X-ray scanner;
- evaporation based technologies;

Additional 2nd line **new** technologies

- tagged neutron inspection system;
- photofission;

Summary - Advantages

1. **RPM (CEA + SYMETRICA)**:

common user interface combining x-ray image and image of radiation detection to identify the location of the source and identification of the R/N material

2. **X-ray Scanning (SMITHS'D):**

good quality of images; wireless connection; simple to operate, comfortable operation cabin; dual use mode – drive through and gantry; applicable at high speed;

good radiation safety solutions (infra gates);

3. **Evaporation Based Detection (MU and BRSU):**

good idea, worth developing;

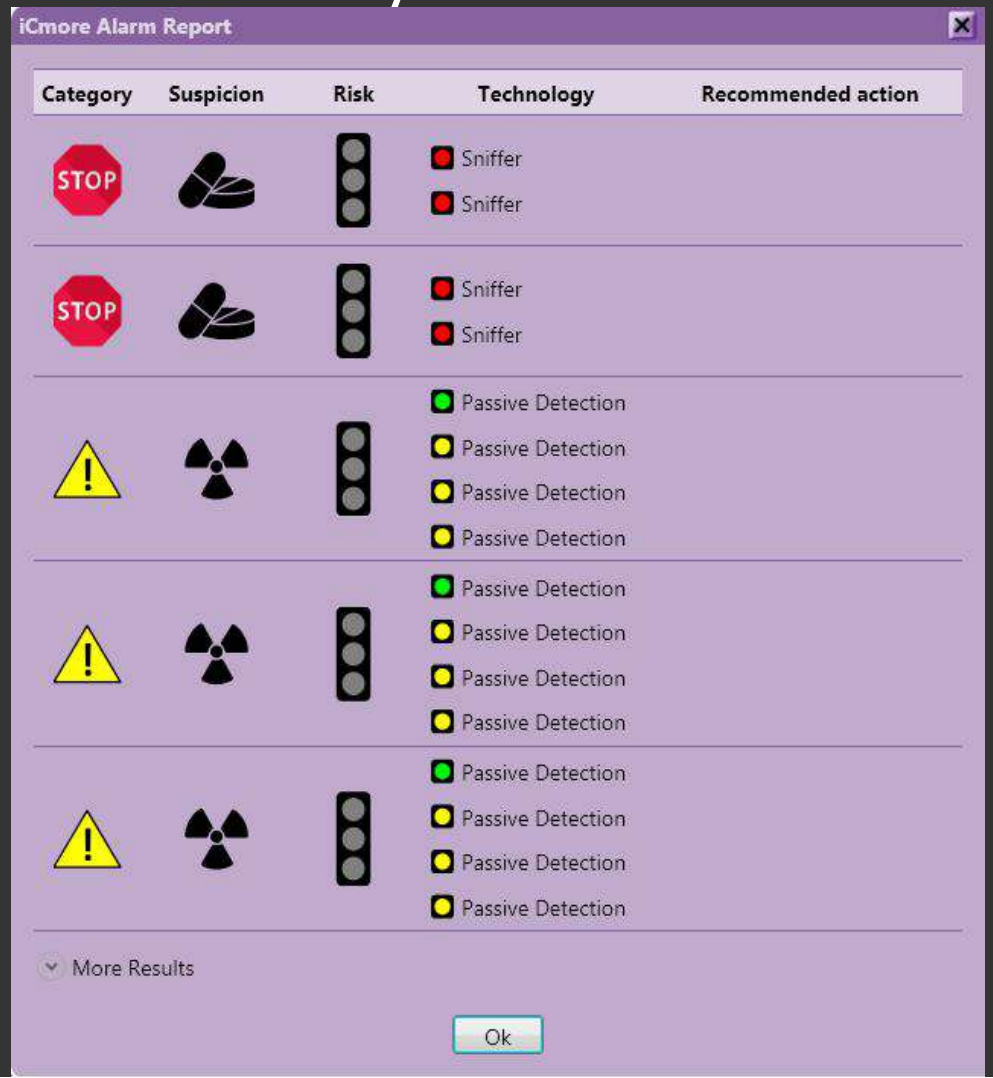
4. **New Secondary capabilities:**

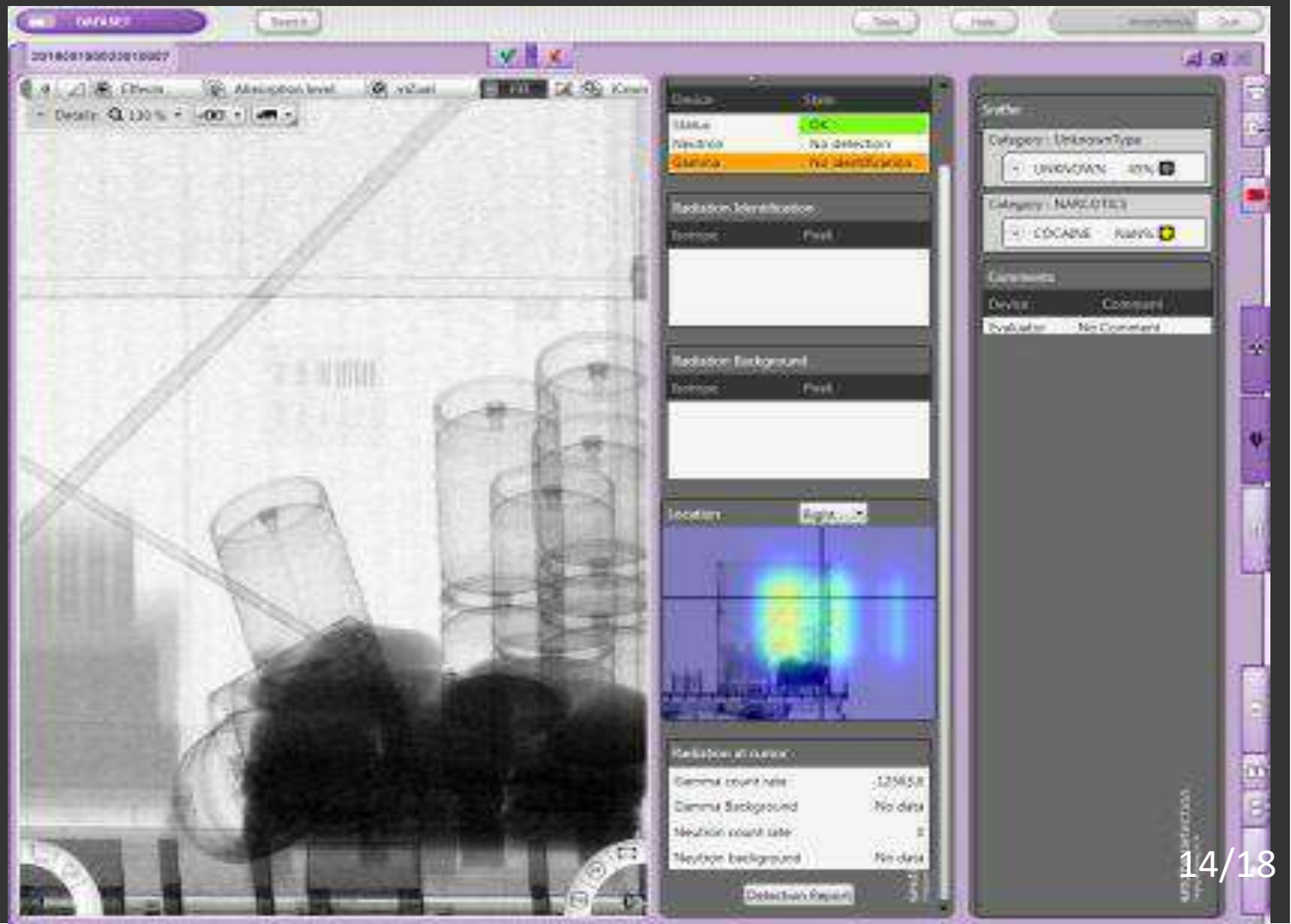
- **TNIS (UP):** Successful Targeted drugs and explosive detection within containers;

- **Photofission (CEA):** Deep penetration successful SNM (**S**pecial **N**uclear **M**aterial) verification within containers;

Summary - Test Experiences: biggest advantage

- Smiths Detection has designed a **common user interface**, based on the X-ray image, in which the results of inspection from the various devices can be viewed by the customs officers.





Overall Evaluation of Field Trials

- Tests were successful with a lot of practical experience for all participants
- Cooperation was excellent between customs and C-BORD partners
- Positive feedbacks from participants:

„I'd like also to tell you that the welcome and the support we got from the customs people was absolutely remarkable. The tests were very well organized and we have produced during these four weeks very promising results for the CBORD project, and to be honest for Smiths as well. We thank you very much to have allowed this."(SERGE)

C BORD Effective Container Inspection at BORDer Control Points

FOSTER – Radiological training facility at EK

- EK developed indoor & outdoor test sites where there is a possibility to held trainings for exploration of hidden, stolen, radioactive sources/nuclear materials at various, hazard changing environmentals.
- Measurement equipments, portal monitors can also be tested

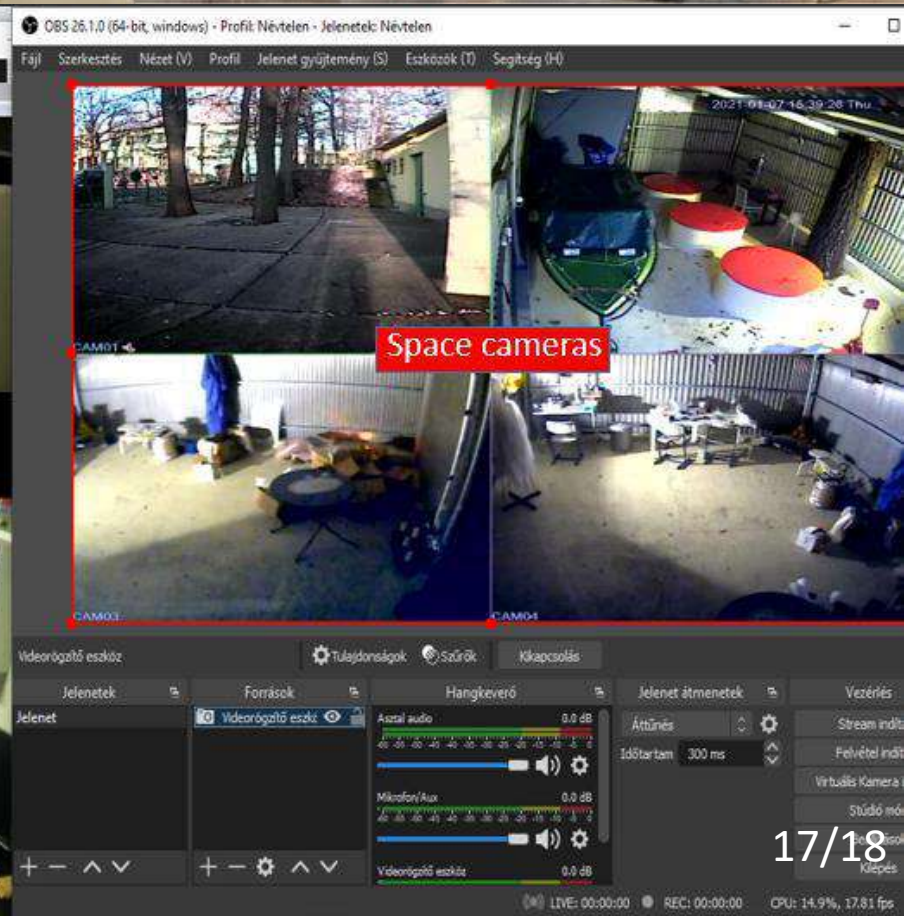
FOSTER

Centre for
Energy Research

First resp**O**nder**S** cen**T**re at **E**nergy **R**esearch on Nuclear Security

Centre for Energy Research

FOSTER



Centre for Energy Research

Thank You for your attention!

Empowering a Pan-European Network to Counter Hybrid-Threats

EU-HYBNET @ INCLUDING JA in Athens

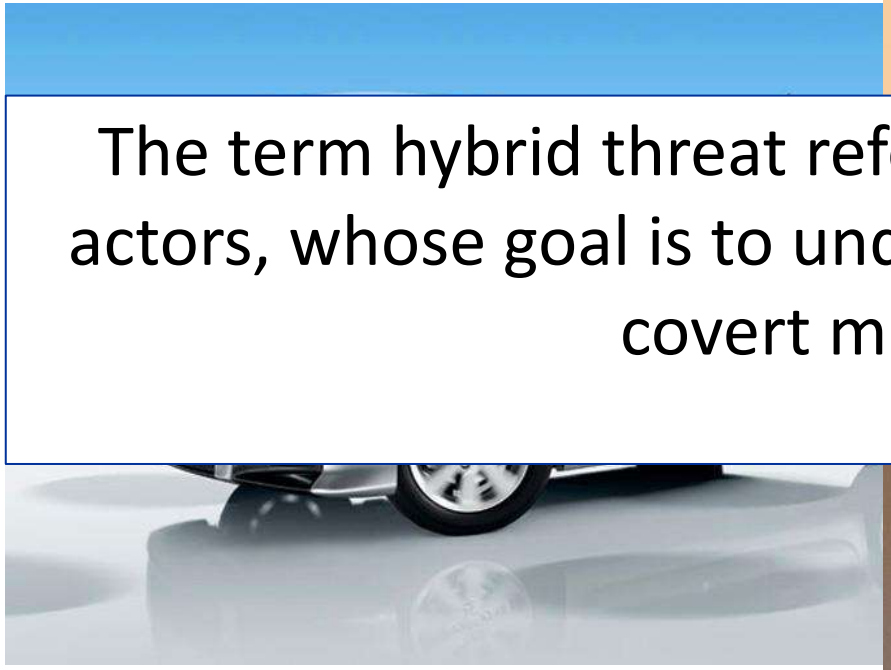
Rachele Brancaleoni/ UCSC, EU-HYBNET Contributor

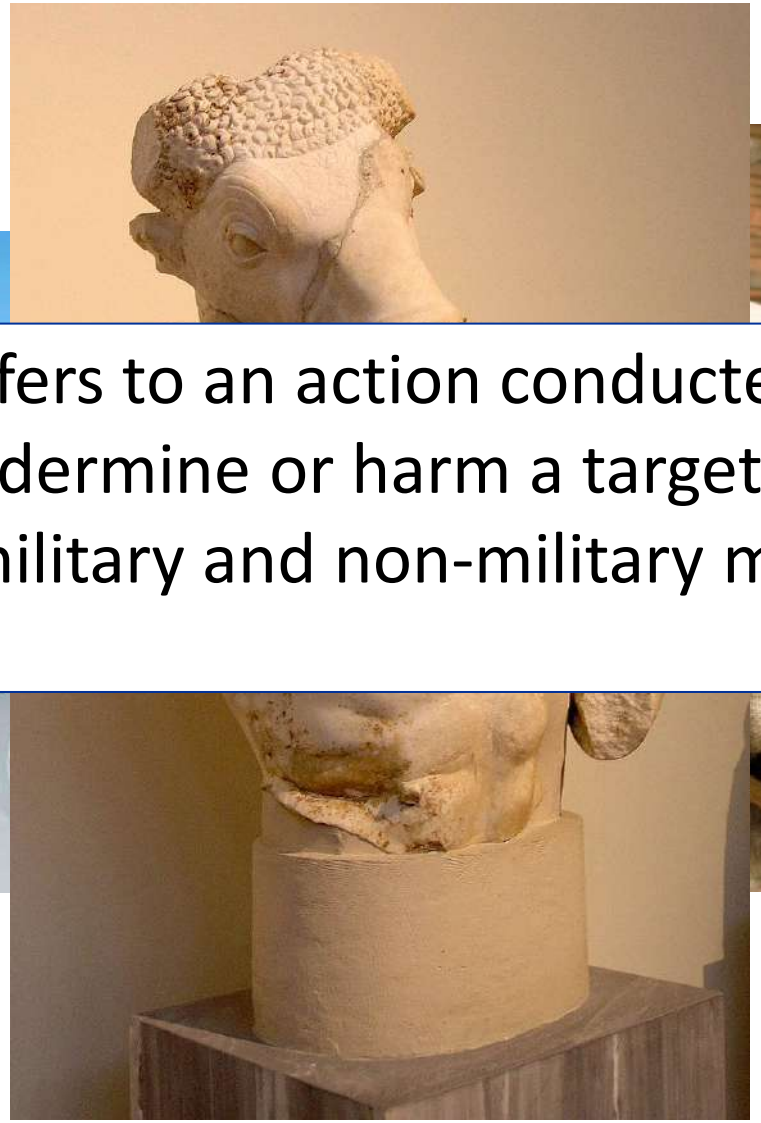
Thanks to Päivi Mattila and Maguelone Laval for their kind support

25th June 2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883054

What is a hybrid (threat)?





The term hybrid threat refers to an action conducted by state or non-state actors, whose goal is to undermine or harm a target by combining overt and covert military and non-military means.

