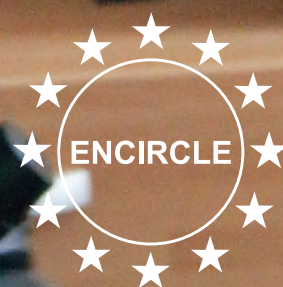


Issue 4

# ENCIRCLE

## M A G A Z I N E



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# Introduction

Welcome to the final edition of the 'ENCIRCLE Magazine! If you missed the previous ones then you can find them via the Encircle News pages <http://encircle-cbrn.eu/news/>. Inside this issue you'll be able to find what we have been doing in the preceding year. You'll find interviews and articles explaining what is behind this innovative four year project and further information on some of the new consortiums that Encircle helped bring into being! Encircle provides support and assistance to the whole European CBRN community, including first responders, and will act as an enabler for the Part B of the Sec-05 H2020 CBRN Cluster.

ENCIRCLE is Part A of the SEC-05 H2020 CBRN Cluster topic and will assist subject matter experts by understanding their particular needs e.g. investment, integration, customer needs and thus tailor the support so it addresses these challenges. The blend of expertise in the project, including national CBRN consortiums, allows a truly unique perspective, especially when it comes to providing assistance to subject matter experts (SMEs).

The work that Encircle did resulted in a number of EC Calls, our previous one had over 200 responses to it and we have information on EU-Radion, EU-Sense and SERSing in the following pages. We also have progress reports on the previous three, Terrific, Cosmic and EU-Sense. You can find out more on all these projects via their websites <https://eu-sense.eu/>, [www.terrific.eu/](http://www.terrific.