(Hybrid CoE)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883054

Project consortium

- 25 partners
- 14 EU Member States
- Duration 2021-2025

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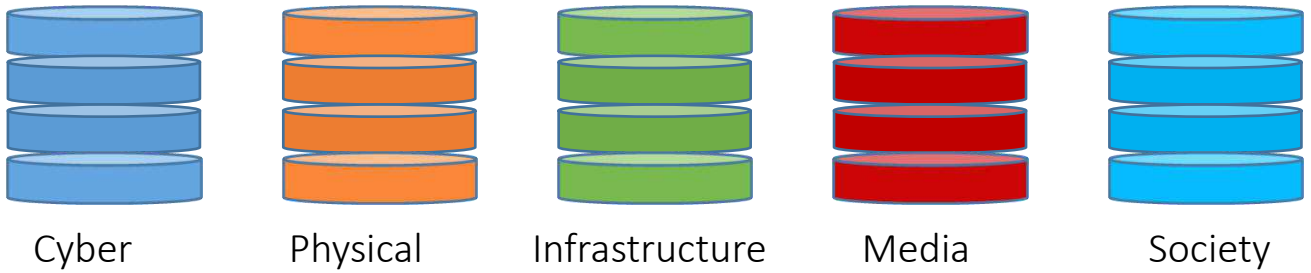
Hybrid Threats: A new security paradigm

- Adversary selects **tools** to achieve **strategic objectives**
  - Tool targets **domains** or the **interface** between them
  - Tool exploits **vulnerability** of **domain(s)** or
  - Tool takes advantage of an **opportunity**
- **Cascading** effect across domains



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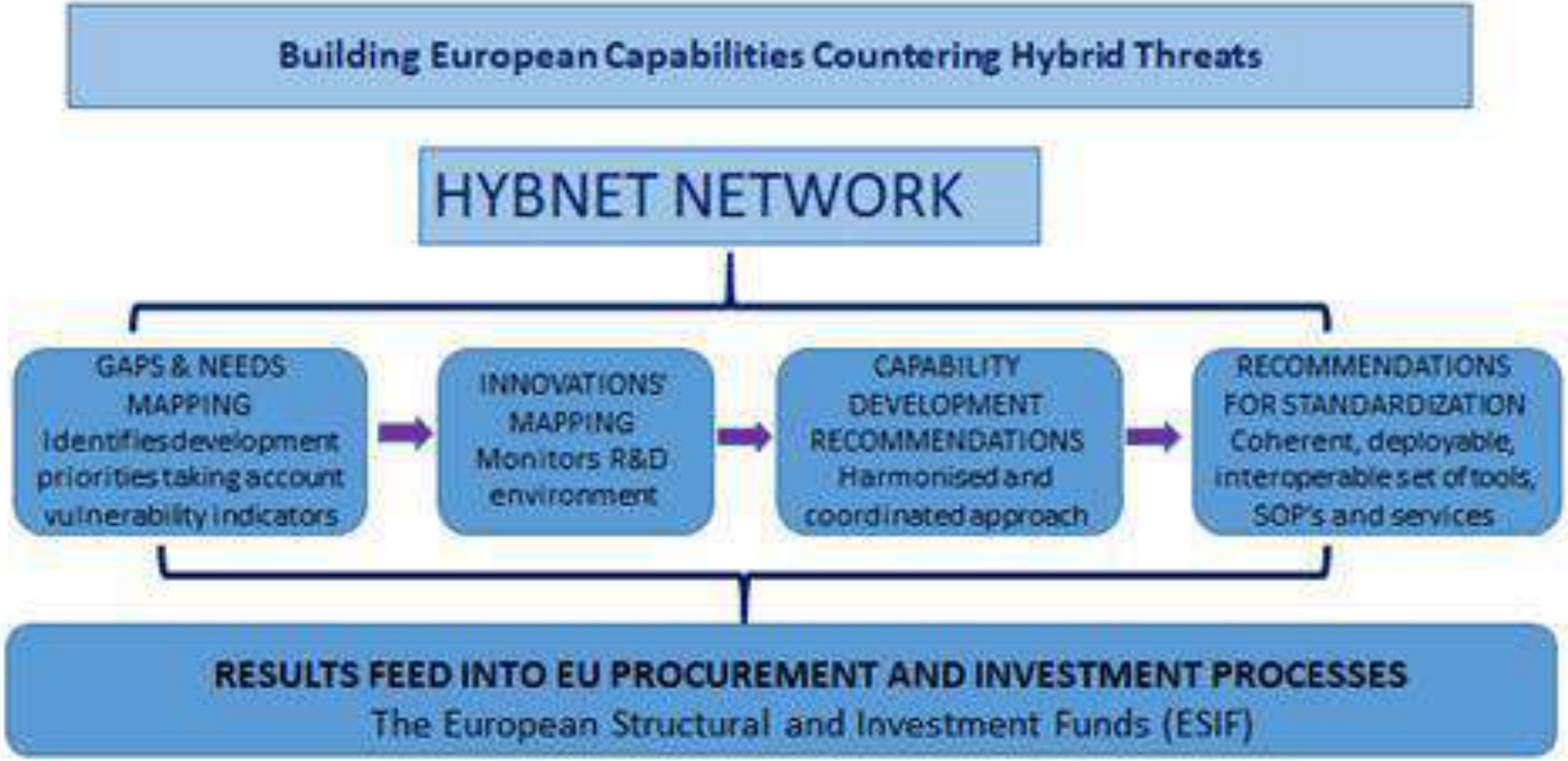
EU-HYBNET in nutshell



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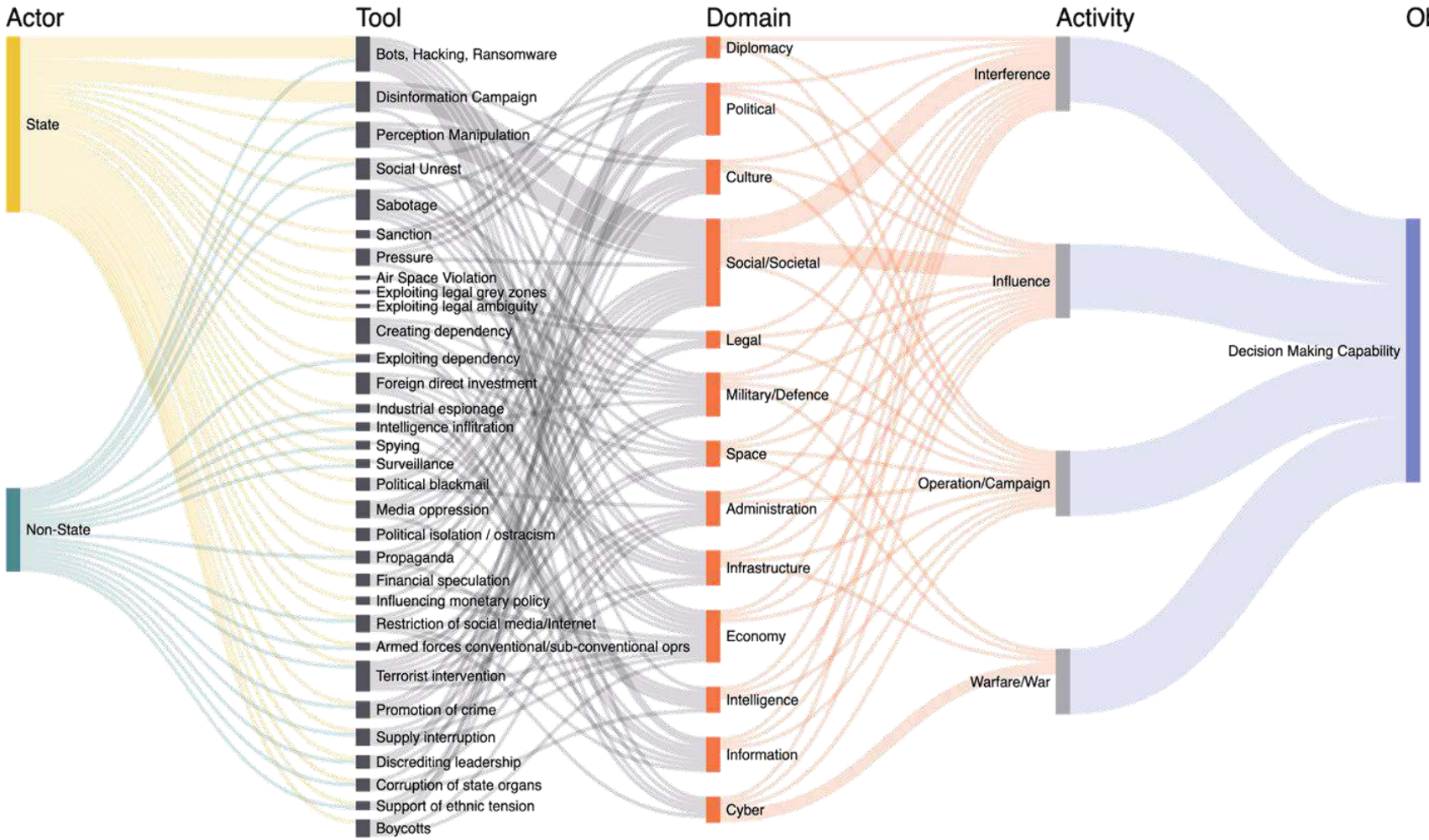
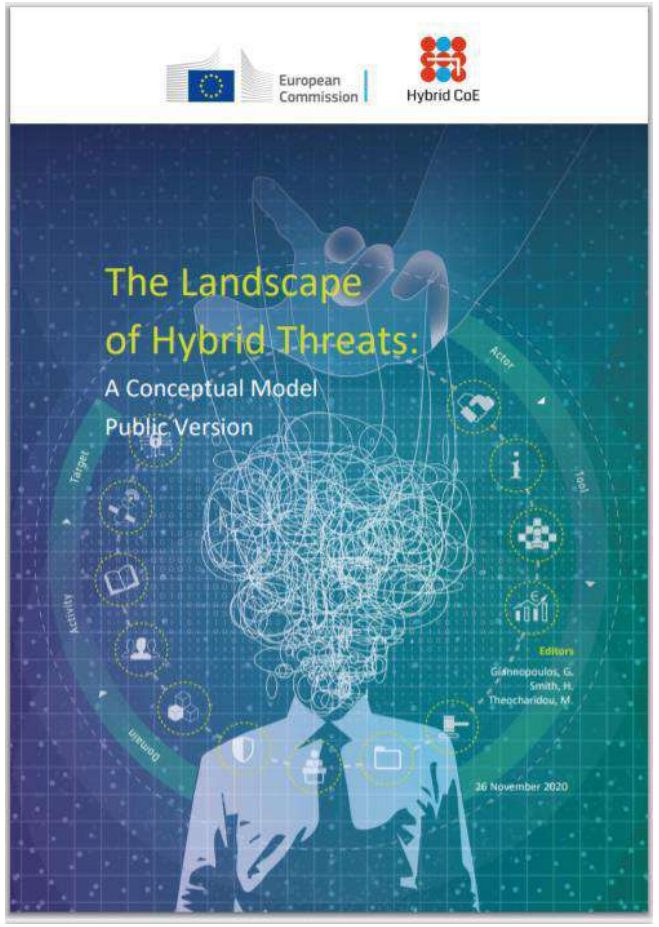
EU-HYBNET - The Conceptual Model to characterise hybrid threats





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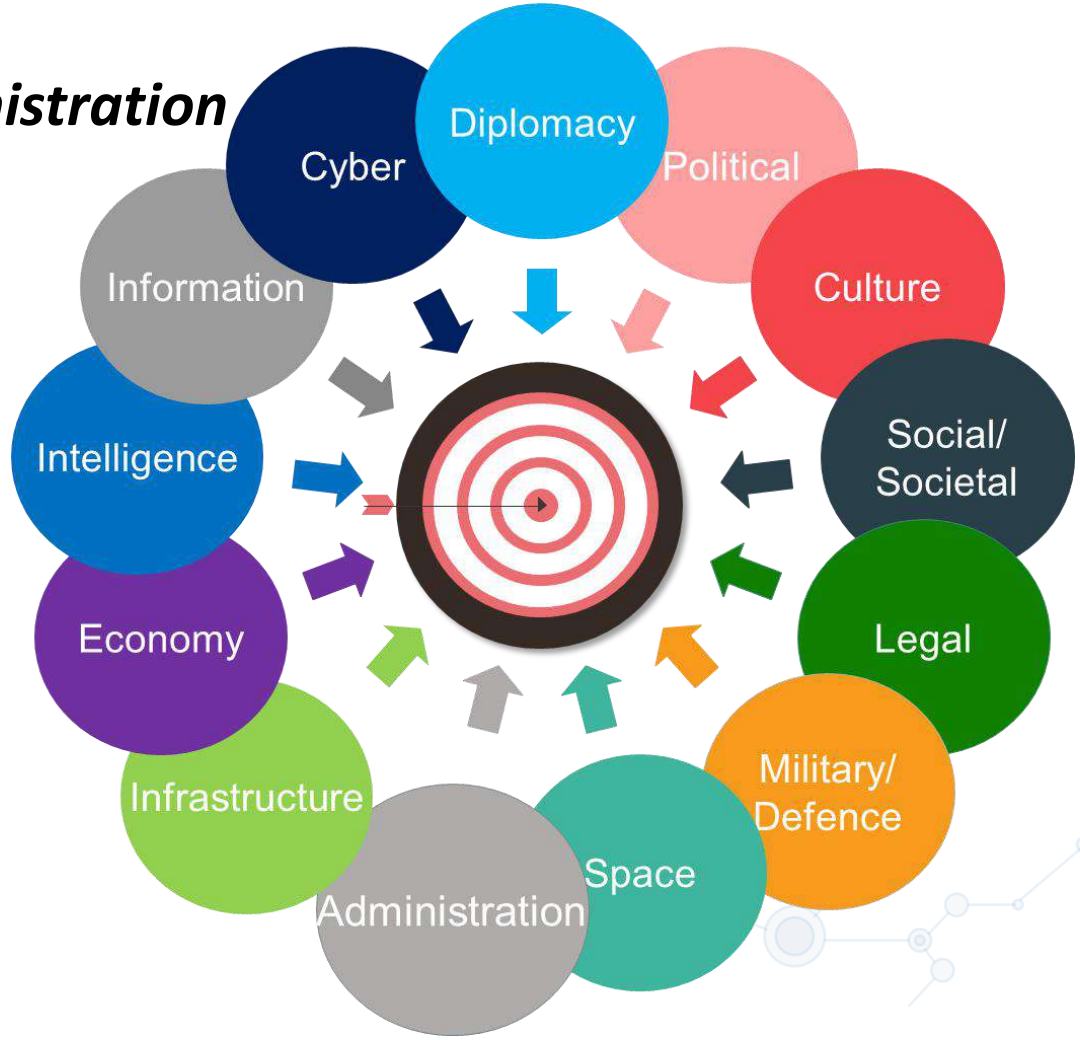
Four Core Themes to Focus on Hybrid Threats in EU-HYBNET

- ***Future Trends of Hybrid Threats***
- ***Cyber and Future Technologies***
- ***Resilient Civilians, Local Level and National Administration***
- ***Information and Strategic Communication***

Building Resilience

Building resilience is the answer to this complex security environment. Resilience in both technological systems and society



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EU-HYBNET process and content

Project cycle 1

Project cycle 2

Project cycle 3

Project cycle 4

Employ measures to identify needs & bridge gaps:
- *Research (R)*
- *Training (T)*

Innovations (I) – current and future
- *Technological*
- *Social and non-technical*

Employ measures to identify possibilities for
- *Standarization*
- *Policy & Innovation*
- *Industrialization*

New European actors join the Network and participate in its activities
- *Practitioners, incl. regional and municipal*
- *Industry and SMEs*
- *Academics*
- *Concerned organizations*

EU-HYBNET membership continually increases with new actors

Final outcome of EU-HYBNET

- Increased mebership of practitioners, industry, SME and academic actors in the European network against hybrid threats
- Research results that foster European actors to take measures against hybrid threats
- Innovations that support European actors to take measures against hybrid threats
- Industrialization and standardization recommendations
- Results feed into EU procurement and investment processes
- Trainings, training material & trained personnel that enhance European capabilities to act against hybrid threats

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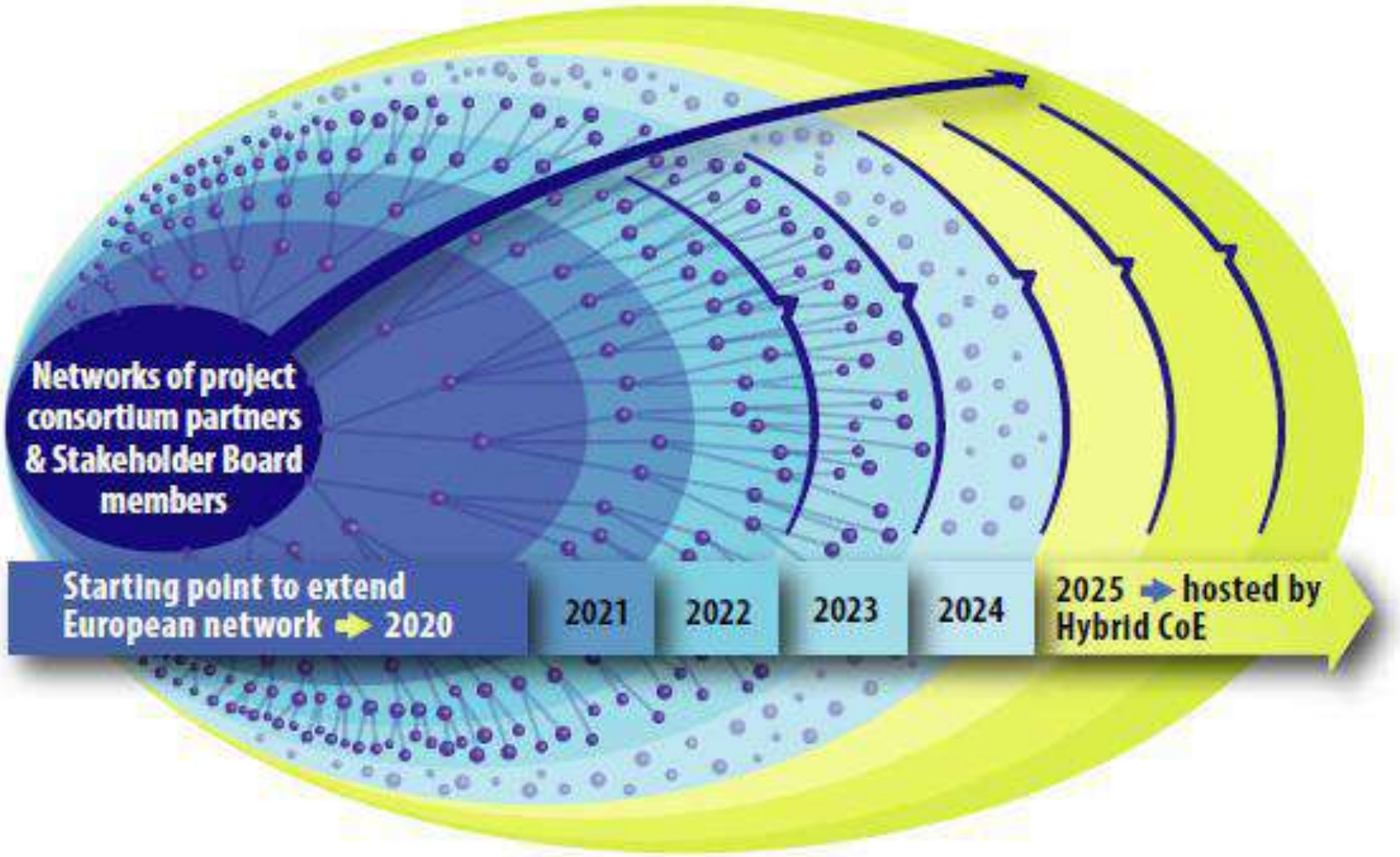
EU-HYBNET Network extension 2020



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EU-HYBNET and INCLUDING

The cooperation between EU-HYBNET and INCLUDING started in November 2020 and it's still fruitfully ongoing.

Through a strong cross-fertilization the collaboration brought an added value to both projects: awareness on nuclear and radiological threats to one side and recognition of hybrid threats and possible implication on the RN area.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883054

EU-HYBNET and INCLUDING: case 1

Unknown accounts start to spread conspiracy theory on social media platforms:

“Police has not done enough to prevent the smuggling of the source”

“Police and government are corrupted”

“Cops are not taking the situation seriously”

“We need new elections now, those who are in the government are incompetent”

“This radioactive source is just the last of many errors and mistakes they did”

Hybrid domain and tool: disinformation

Target: Police, citizens, government

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No. 883054

EU-HYBNET and INCLUDING: case 2

Media stated that EU is not supporting enough member states in preventing illegal trade and smuggling. It is stated that EU legislation is designed to make smuggling easier.

This raise anti-EU mood in the population and news feeds target anti-EU political parties. The goal is to resign from EU and security concerns are used as key topic in the discussion.

Hybrid domain and tool: disinformation, cyber/news feed manipulation

Target: EU, political parties, Government, Citizens

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EU-HYBNET and INCLUDING: case 3

A media channel from the economical competitor state stated that the port is unsafe and highly contaminated, so out-of-service. This information easily spread into the social media platforms. Shipping companies are targeted by this news.

This clearly caused an economical loss for the state. The government and port authorities need to have a media campaign that delivers correct information on the safety of the port.

Hybrid domain and tool: economy, disinformation

Target: state economy

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883054

EU-HYBNET and INCLUDING: case 4

Mr. Smith works at the Crisis Management Authority and he has taken the lead for management of the radioactive source from the port.

A non-state actor prepared a fake Mr. Smith official email account and started sending emails with contrary requests (of the official one) to his colleagues in the field. This generates chaos among the authorities involved.

Weeks after, media were informed of this event and government is accused to have overlooked cybersecurity protection measures. This fuels new discussion on the need for new elections and doubts on the real capacities of civil protection.

Hybrid domain and tool: cyber, identity theft, internal communication

Target: Civil Protection, crisis management, government

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883054

THANK YOU!

Dr. Päivi Mattila, EU-HYBNET coordinator

Laurea University of Applied Science, Finland

paivi.mattila@laurea.fi

https://euhybnet.eu/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883054

PReparedness against CBRNE threats through c**O**mmon **A**pproaches between security pra**CTI**tioners and the **V**ulnerabl**E** civil society

Including citizens and practitioners in CBRNe research & exercises: the PROACTIVE approach

Laura Petersen

UIC Security Division

INTERNATIONAL UNION OF RAILWAYS

14/06/2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 832981

PReparedness against CBRNE threats through c**O**mmon **A**pproaches between security pra**CTI**tioners and the **V**ulnerabl**E** civil society

Topic: H2020 SU-FCT01-2018
Type of program: RIA
Grant Agreement no.: 832981

Time frame: 05/2019 – 04/2022
Budget: 4.97 M€
Coordinator: UIC Security Division

Website: https://proactive-h2020.eu/
Twitter: @PROACTIVE_EU
LinkedIn: PROACTIVE_EU

15 Consortium Partners

8 LEAs
2 practitioners
1 research centre
4 SMEs

Extended Network

82 practitioners
41 civil society stakeholders
3 external ethics experts

Mixed Research Methods

Systematic reviews
Workshops
Online surveys
Interviews & focus groups

31 deliverables

completed

20 deliverables

publicly available on the website

12 countries

9 EU Member States
3 associated countries

Synergies with projects

eNotice, NO-FEAR
ENCIRCLE, TRANSTUN, RESIST, BULLSEYE
EUPROTECT, Healthy Gateways JA
IN-PREP, **INCLUDING**, SHOTPROS, PERSONA
COVINFORM

3 joint field exercises

Germany
Italy
Belgium

Toolkits

Web platform for practitioners
Mobile app for citizens
Policy recommendations

Objectives

Enhance preparedness against and response to a CBRNe incident through:

a better **harmonization of procedures** between various categories of practitioners

Practitioner Stakeholder Advisory Board (PSAB)

and a better articulation with the **needs of vulnerable citizen groups**

Civil Society Advisory Board (CSAB)

Workflow

- **CBRNe terrorism in Europe and beyond**: Human Factors analysis of preparedness and response
- **Engagement** of LEAs and other Practitioners & of the civil society
- **Toolkit** for LEAs, security Policy-makers and civil society
- **Joint exercises**, evaluation and validation of the tools
- **Legal, Ethical and Acceptability Requirements**

CBRNe terrorism in Europe & beyond: Human Factors analysis

Aim	Recommendations

Guidance documents	• Seek to be uniform
	• Provide evidence-based advice about
	  ○ communicating with the public
	  ○ likely public behaviour
	  ○ strategies to increase public compliance
	• Inform responders about the needs of vulnerable groups

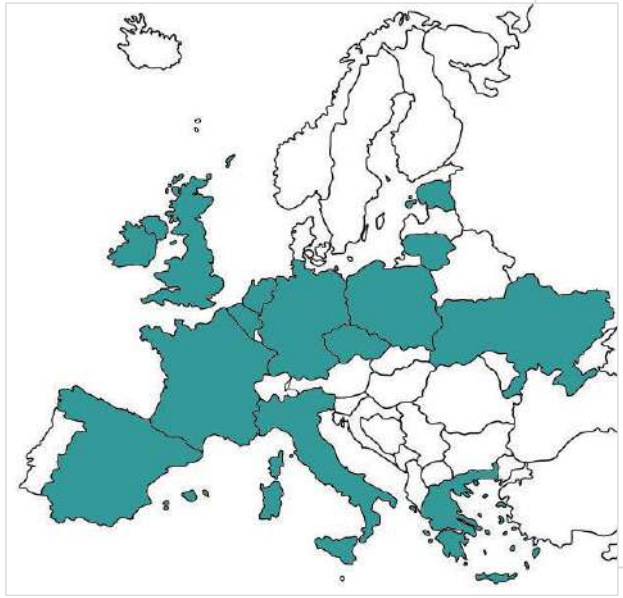
Counter Low Knowledge	• Implement information campaigns & education programmes • Pitch messages at the appropriate level (language & complexity)
Dissemination	• Be honest, empathetic, assertive & reliable • In written form (non-complex) • Via multiple platforms in a consistent manner • Pre-planned
Communication with the public	• Communicate effectively (re: above recommendations) • Inform about loved ones, actions to apprehend terrorist, importance of complying with instructions & delivered by a credible spokesperson • Reduce anxiety by providing self-efficacy • Inform about risks
Vulnerable Populations	• Provide information in multiple languages, pictographic form, and sign language. • Be culturally appropriate by respecting religion and values • Give more consideration to those with mobility issues

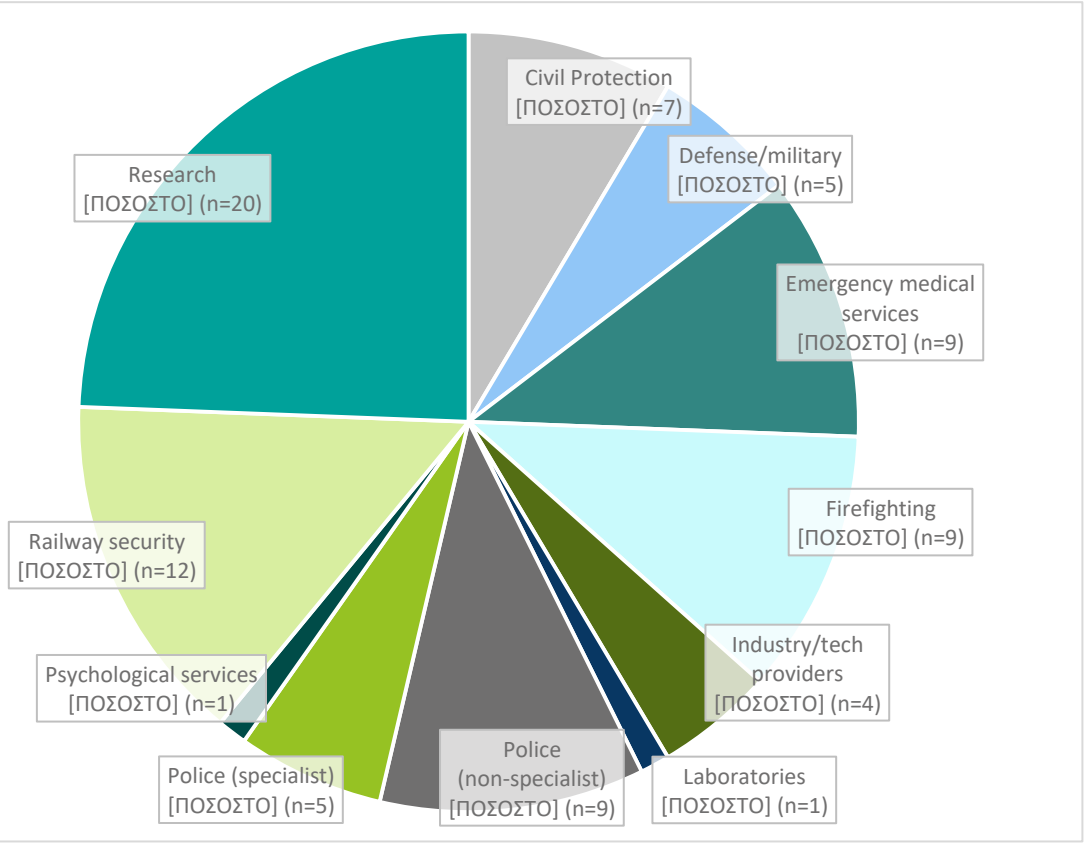
Engagement of Practitioners & of civil society

- Practitioner Stakeholder Advisory Board (PSAB)
  - Panel of experts from different areas of knowledge and Practitioner stakeholders

–> Permanent recruitment

Join us!

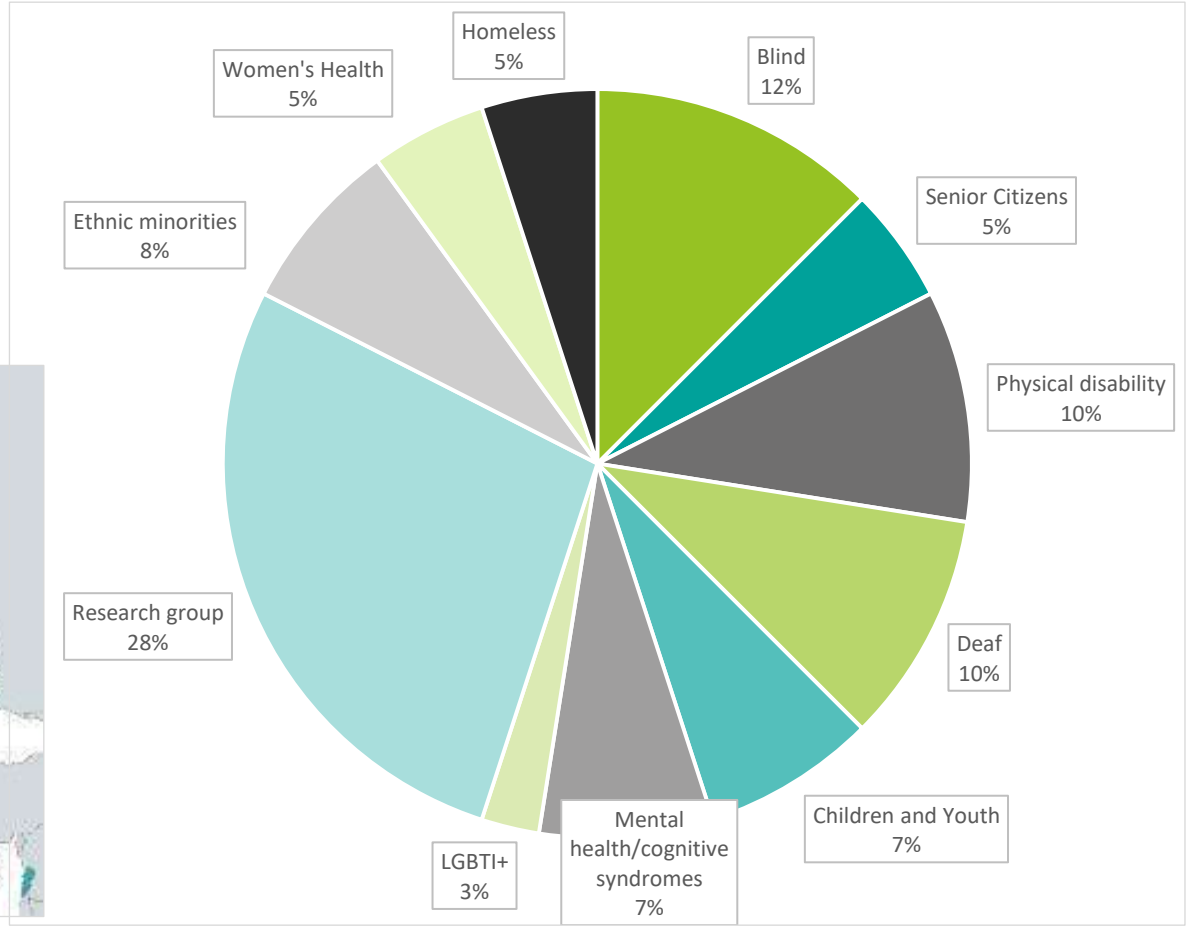




Engagement of Practitioners & of civil society

- The Civil Society Advisory Board (CSAB)
  - Members of the public
  - CSOs to best represent human diversity

  –> Permanent recruitment

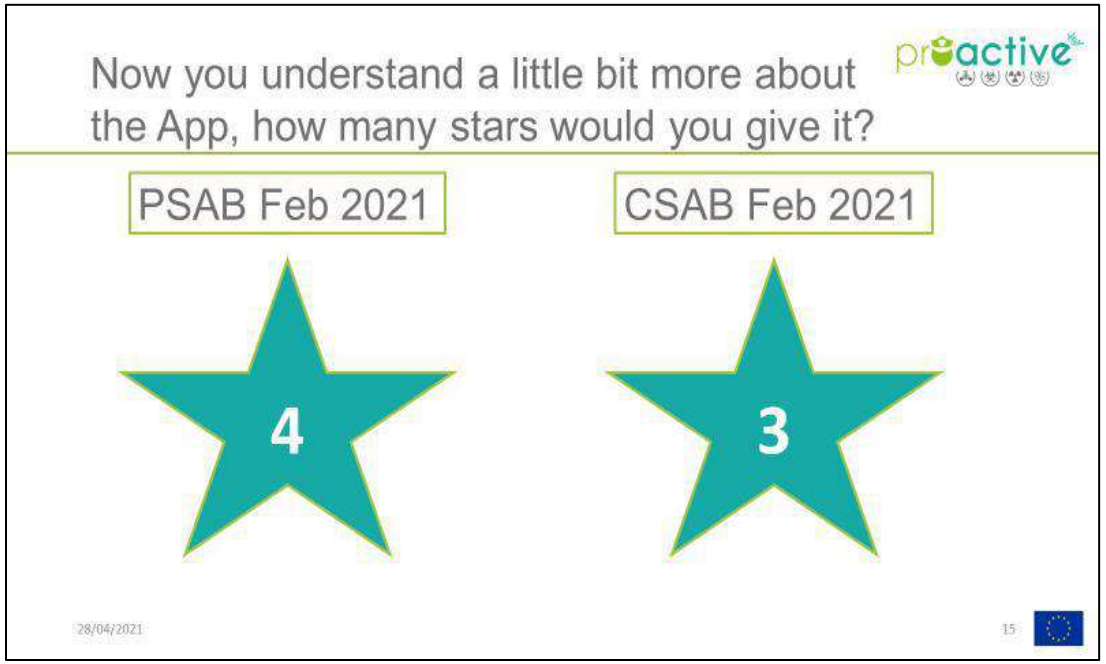


Engagement of Practitioners & of civil society

- Practitioners
  - 223 participants from 23 different countries & 18 interviewees
  - 9 total recommendations, including:
    - SOPs should include information about vulnerable groups;
    - Involve vulnerable persons in exercises;
    - Needs of vulnerable groups need to be addressed in communication strategies;
    - More cooperation between practitioners and CSOs at institutional level.
- Civil Society Orgs
  - 91 participants from 20 different countries
  - 15 total recommendations, including:
    - SOPs should include information about vulnerable groups;
    - Include vulnerable persons in exercises;
    - Responders in PPE should attach a photo to their clothing;
    - Involve carers.

Toolkits for LEAs, security Policy-makers and civil society

- Iterative, co-creation process
  - Workshops held with PSAB & CSAB



Joint exercises, evaluation and validation of the tools

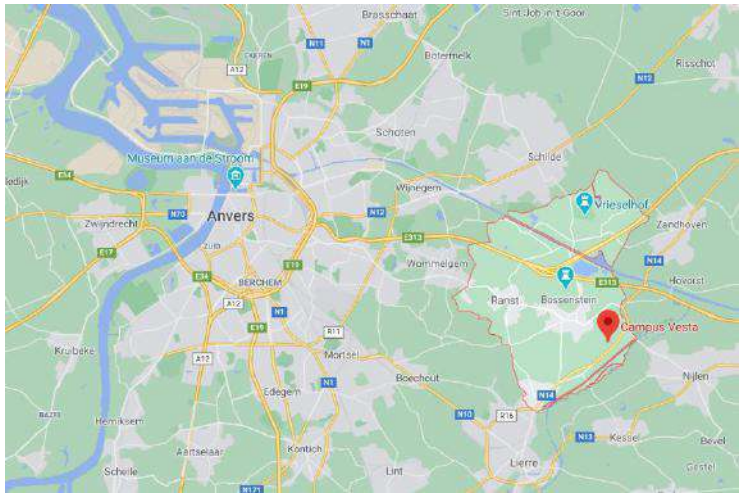
- Three field exercises (dates TBC)
  - Each in a different country
  - Jointly with project eNOTICE
  - Followed by an evaluation workshop

Members of vulnerable groups will participate as role-play volunteers in the exercises

1. Dortmund, Germany (Apr 2022)

2. Rieti, Italy (Oct 2022)

3. Ranst, Belgium (May 2023)



1st Field Exercise
Dortmund (Germany) – April 2022

Main partners: Stadt Dortmund Feuerwehr, DB

- Railway-based scenario
- Scenario based on the release of a Biological Agent
- Focus will be on Specialist Operational Response – decontamination of people and equipment

2nd Field Exercise
Rieti (Italy) – October 2022

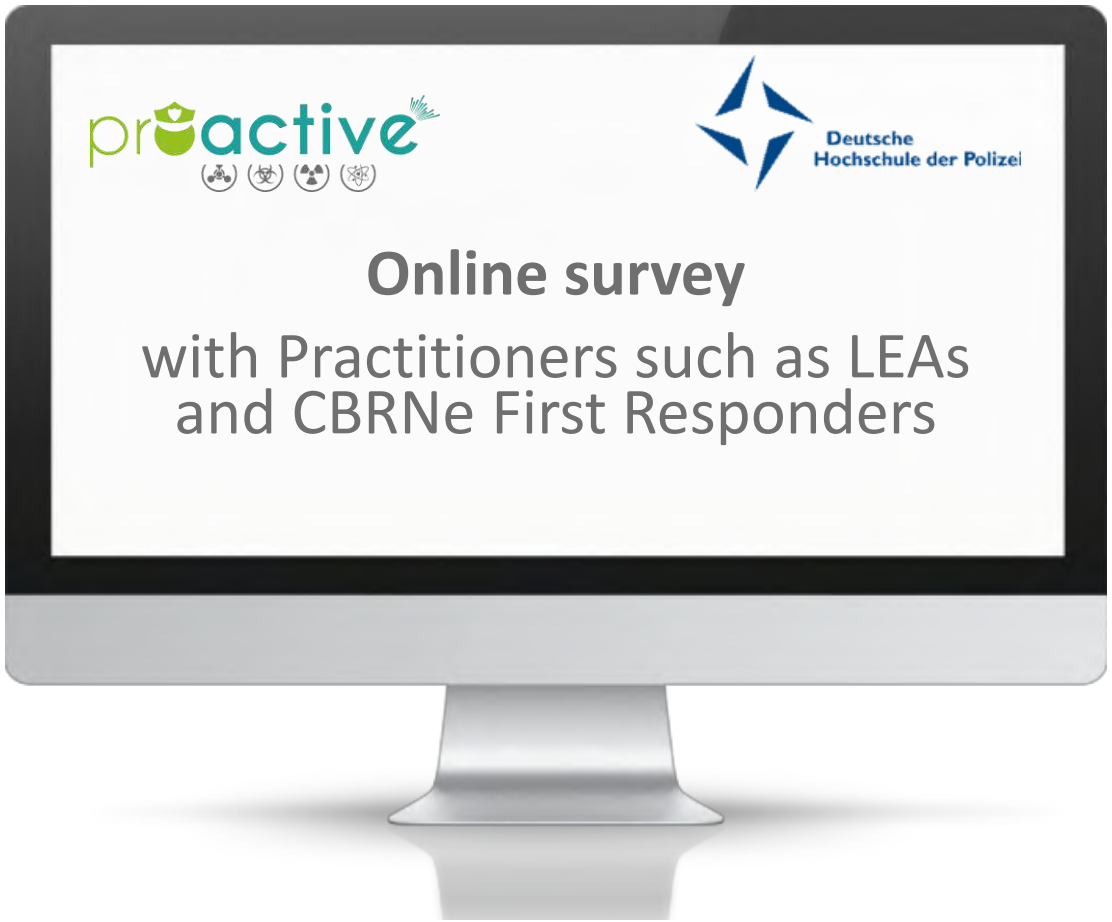
Main partners:

- Railway-based scenario
- Scenario based on the release of a Chemical Agent in a railway carriage
- Focus on Initial Response

Legal, Ethical and Acceptability Requirements

- Involvement of vulnerable groups requires strict ethical oversight
- Consideration for the toolkits (Data Breach Tabletop exercise held)

Ongoing study in May & June 2021
Contribute and share with your network!



- Link to the online survey: https://proactive.limequery.com/951566?lang=en
- **Deadline: 28 June 2021**
- Any queries: PROACTIVE_study@dhpol.de

Please participate!

Thank you

Laura Petersen

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#PROACTIVE_EU

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UrbanAware

A CBRN/HazMat Information Management System for incident planning, training and response

INCLUDING Annual Workshop
25 June 2021

Murray Purves
murray.purves@riskaware.co.uk

RISKAWARE

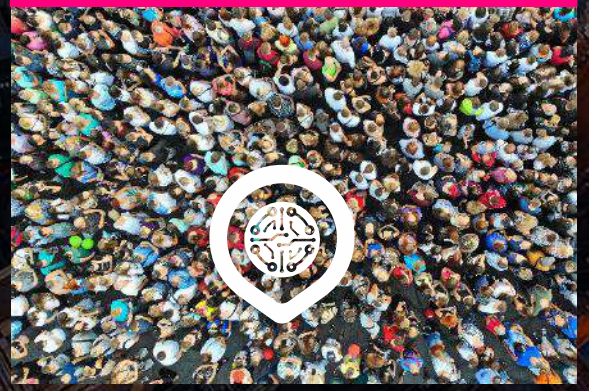
Actionable Intelligence

Riskaware enables informed decision making to help people and governments respond to environmental, human and security challenges worldwide.

CBRN

Marine Protection

Cyber Security

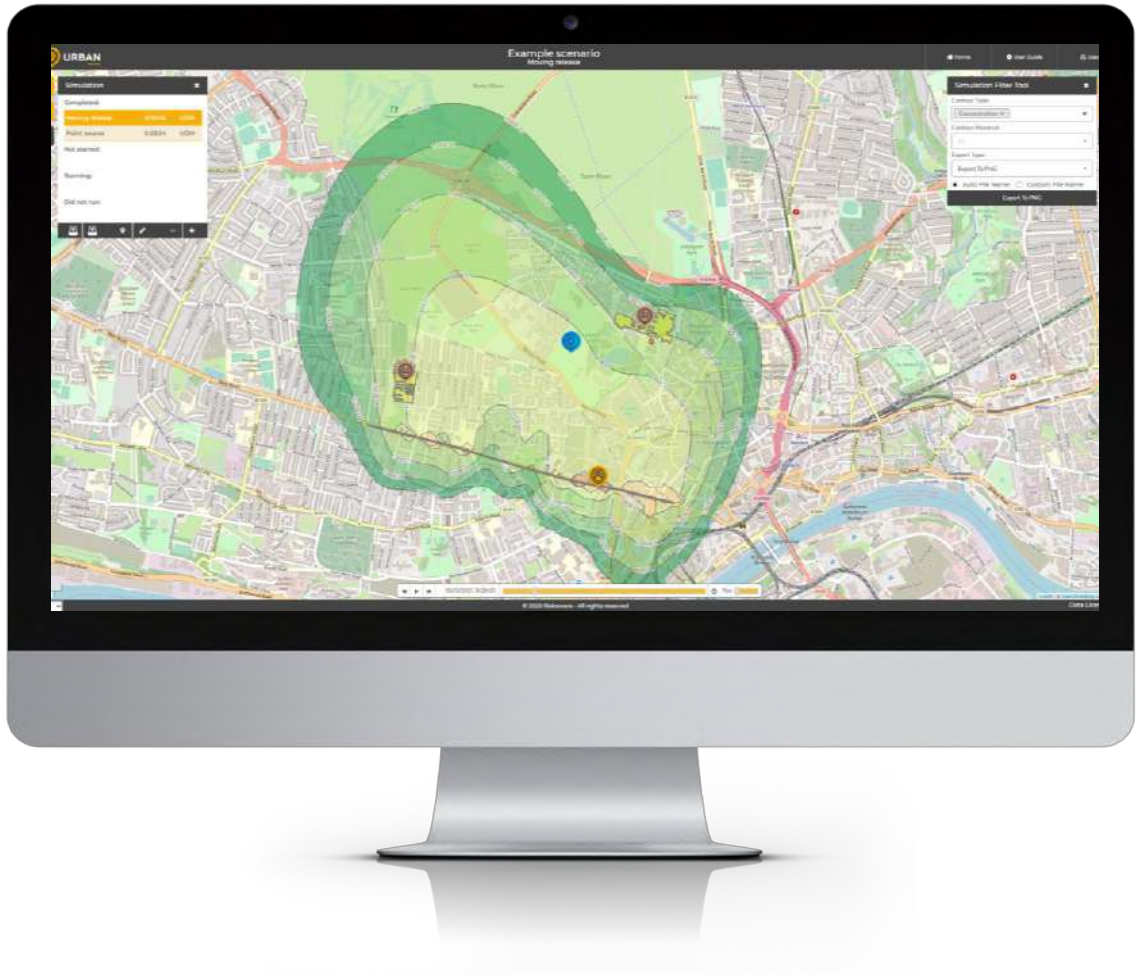


Biosurveillance

CBRN

- 20 years working with Dstl
  - Development CBRN Modelling and Simulation Capability
  - Decision Support Tool
  - Information Management Systems
  - Sole license via Ploughshare Innovations for Dstl HASP Suite
- 20 years working with US DoD
  - DTRA Hazard Prediction Assessment Capability (HPAC)
  - Common CBRN Model Interface (CCMI) standard for JPM IS
- Development of UrbanAware under ESA funding (50%)
  - Next generation CBRN Information Management Capability
  - Underpinned by Dstl HASP Suite
  - Leverages latest space based data services

UrbanAware



- Next-generation CBRN/HazMat information management system
- Aim to bring high quality, high performance, military developed modelling capabilities to a wider audience
  - Accessible to the non-expert
- Modern interface, focus on UX
- Integration with data services/equipment
  - Detectors/sensors, space-based data
- Flexible deployment
  - Cloud, on-premise, local

EuroSIM CBRN

- Develop the UrbanAware demonstration capability
- Apply space-based data to CBRN incident modelling & emergency response
- Integrate with data services and equipment
- Recently funded to add detector integration & additional modelling capabilities
- Under trials with a range of organisations across Europe
- Open-source/processed and space-based geospatial data provided by 4 Earth Intelligence
- Additional support from Thales Alenia Space

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UrbanAware - capabilities

- Applications for analytical (“what-if”) scenarios, training/exercises and incident response
- Predict the transport and dispersion of CBRN/HazMat (UDM)
- Predict the ingress of hazardous materials into buildings (BVIM)
- Model explosive hazards
- Plan responses: cordons, operating locations, shelter/evacuation
- Log key activities undertaken
- Share data with others
  - Desktop/web UI, mobile app
- Visualise and analyse sensor/detector readings
  - Perform modelling based on these data feeds

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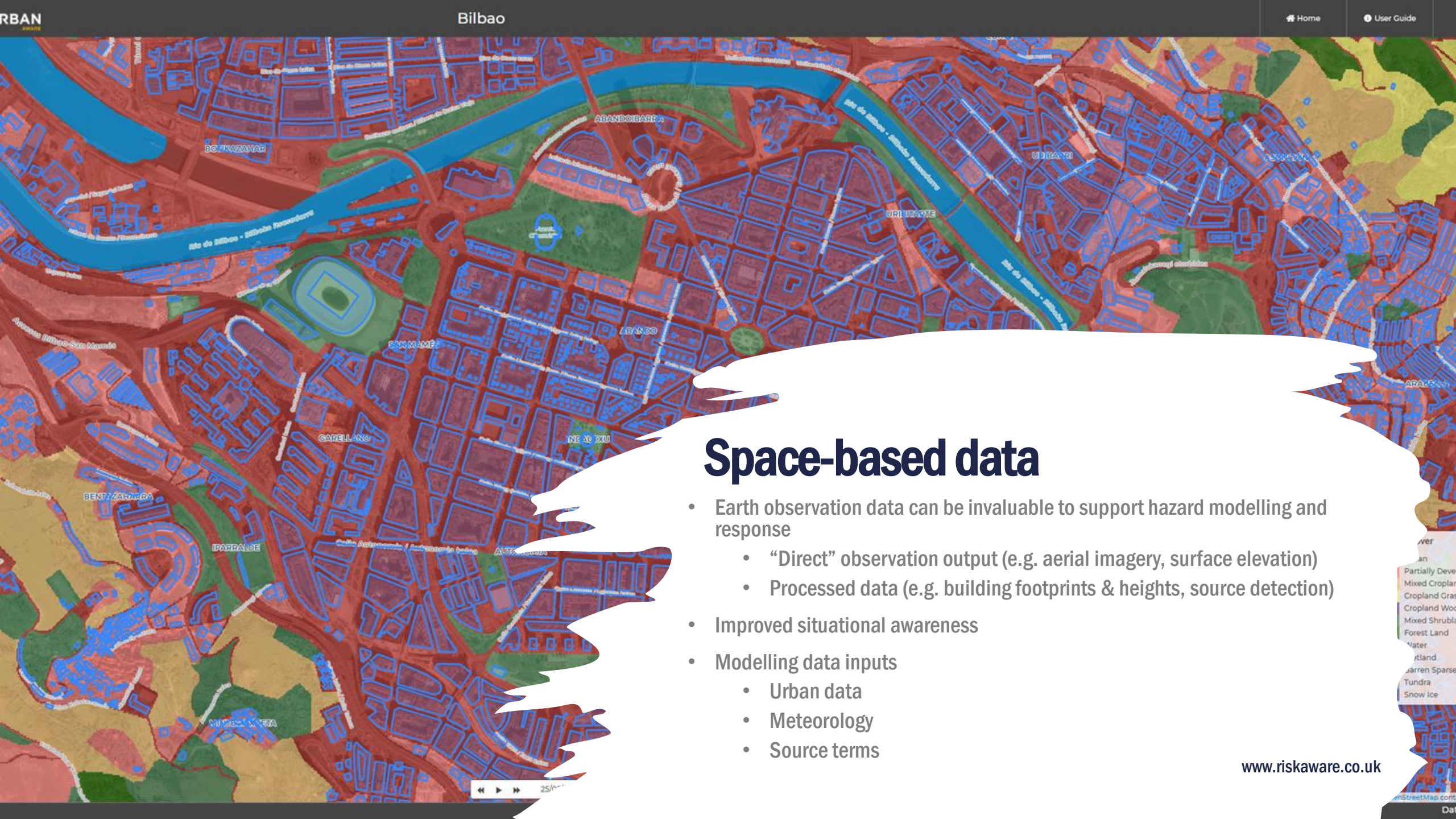
Development status

- Version 0.4.0 of UrbanAware
  - Early beta testing by select stakeholders
- Focus is on analytical workflows
  - “what-if” modelling and analysis
- End-to-end incident modelling capability
  - Urban Dispersion Model – account for the effects of the urban environment
  - Building, Ventilation and Infiltration Model – predict ingress of contaminants
- Automated and user-defined meteorological data
- Integration of space-based and other geographic data
  - Modelling inputs and map overlays
- Basic incident management tools



Space-based data

- Earth observation data can be invaluable to support hazard modelling and response
  - “Direct” observation output (e.g. aerial imagery, surface elevation)
  - Processed data (e.g. building footprints & heights, source detection)
- Improved situational awareness
- Modelling data inputs
  - Urban data
  - Meteorology
  - Source terms

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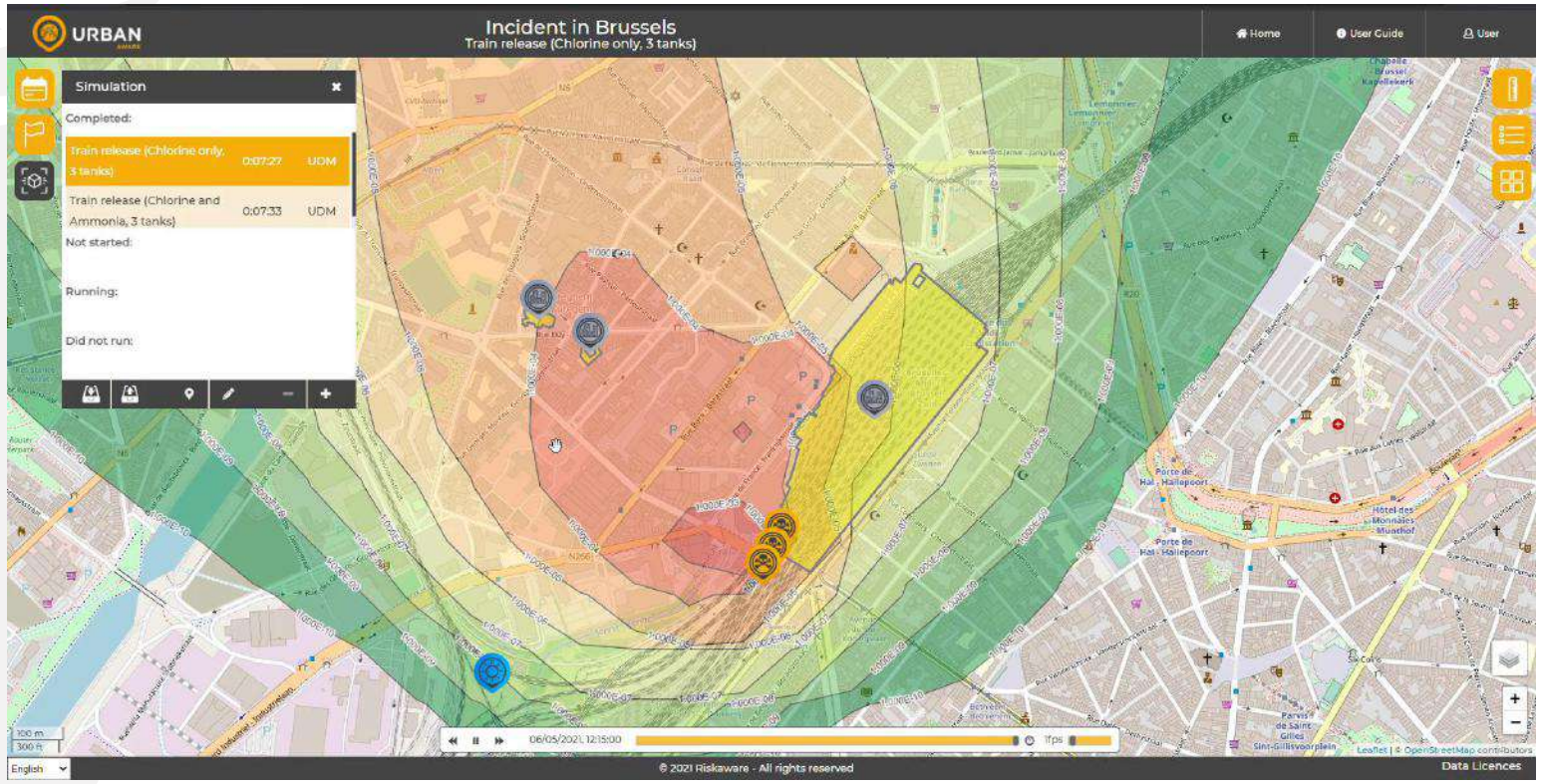
Building data

- 3D building data is a key geospatial dataset in UrbanAware
  - Either from mapping services or custom-built (e.g. for industrial site or port)
- Key input for urban modelling
- Population & other data integrated with it to enhance situational awareness

Building data [2]

- Complementary datasets are used to estimate additional building properties
  - Space-based (e.g. land use, population, other observations)
  - Other (e.g. building age, building type, energy efficiency data)
- Use building usage and ventilation type to configure the BVIM model
  - Estimate infiltration into buildings

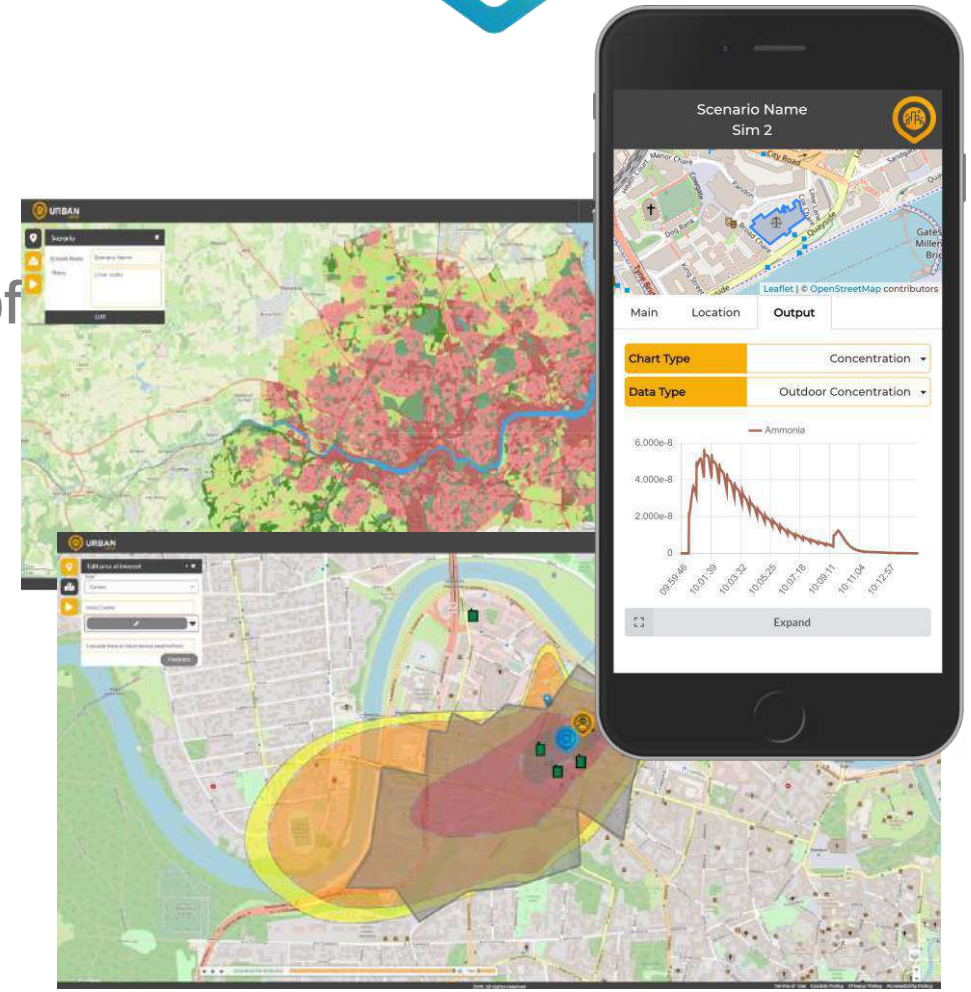


Detector integration

- We have been working on integrating live and simulated detector/sensor feeds in the UrbanAware system
- Prototype presented at EU PRoTECT event in (virtual) Vilnius – 3 June 2021
- Capabilities and opportunities offered by detector integration
  - Early warning and reporting
  - “Live validation”
  - Optimisation of detector deployment (Sensor Placement Tool)
  - Source Term Estimation
- Initial capability funded under EuroSIM CBRN Contract Change Note

Future direction

- UrbanAware is still very early in its lifecycle
  - Under active development
- While we have our own plans and priorities, the direction of UrbanAware development is very much influenced by our stakeholders
- We are actively seeking funding to develop additional capabilities that meet more needs
- Some current priorities
  - Operational/response tools: integration with mobile app, operational overlays
  - Event log
  - Sensor integration
  - Data sharing and export
  - Integration of additional models and capabilities



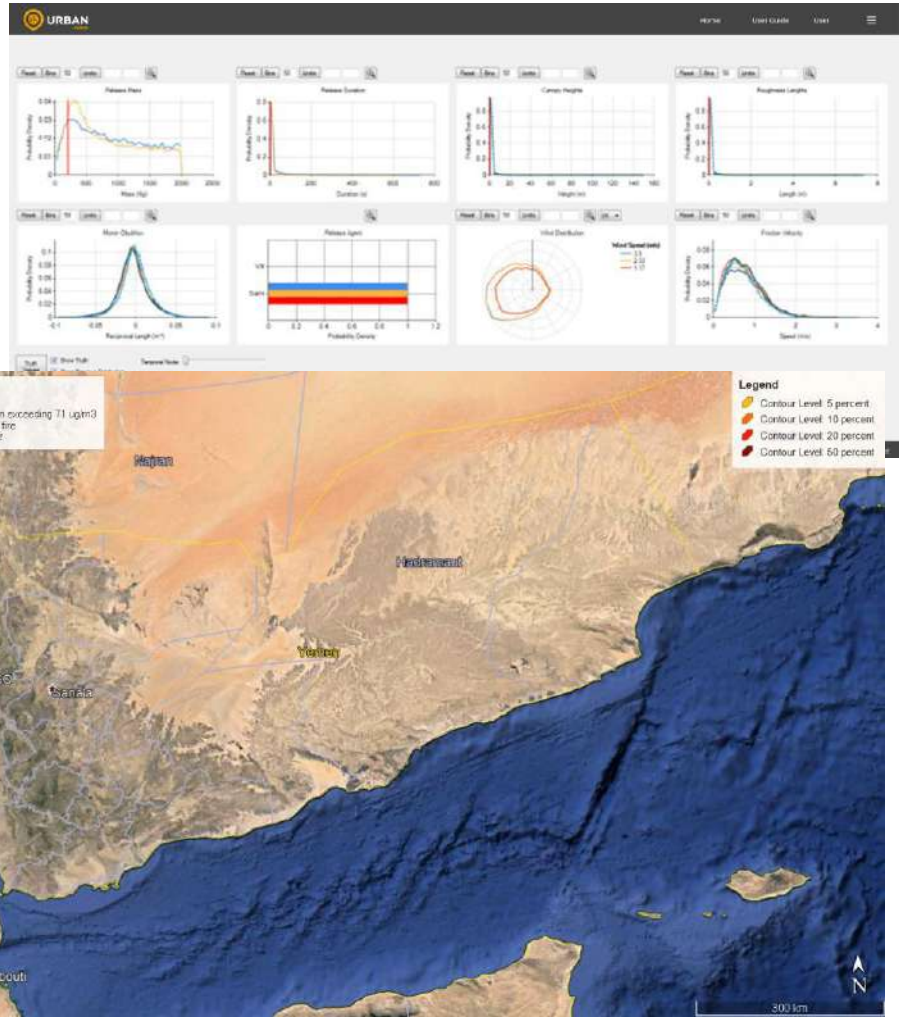
Future: Integration of additional modelling capability

HASP capabilities

- Sensor Placement Tool – optimise deployment of detection assets
- Source Term Estimation –predict location & characteristics of unknown releases

Other models

- Incident Source Models – explicitly model more events causing material release
- HYSPLIT
  - Long-range dispersion modelling (regional/national/continental sca
- Radiation transport models



Contact

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URBAN
AWARE

Security of Explosives pan-European Specialists Network

Evolution of Threats and Strategies of attacks with exlosives

Ioannis Daniilidis, Dr

Center for Security Studies - KEMEA

INCLUDING 2nd annual workshop
24-25.06.2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 786805

EXERTER Network

- The H2020 project EXERTER connects practitioners and experts into a pan-European network of explosives specialists.

- **The network aims to:**
  - Highlight innovative methodologies, tools and technologies that will offer solutions to enhance the overall Security of Explosives
  - Discuss and highlight needs, solutions, issues etc. within the network and community
  - Be a link between actors; manufacturers, academia, research and practitioners, to support development and exploitation

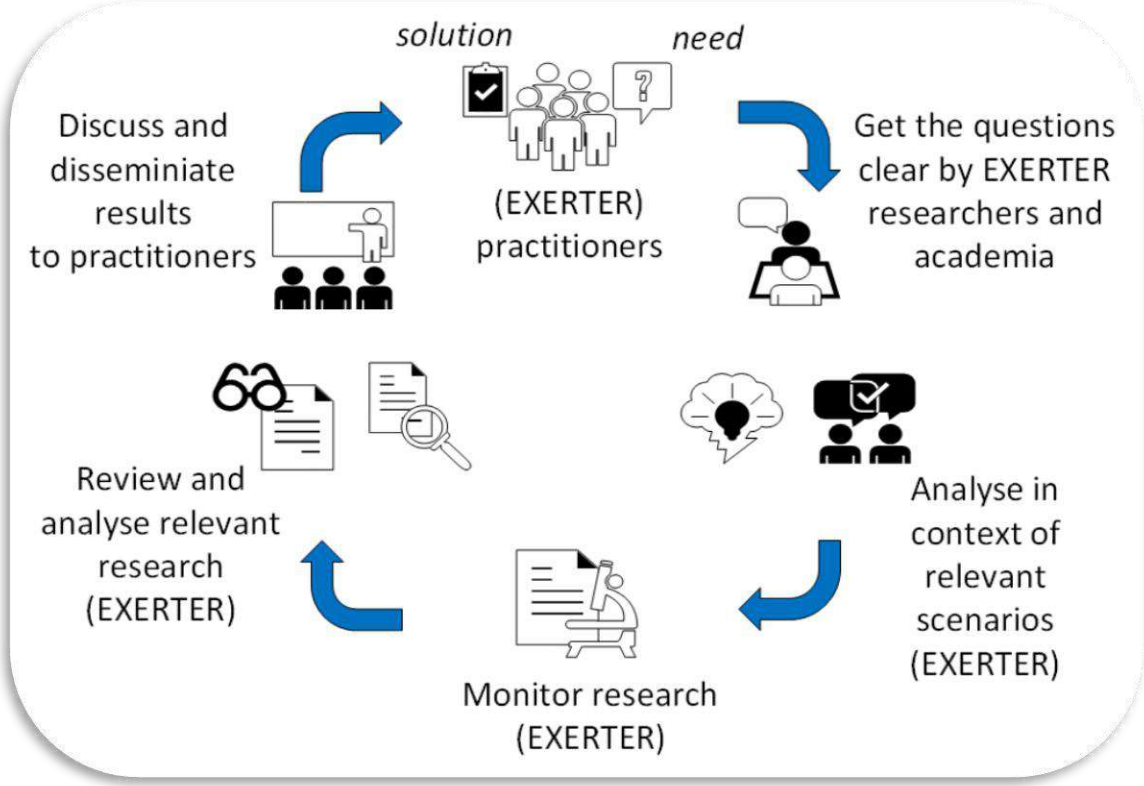
Project work

- A yearly set of scenarios are used to focus the discussions on selected topics.
  - Review of research initiatives, looking at standardisation and certification, market screening and evolution of threats
  - Discussions with stakeholders at several occasions
  - Presentation of outcomes at the annual EXERTER Conference
- Cover large part of the course of events by using four different response domains:

Project work

- Reviews of initiatives within project (research, standardisation etc.)

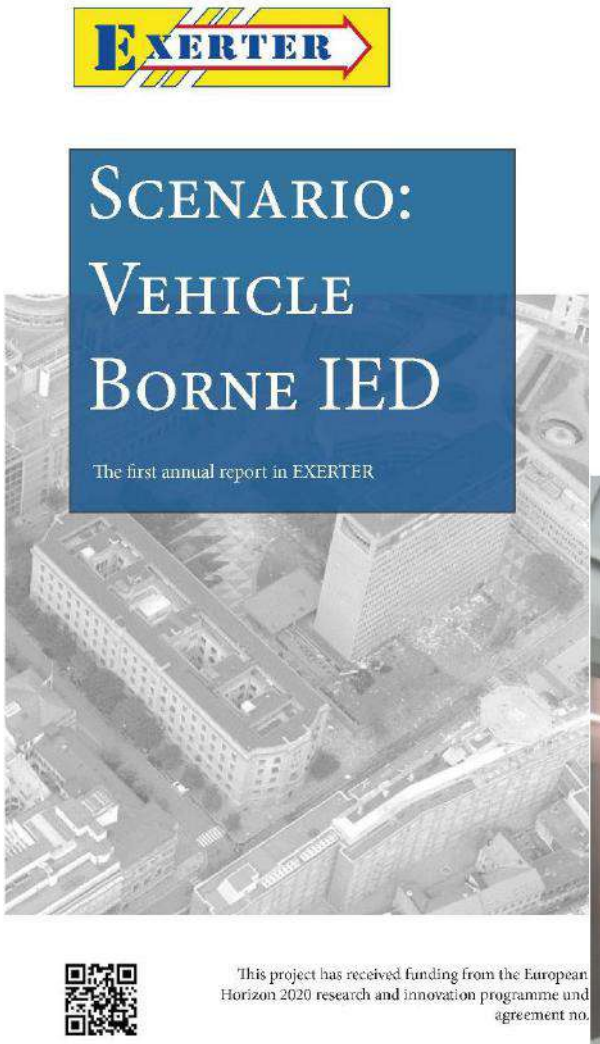
- Networking activities/involvement of practitioners and stakeholders
  - Workshops
  - Conferences
  - Webinars
  - Webdiscussions
  - Discussions with EC, other projects, etc.
  - Newsletters

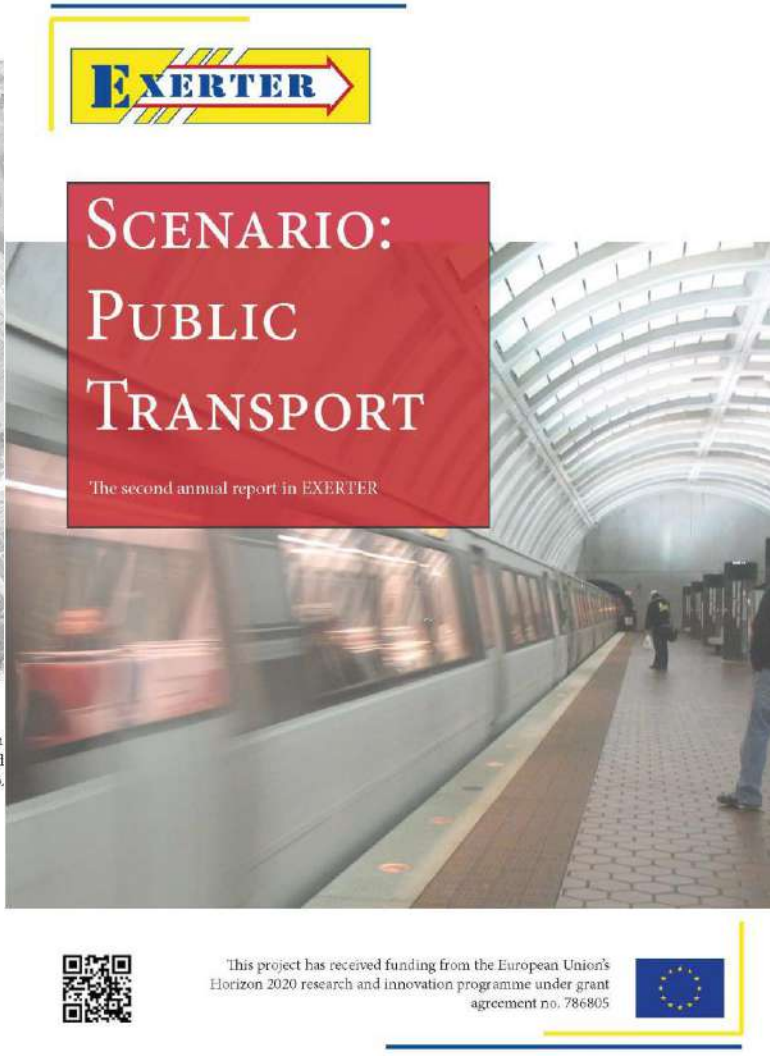


Selected outcomes

- Discussions on needs and possibilities through workshops and discussions
- Input regarding future priorities, research needs, technical developments etc. have been brought up within network and shared
- Experiences and knowledge have been shared within the community at Conferences, Webinars and Newsletters

Yearly summaries of outcomes available on www.exerter-h2020.eu





Selected recommendations

Training:

- CCTV operatives and security staff to identify suspicious behaviour related to IED attacks
- First responders identify and notice the presence of potential secondary devices
- Training courses and guidelines for vehicle screening operations

Automatic license plate and vehicle security cameras:

- Database system for automatic identification of vehicles (ability to alert for various events)
- Automatic alert in case of presence of an unauthorized vehicle
- Information (e.g. illegal parking) shared with LEA officers

Methods to identify suspicious behaviours (people, vehicles):

- New ways of raising citizens' awareness
- Develop automatic systems for controlling and reporting.

Driver Identificat
facial reco
with CCTV

- Database (suspicio vehicles)
- Quick information shared with LEA officers

And finally, stand-off detectors (traces, bulk, anomalies, non-chemical components, etc.) (e.g. for unusual chemical signals)

Examples of possible future initiatives:

- Developing procedural standards, design guidelines and certification of protection guidelines
- Developing mobile structural components for reducing blast wave effects
- Process to integrate physical security into the common design process
- Making existing solutions available and research results easily accessible to end users
- Basic research on physical security aspects of new façade components and load bearing

Research on organizational measures is suggested regarding:

- Measures to reduce congestion in train/metro stations
- Evacuation concepts in case something suspicious is detected, for example based on existing emergency plans.
- Training of train crews, train station staff and first responders (police, fire-fighters, ambulance, bomb squad) with respect to fast evacuations, care about injured persons, prevent further attacks and IED neutralisation.

Proposed research initiatives in the REACT domain:

- Stabilize phone networks to avoid collapse in the aftermath of a terrorist attack.
- Improved surveillance of public spaces will help the forensic investigation after an attack.
- Standoff detection of secondary devices and leftover HMEs at the scene.
- Simulation tools that facilitate forensic investigation.

Potential areas for further study:

- Stricter regulations for commercial explosives
- Permanent markings on/in explosives and detonators
- Carriage of explosives not listed as "high consequence" dangerous goods in the ADR treaty
- European guidelines for training of explosive detection dogs
- Increased system/use of detection markers and ID taggants

Objectives

- *“EXERTER will provide recommendations to practitioners regarding attack strategies extrapolated from recent incidents and the use of new threats to be able to develop plans of how these can be matched with emerging technologies and to develop tools to close gaps and enhance future exploitation of new technologies. ”*

- The study of past terrorist attacks, as well as possible of attacks occurring during the time of the project, in order to draw conclusions on new trends and patterns of threat and attack strategies and to extrapolate these into possible predictions of future events.

Response Domains

Prevent

- Inhibition
- Technical Intell.

- End Users
  - Police
  - EC
  - Ministries
  - Intelligence services
  - Industry
  - Contigency agencies

Detect

- Detection

- End Users
  - Transport organisations
  - Aviation industry
  - Security organisations
  - Police patrolling
  - Infrastructure protection providers

Mitigate

- Protect
- Neutralise

- End Users
  - Bomb squad
  - Police
  - Fortification agencies
  - Contingency agencies

React

- Post blast analysis
- Forensics

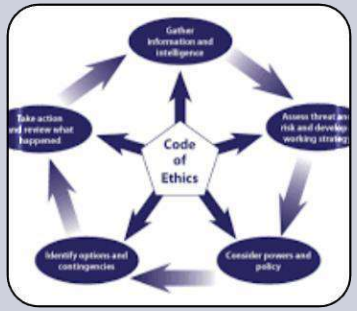
- End Users
  - Forensics Labs
  - Forensics Institutes
  - First responders
  - Law enforcement
  - Judiciary

Potential Scenario: Use of IEDs

PREVENT

Reporting

Early Identification of Threats



Decision Making Tools

Control of Precursors

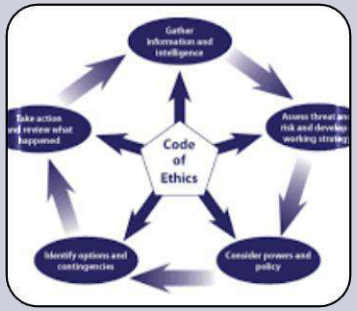
Identification of Future Threats

Identification of potential Perpetrators/ Intelligence/ Specialist Investigations

Given the scenarios presented, how would you prevent an attack?

Potential Scenario: Use of IEDs

DETECT



Decision Making Tools

Identifying Perpetrators

Identifying Threats

Tools or techniques for discouraging attacks

EU Legislation contributing to improved security

Identifying potential capabilities, technologies and equipment which could be useful for detection of explosives

What could outcomes help your organisation?

Potential Scenario: Use of IEDs

MITIGATE

Structural – Counter IED measures for businesses & buildings

Organisation - Training

Organisation – Supporting business owners/ members of public

Organisation - IED neutralization

Organisation

Improved security techniques

Structural - Blast mitigation design for ATMs

How could you improve your current capabilities for mitigating the consequences of an IED Attack?

Potential Scenario : Use of IEDs

REACT

Search methods for secondary IED and/or additional perpetrators

Handling IEDs

Coordination of various agencies and rescue personnel

Evidence collection methods

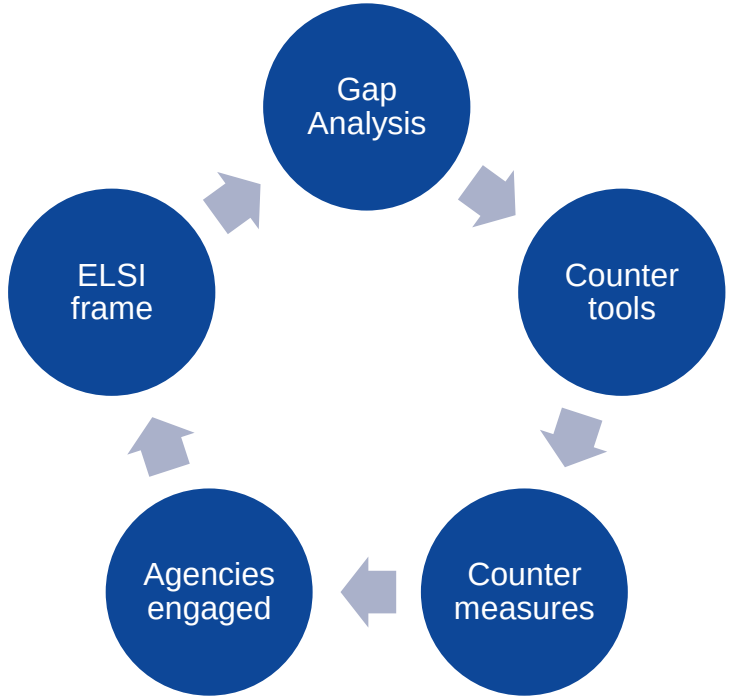
International Information exchange in forensic matters

Support to the legal processes

How could you improve your current capabilities and processes when reacting to an IED Attack?

Prevention and Protection Plan

- ***Prevent:*** *Detection, monitoring and elimination of the terrorist phenomenon, hindering the emergence and proliferation of radicalization phenomena*
- ***Protect:*** *Strengthening of the security measures to reduce vulnerabilities*
- ***Monitor:*** *Enhancement of the analysis and terrorist risk-assessment capabilities*
- ***Respond:*** *Necessary coordination channels to minimize the consequences of an attack and re-establish normality.*



Pillars for potential scenario analysis

Target of attack

- What is the target of an attack?
- What is the motive?
- What is the message through this target?
- Soft targets, mass gathering locations

Threat

- Perpetrators:
  - Lone wolf actor / low profile
  - “Wolf pack”
  - Terrok (fusion of classical terrorist and amok runner)
  - Individual criminal entrepreneurs offer Crime-as-a-Service (CaaS)
- Technology as an enabler

Vulnerabilities

- Lack of secure infrastructure and resources (human and structural)
- Legal and ethical framework; policy implementation for safeguarding public sites
- Intelligence info not assessed and evaluated properly
- Urban environment landscape (access by first responders)

Attack strategy

- Lone wolf perpetrator or synchronised small group attack
- Low tech weapons; minimum preparation
- High tech weapons (e.g. drones, Radio-controlled IED etc)
- Attaching an explosive device to the body of a victim is a new modus operandi

Intention + Capability + Vulnerability = Probability

Evolving Threat of Explosives

- *Shift from the previously predominant use of TATP to a broader range of homemade explosives (HME), such as black powder, chlorate mixtures and fertilisers-based mixtures.*
- *Increased use of pyrotechnic mixtures (mainly fireworks) is observed, which are obtained legally or, more often, illegally.*
- *Attempts to use IEDs in combination with chemical or biological toxins were identified in 2018, something that was also promoted in jihadist propaganda and IED-making manuals.*
- *Knowledge transfer, in terms of HME and IED production, is enhanced through the use of online, and often encrypted, social networks and forums, while there is an increasing trend of receiving bomb-making knowledge from readily available online open sources (i.e. pyro/explosive enthusiast sites and forums).*

Evolving Attack Strategies #1

New modi operandi and criminal activities enabled by advanced technologies like online trade in illicit goods, virtual currencies, alternative banking platforms, and encrypted communication technologies. In particular, the following technological advances seem to raise important concerns among experts, while their application could critically influence almost every area of crime, including terrorist activities and the use of explosives:

- *Artificial Intelligence can transform the security landscape by becoming a tool for conducting cyber-attacks, target selection, production and spreading of false information (fake news, deep fakes, etc.), as well as for handling AI drones (swarm) and self-driving vehicles.*

Evolving Attack Strategies #2

- *Darknet and cryptocurrencies that comprise key facilitators for trade in illicit goods, with decentralised Darknet markets enabling vendors and customers to carry out transactions with high degree of anonymity.*

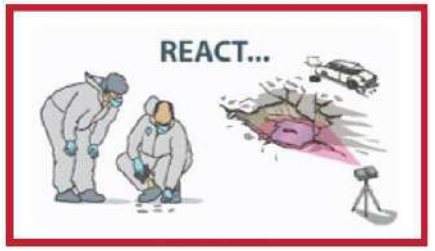
- *The criminal abuses of 3D printing technology can obtain an even more complex nature with the development of programmable matter (PM) technology and its use in 4D printing.*

- *Technology enablers such as computing and telecommunications (from social media to blockchains etc), introduce the additional dimension of digital and cyber to the landscape of the physical order; the timeline of a plot can be "hacked". It is therefore imperative to identify the aforementioned pillars that involve both technological and procedural advancements.*

Permanent assessments at National and EU level on:

- *Foreign Terrorist Fighters (FTF)*
- *Local cells*
- *Terrorist propaganda*
- *Civil aviation / Maritime / Land transport risks*
- *Critical infrastructures – concern of "grey spaces"*
- *New terrorist Modus Operandi (for example use of drones, a*ttaching an explosive device to the body of a victim forcing them to perform illegal acts such as ATM robberies etc*)*

Person-Borne IED



How could one…

- *control access to precursor material and manuals?*
- *rapidly detect IEDs hidden on a person?*
- *detect the manufacture of HMEs?*
- *neutralize the IED on a person quickly (not necessarily kill the attacker)?*
- *mitigate the damage in a crowd?*
- *predict future attacks by analyzing, reconstructing the devices and the manual to build them?*
- *network across borders to exchange experience?*

Acknowledgements

The EXERTER project is a collaboration between:






This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 786805

Thank you for your attention!

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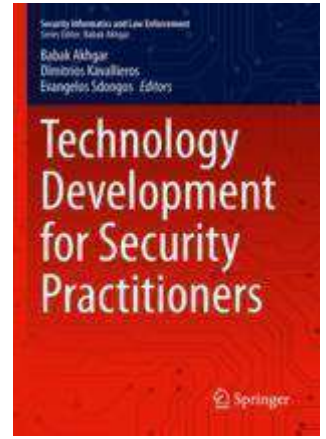

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https://www.springer.com/gp/book/9783030694593

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Medical aspects of C.B.R.N. threats

25 June 2021

Col Athanasios Zafeirakis, MD, PhD
Brig Gen (ret) Ioannis Galatas, MD, MSc

UNITED NATIONS

W.M.Destruction

Weapons of nuclear detonation, radioactive material weapons, lethal chemical and biological weapons and any other developed in the future which might have characteristics comparable in destructive effect to weapons mentioned above.

W.M.Disruption

Weapons that would paralyze economic activity and cause strong psychological impact to society (as opposed to causing mass casualties).

C → Disruption, but .....

B → Disruption / Destruction

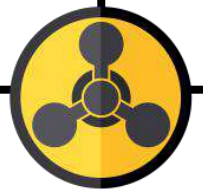
R → Disruption, but .....

N →  Destruction

(e) → Disruption, but .....

Medical aspects of Chemical Weapons

Chemical Warfare Agents



Toxic

Choking

Chlorine (Cl)
Phosgene (PS)
Diphosgene (DP)
Chloropicrin (CG)

Blood

Hydrogen cyanide (AC; HCN)
Cyanogen chloride (CK; NCCl)

Blister

Sulfur mustard (H,HD,HT)
Nitrogen mustard (HN-1, HN-2, HN-3)
Lewisite (L)
Halogenated oximes (CX)

Nerve

G-agents

Tabun (GA)
Sarin (GB)
Chlorosarin (GC)
Soman (GD)
Ethylsarin (GE)
Cyclosarin (GF)
GV

V-agents

EA-3148
V-sub x/GD-7
VE
VG
VM
VP
VR
VS
VX

Novichok agents

A-234

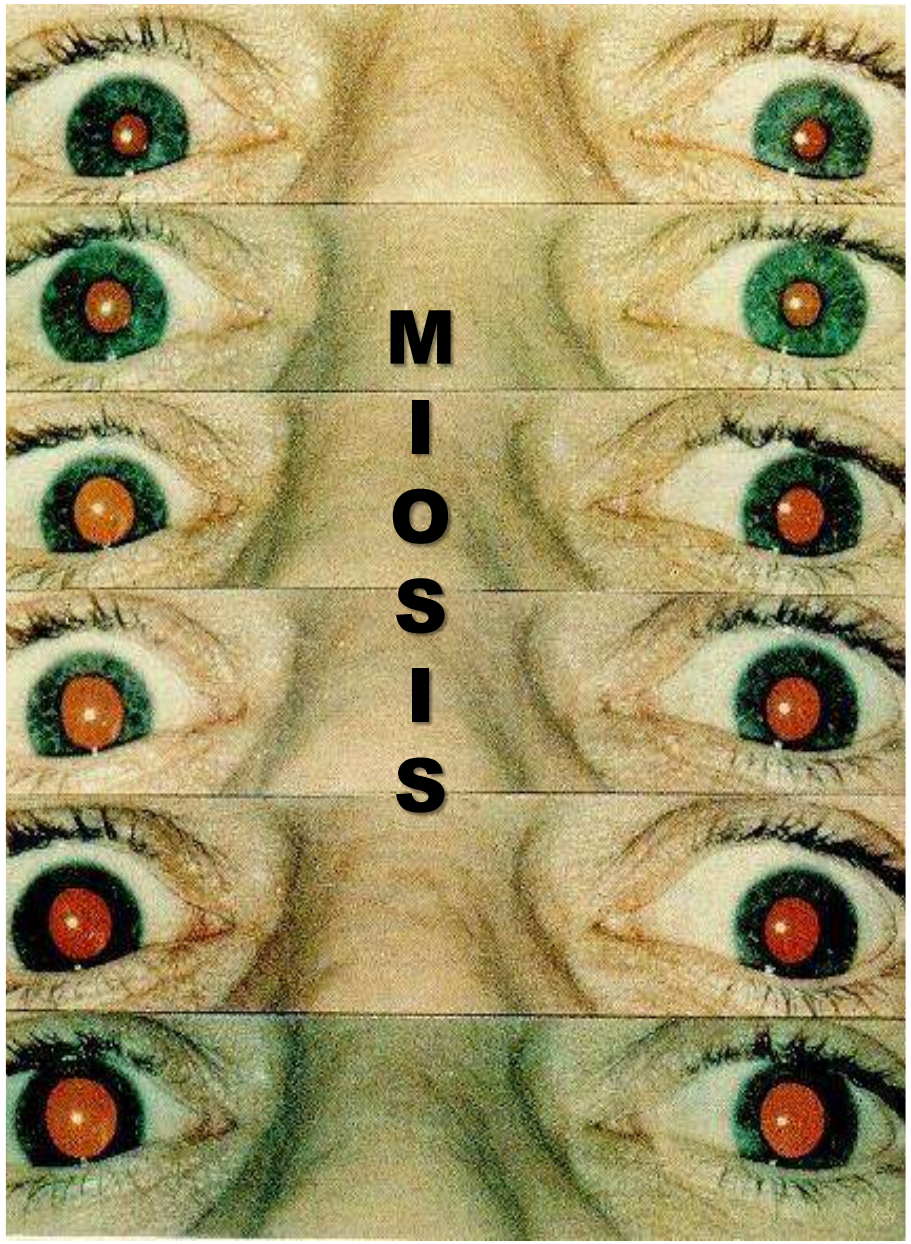
Incapacitating

LSD-25
DMHP
BZ

Riot control agents

Chloroacetophenone (CN)
Chlorobenzylidenemalononitrile (CS)
Chloropicrin (PS)
Cromobenzylcyanide (CA)
Dibenzoxazepine (CR)
Combinations of various agents.

Nerve agents

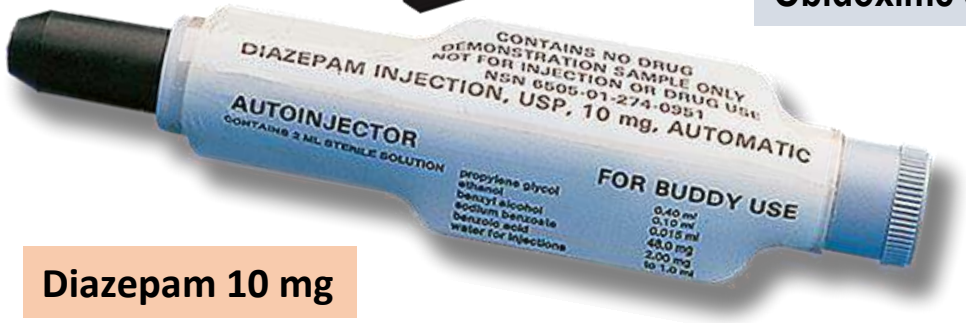


Nerve agents

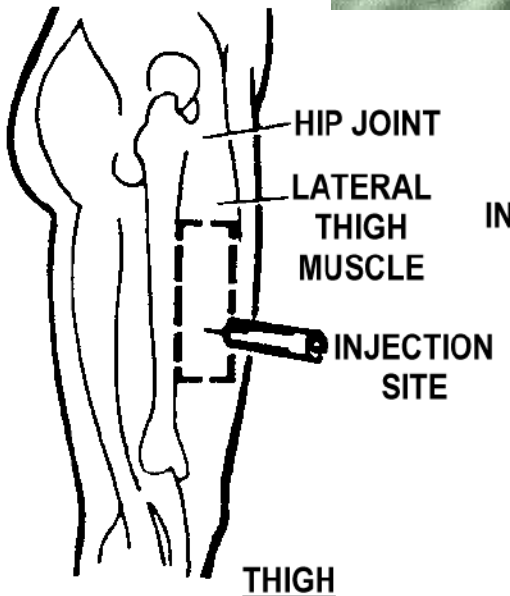
2.1 mg of atropine
600 mg pralidoxime

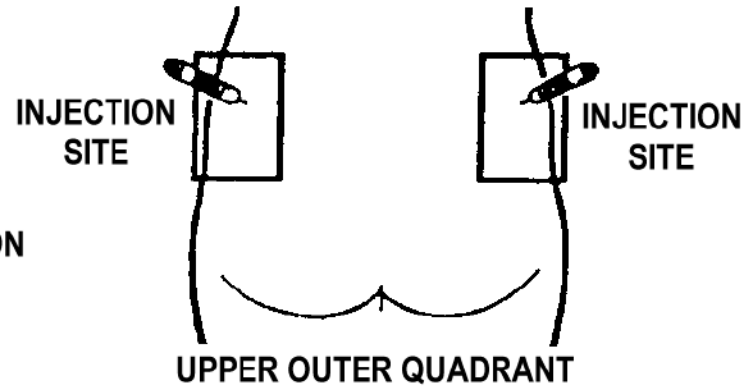
CHEM® PROTECT

Atropine 2 mg
Obidoxime dichloride 220 mg



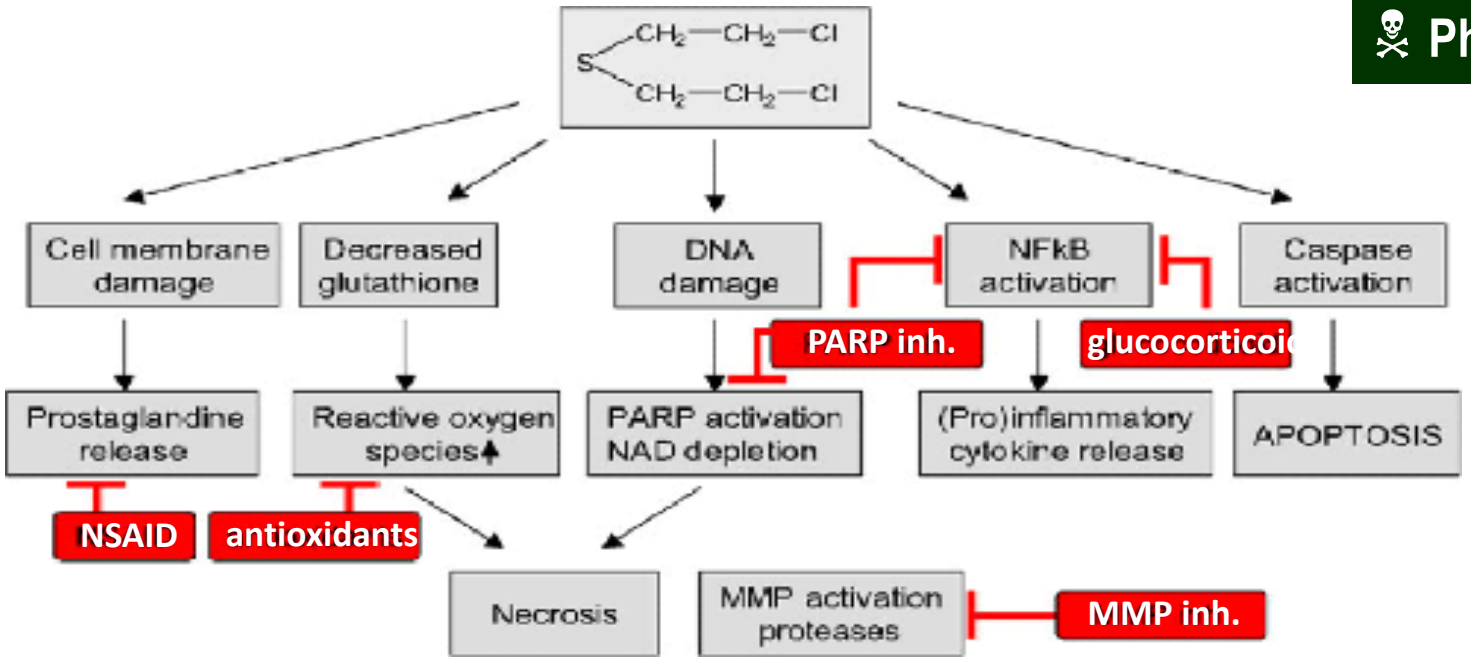
Diazepam 10 mg





Mode of action:

- Mustards penetrate skin and mucous membranes easily (eyes & respiratory system)
- It transforms to another chemical substance and reacts with enzymes, proteins and DNA;
- **End-result:** cell death;
- **Onset of action:** few minutes;
- **Blisters do not contain mustard**



- Mustards
- Lewisite
- Phosgene

Medical aspects of Bioterrorism

BW Agents Differ from CW Agents

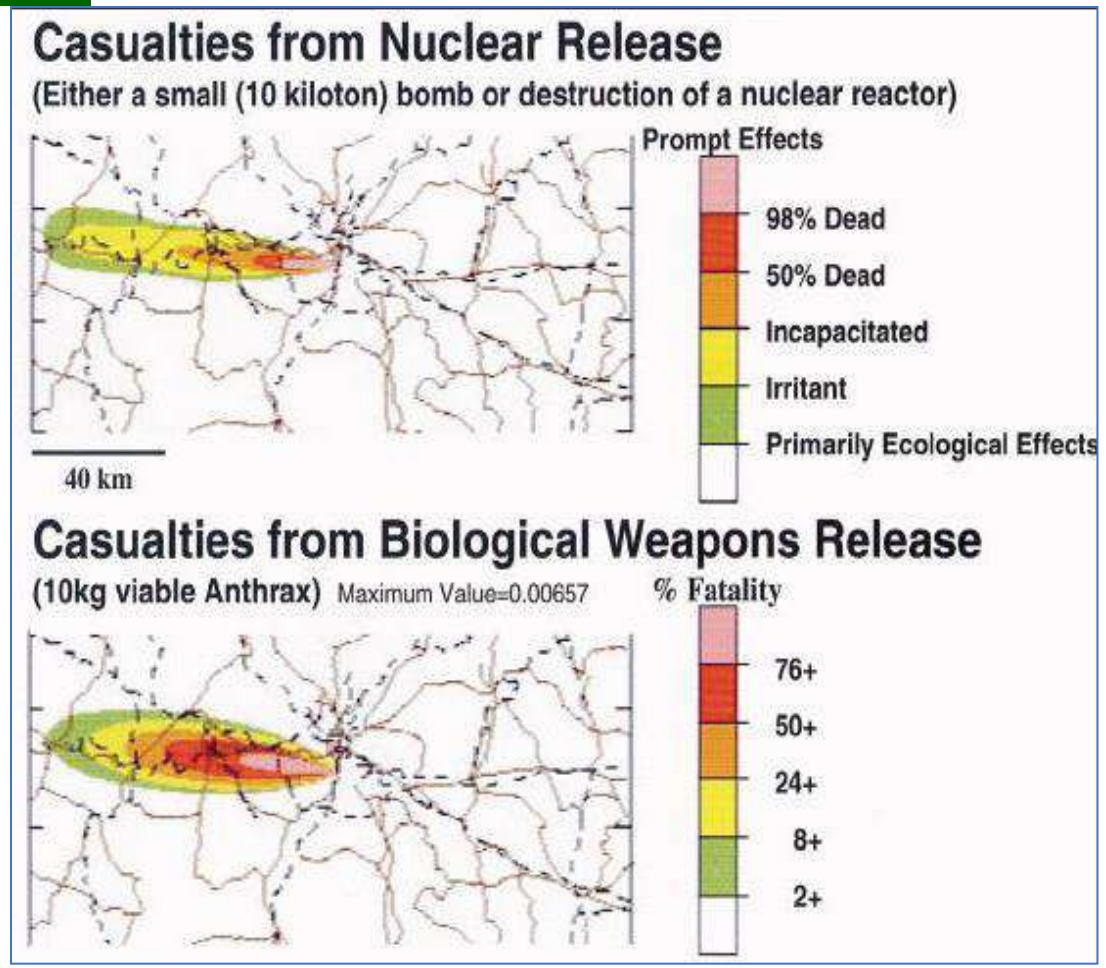
Chemical Agents	Biological Agents
➲ Man-made	➲ Natural (or so)
➲ Many are dermal-active	➲ Not dermal-active
➲ Legitimate industrial use	➲ No use other than as weapons
➲ Characteristic odor & taste	➲ Odorless & tasteless

BW Attack or Naturally Occurring Disease?

- Many unexplained disease or death incidents;
- Casualties originate from same area;
- Single case infection caused by an uncommon agent;
- Simultaneous / serial epidemics;
- Unusually high disease severity, resistance or response failure in standard treatment;
- Unusual disease for a specific geographic area or for a specific age group;
- Unusual season of transmission;
- Dead animals;
- Relevant claims by terrorists of a bioterrorism attack or existing intelligence for a potential threat.

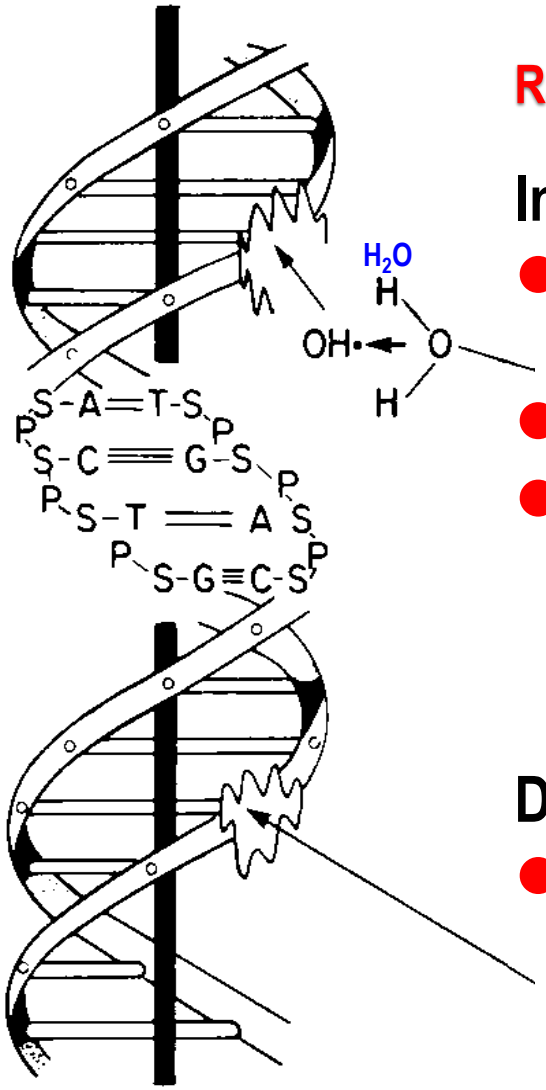
In order to kill 50% of personnel in
1 km^2 these are the quantities needed:

- Phosgene 21,000 Kg
- Mustard gas 4,000 Kg
- Tabun 2,000 Kg
- Sarin 500 Kg
- **Anthrax** **5 g**



Comparative effects of Nuclear and Biological weapons (WHO, 1970)

Medical aspects of Exposure to Radiation



Radiation Damage to Chromosomes

Indirect damage

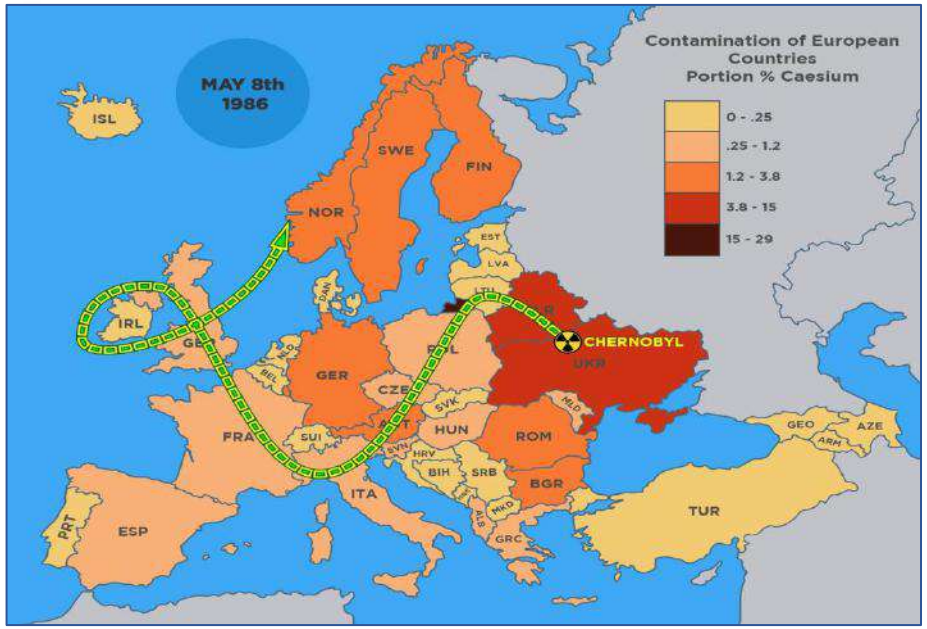
- Water molecule is ionized, breaks apart, and forms **hydroxyl** (OH) free radical;
- OH free radical is highly reactive;
- **75% of radiation-caused DNA damage is due to OH free radicals.**

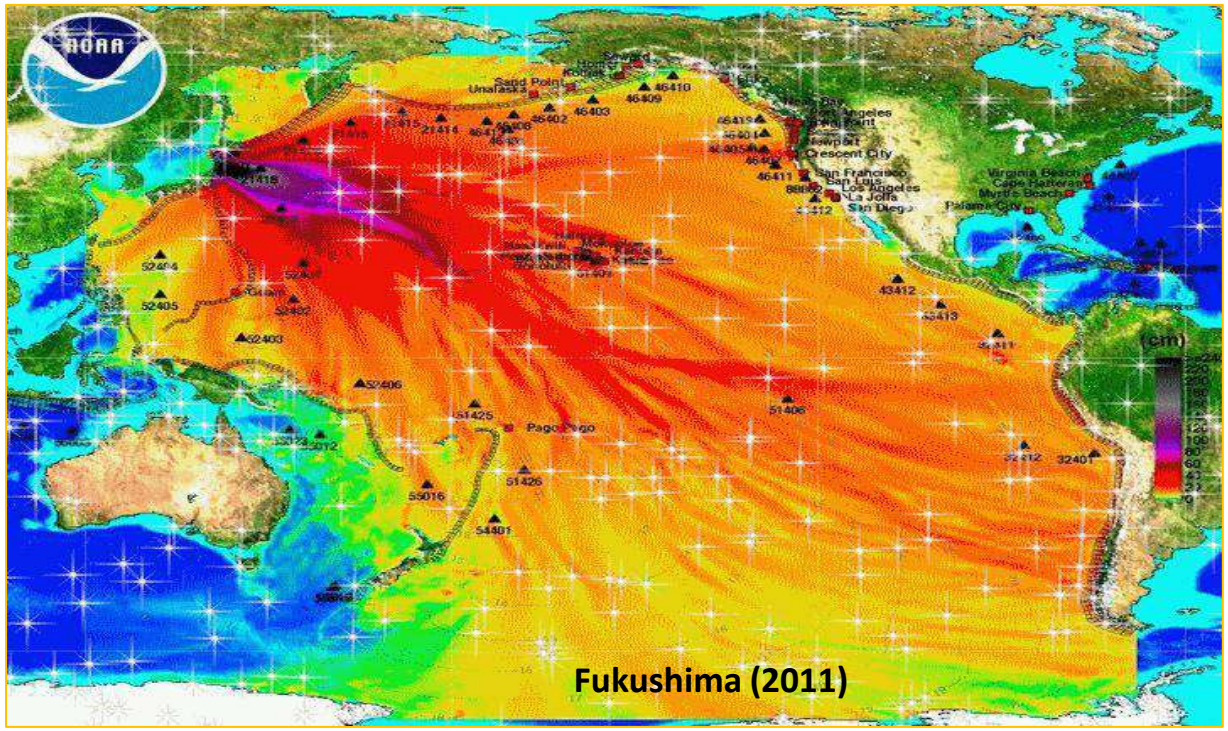
Direct damage

- DNA molecule is struck by radiation, ionized, resulting in damage.

Exposure? HOW?

Accidental





Natural

Deliberate

RDD

RED

Goiania incident (1986)

- **Abandonned 50 TBq Cs-137 from cancer teletherapy unit;**
- Scrap scavengers break in, steal and move it to junkyard;
- **Source capsule rupture:** dispersible and soluble CsCl;

- **4 dead**
- 249 contaminated;
- **118,000 "worried well"**

City contaminated

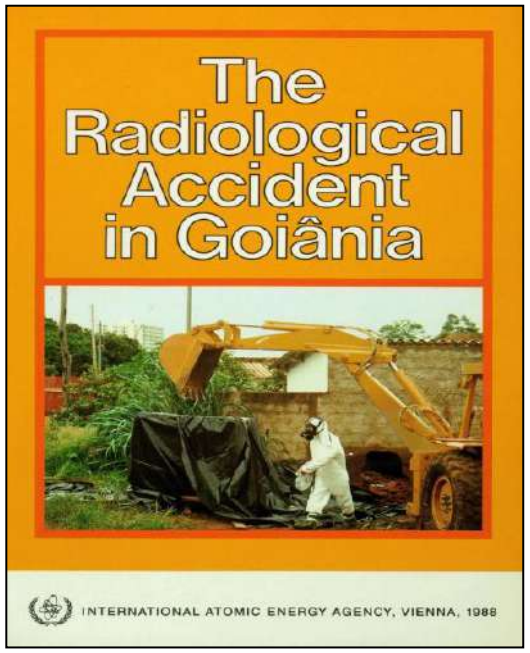
- 6 months intensive cleanup (esp. within 1 km^2)
  - ↳ 20 M $
- 8 houses + some buildings demolished
- Hundrends of people evacuated

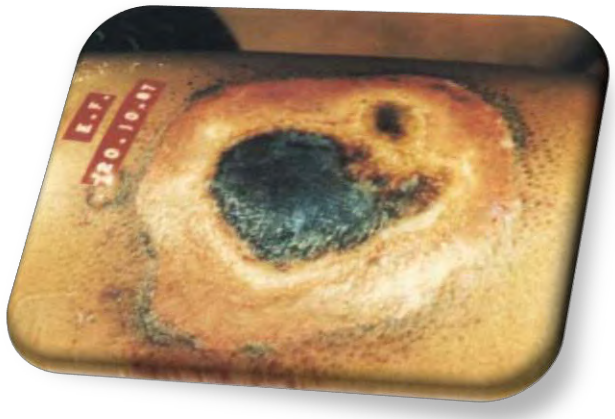
- **Indirect costs** ► 100's M $

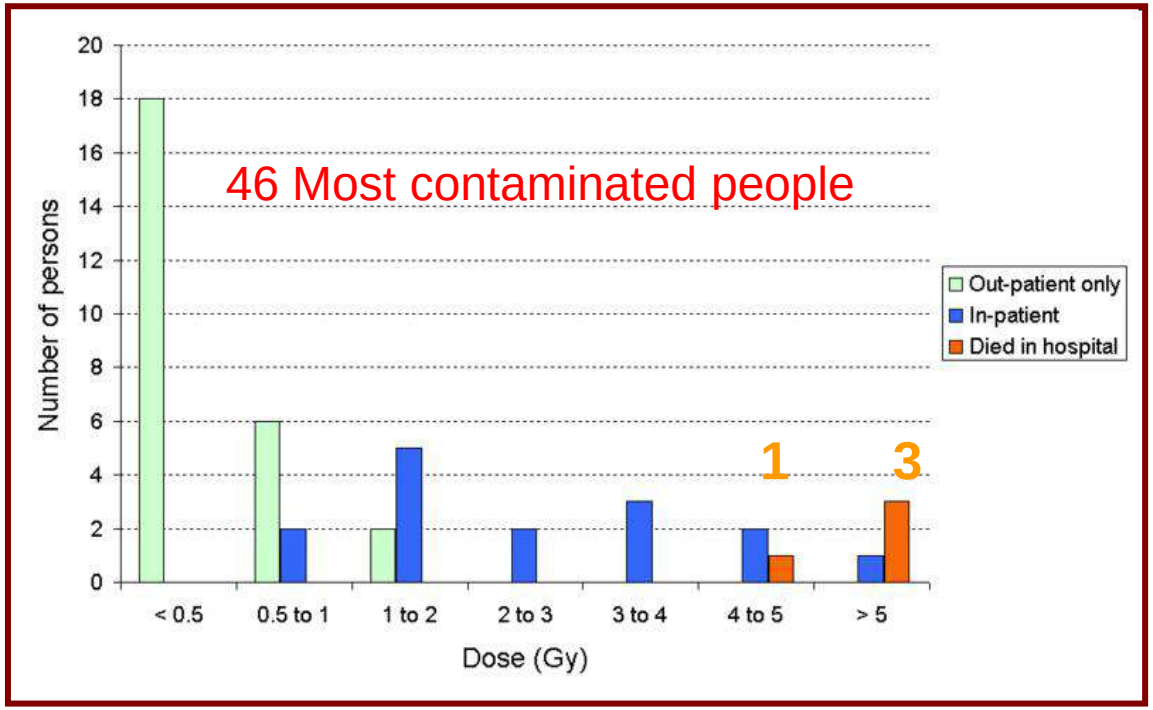
Goiania incident (1986)

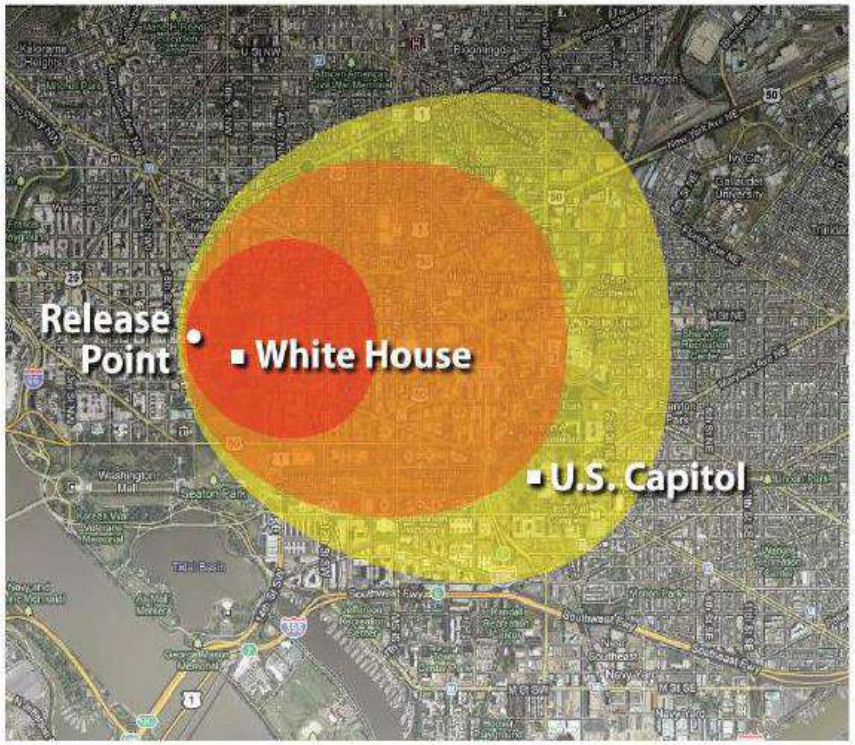
Syndrome	Acute dose (Gy)	Characteristics / sequelae
Subclinical	< 2	Subclinical
Haemopoietic	2 - 4	Neutropaenia, thrombocytopaenia, haemorrhage, infection, electrolyte imbalance
Gastrointestinal	6 - 10	Lethargy, diarrhoea, dehydration, necrosis of bowel epithelium, death in 10 to 14 days
Cerebrovascular / cardiovascular	> 30	Agitation, apathy, disorientation, disturbed equilibrium, vomiting, opisthotonus, convulsions, prostration, coma, death in 1 to 2 days

Reference: NCRP Report No. 98









Effects and Actions

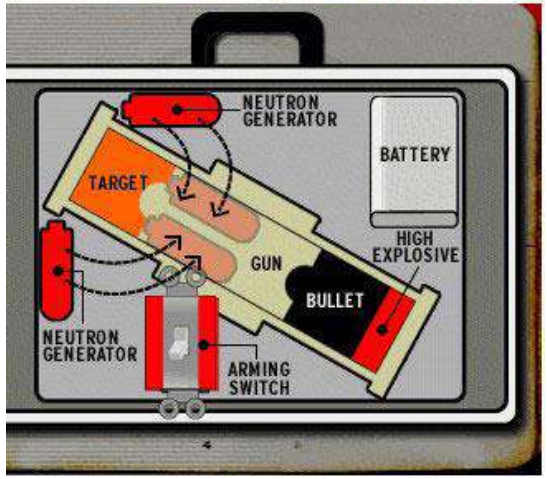
	Area km²	Area mi	Equivalent Dose (rem)	Exceeds relocation PAG for which year:	Population	All Cancers	Fatal Cancers
	2.10	0.81	>2.00	First year only	38,000	233	159
	7.60	2.93	>0.500	Any subsequent year	94,700	278	189
	13.2	5.10	>5.00	50 years (cumulative)	125,000	461	314

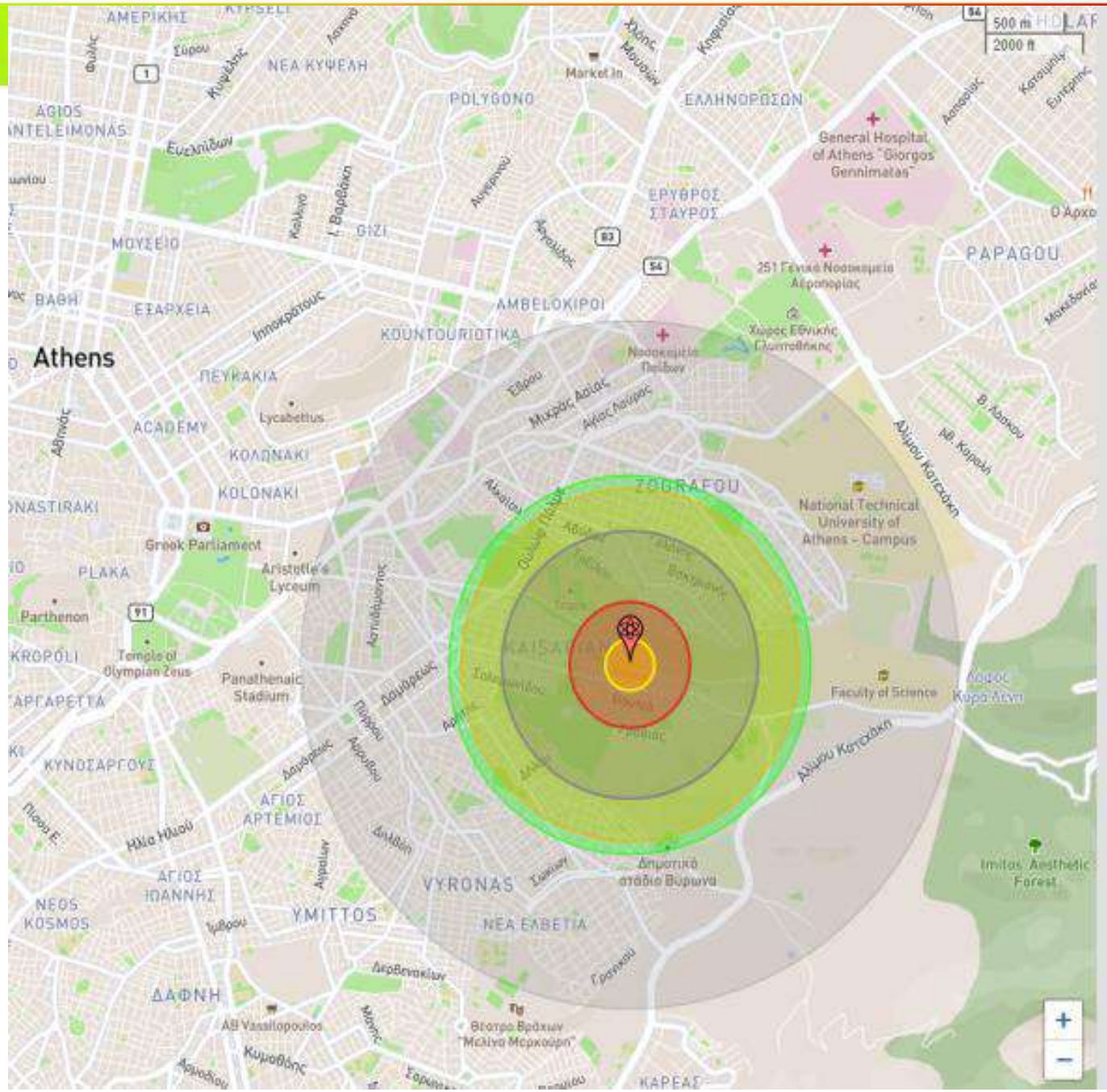
Areas and counts are cumulative. RDD detonated at 38.9 N, 77.0 W. PAG: Protective Action Guide

An illustrative example of a hypothetical RDD attack in the heart of U.S. capital; the RDD in this scenario uses 1,000 Ci of Cs-137 (roughly the equivalent of the Goiânia accident)

Common radionuclides that might be used in a "dirty bomb"	
Radionuclide	Threshold (grams) to contaminate 1 square km*
Co-60	0,01
Ir-192	0,01
Sr-90	0,37
Cs-137	0,48
Ra-226	13
Am-241	22,7
Pu-239	220

* refers to the theoretical amount of radionuclides in pure and perfectly dispersed form, required to contaminate that area to the level that a person living there for one year would receive a cumulative dose of 20 mSv





NUKEMAP 2.7 FAQ

You might also try: MISSILEMAP

Estimated fatalities:
5,830

Estimated injuries:
16,230

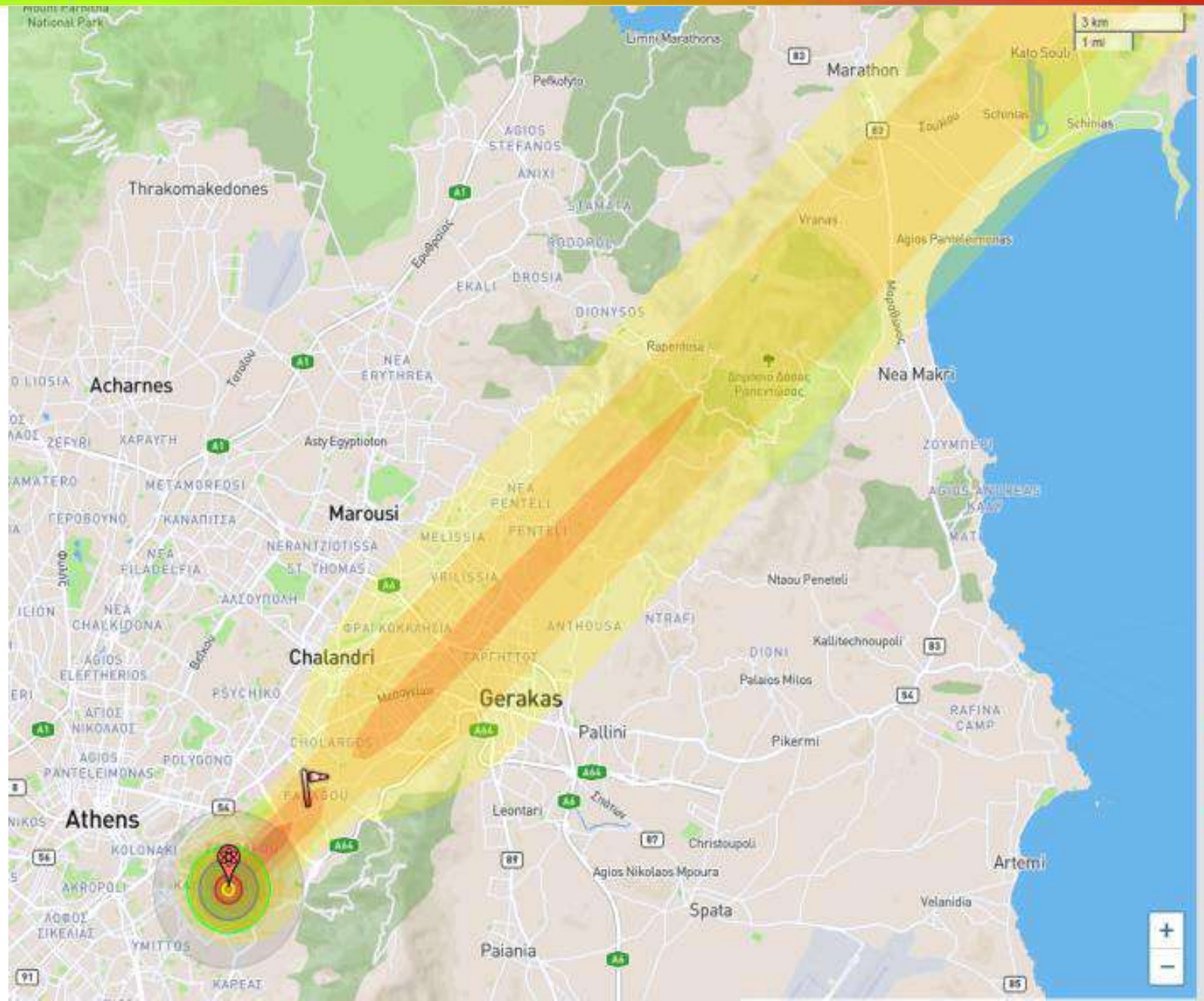
In any given 24-hour period, there are on average 54,740 people in the light (1 psi) blast range of the simulated detonation.

Modeling casualties from a nuclear attack is difficult. These numbers should be seen as evocative, not definitive. Fallout effects are deliberately ignored, because they can depend on what actions people take after the detonation. For more information about the model, click here.

Effect distances for a 5 kiloton surface burst ▼

- Fireball radius: 150 m (0.07 km²)
  Maximum size of the nuclear fireball; relevance to damage on the ground depends on the height of detonation. If it touches the ground, the amount of radioactive fallout is significantly increased. Anything inside the fireball is effectively vaporized.
- Heavy blast damage radius (20 psi): 370 m (0.44 km²)
  At 20 psi overpressure, heavily built concrete buildings are severely damaged or demolished; fatalities approach 100%. Often used as a benchmark for heavy damage in cities.
- Moderate blast damage radius (5 psi): 0.78 km (1.93 km²)
  At 5 psi overpressure, most residential buildings collapse, injuries are universal, fatalities are widespread. The chances of a fire starting in commercial and residential damage are high, and buildings so damaged are at high risk of spreading fire. Often used as a benchmark for moderate damage in cities.
- Thermal radiation radius (3rd degree burns): 1.03 km (3.36 km²)
  Third degree burns extend throughout the layers of skin, and are often painless because they destroy the pain nerves. They can cause severe scarring or disablement, and can require amputation. 100% probability for 3rd degree burns at this yield is 8 cal/cm².
- Radiation radius (500 rem): 1.11 km (3.86 km²)
  500 rem ionizing radiation dose; likely fatal in about 1 month; 15% of survivors will eventually die of cancer as a result of exposure.
- Light blast damage radius (1 psi): 2.01 km (12.7 km²)
  At a around 1 psi overpressure, glass windows can be expected to break. This can cause many injuries in a surrounding population who comes to a window after seeing the flash of a nuclear explosion (which travels faster than the pressure wave). Often used as a benchmark for light damage in cities.

Note: Rounding accounts for any inconsistencies in the above numbers.



NUKEMAP 2.7 FAQ

You might also try: MISSILEMAP

Moderate blast damage radius (5 psi): 0.78 km (1.93 km²)

At 5 psi overpressure, most residential buildings collapse, injuries are universal, fatalities are widespread. The chances of a fire starting in commercial and residential damage are high, and buildings so damaged are at high risk of spreading fire. Often used as a benchmark for moderate damage in cities.

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At a around 1 psi overpressure, glass windows can be expected to break. This can cause many injuries in a surrounding population who comes to a window after seeing the flash of a nuclear explosion (which travels faster than the pressure wave). Often used as a benchmark for light damage in cities.

Note: Rounding accounts for any inconsistencies in the above numbers.

Estimated total-dose **fallout contours** for a 5 kiloton surface burst with a 15 mph wind: ▼

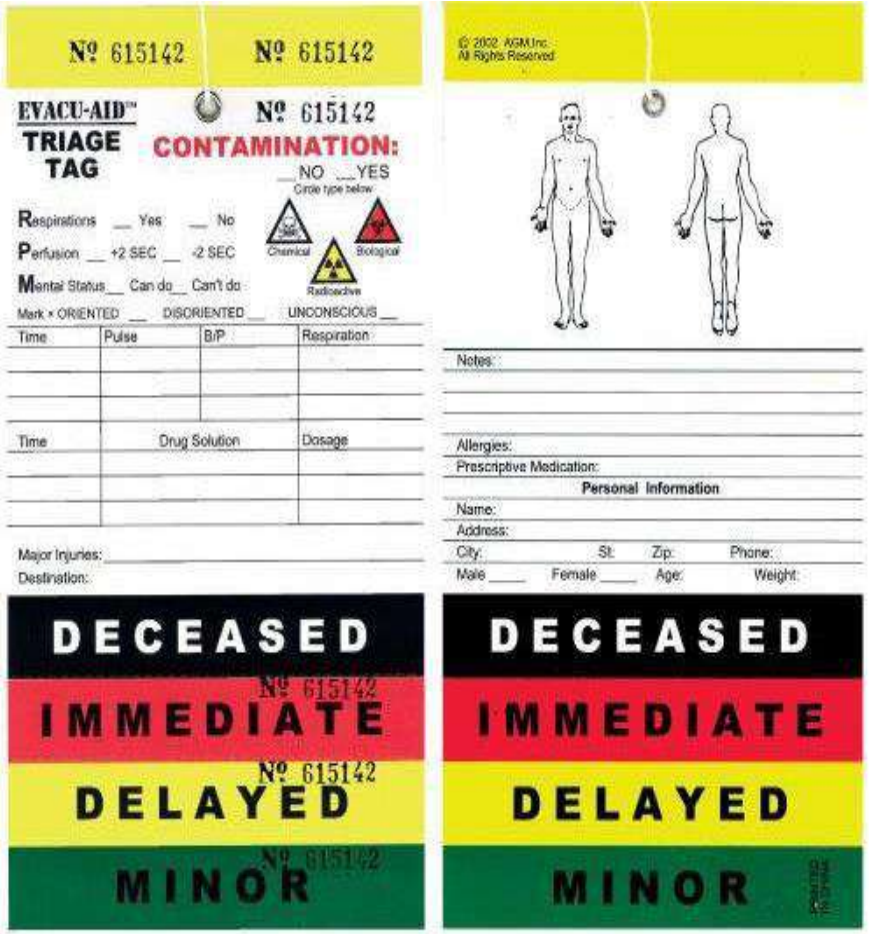
Fallout contour for **1** rads per hour:
- Maximum downwind cloud distance: 79.3 km
- Maximum width: 5.77 km
- Approximate area affected: 564 km²

Fallout contour for **10** rads per hour:
- Maximum downwind cloud distance: 49 km
- Maximum width: 3.39 km
- Approximate area affected: 257 km²

Fallout contour for **100** rads per hour:
- Maximum downwind cloud distance: 18.6 km
- Maximum width: 1.01 km
- Approximate area affected: 64 km²

Fallout contour for **1,000** rads per hour:
- Maximum downwind cloud (stem only) distance: 2.46 km
- Maximum stem width: 500 m
- Approximate area affected: 1.72 km²
- The selected radiation level is too high for cloud fallout at this yield, and so this contour is not mapped. Maximum radiation contour for cloud fallout that can be mapped for this yield is 267 r/hr.

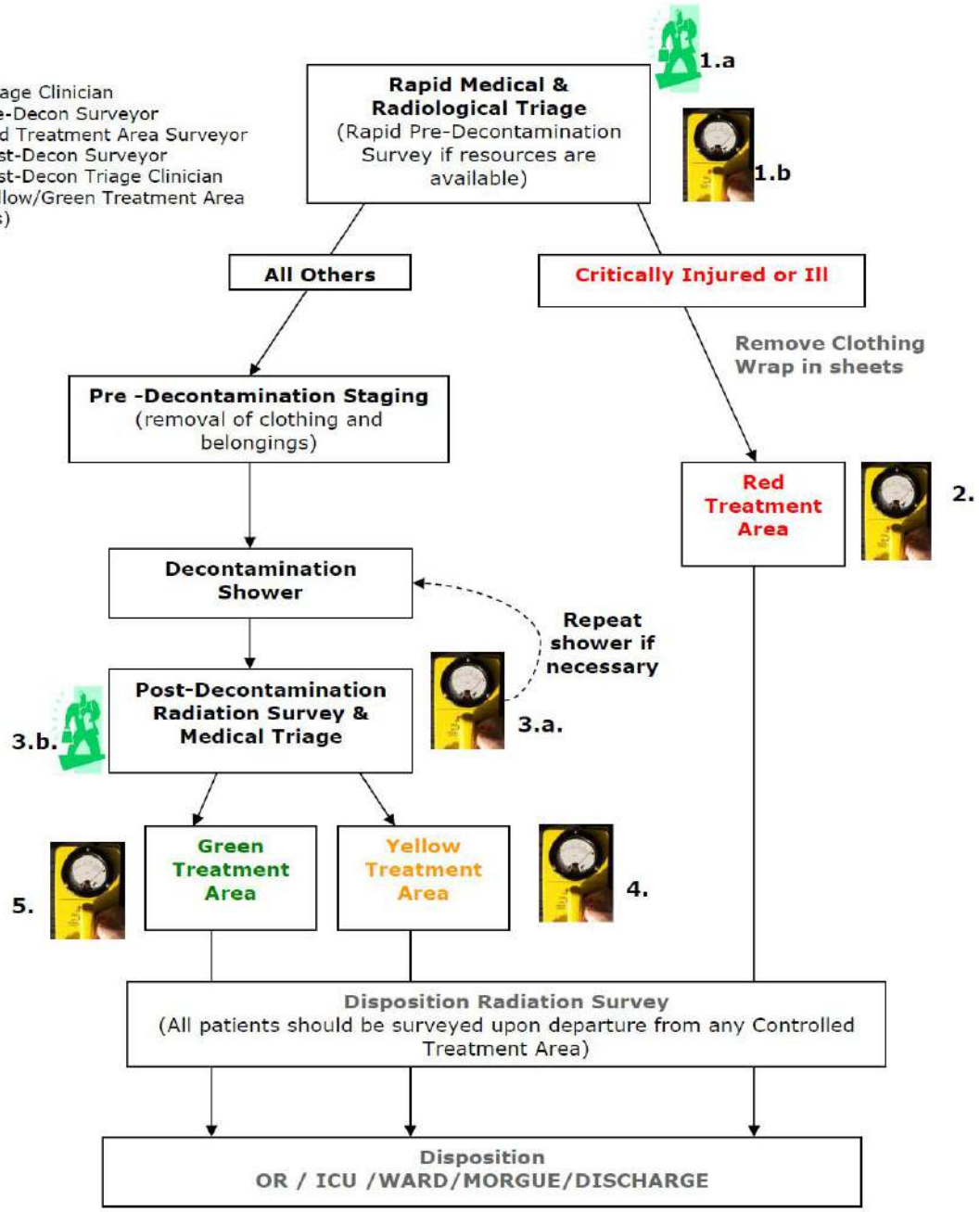
Fallout windsock is 3 km from ground zero. Click here to hide the windsock.
To change the radiation doses to map, click here.
For more information on the fallout model and its interpretation, click here.



Adapted from
https://disastersurvivalskills.com/products/triage-tags

Summary Flow Chart of Triage Process for a Contaminating Radiation Incident

1.a Triage Clinician
1.b Pre-Decon Surveyor
2. Red Treatment Area Surveyor
3.a Post-Decon Surveyor
3.b Post-Decon Triage Clinician
4. & 5. Yellow/Green Treatment Area Surveyor(s)

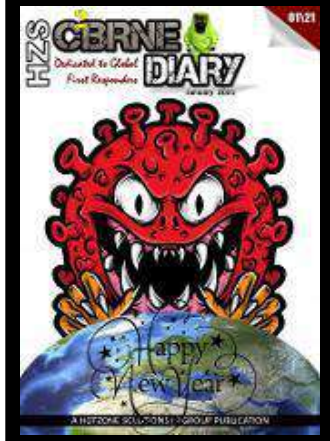


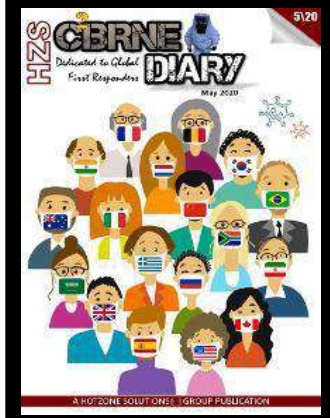
NYC Hospital Guidance for Responding to a Contaminating Radiation Incident

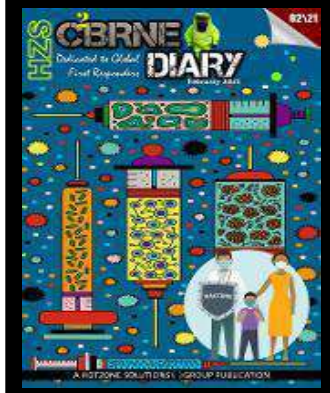
Tokyo sarin incident

1995

St Luke's HOSPITAL & Health Network







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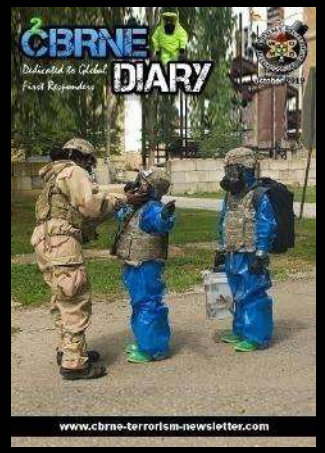

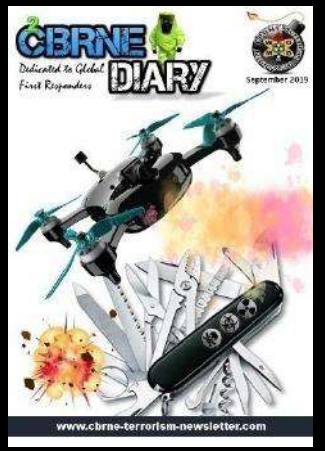

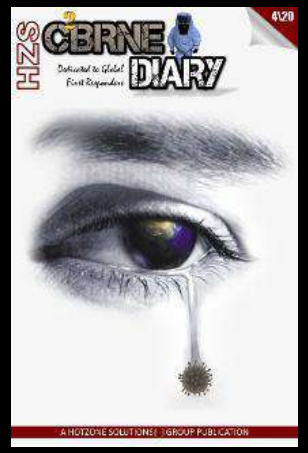

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Thank You!

for your attention!

A radiographer wearing PPE during WWI (France, 1918)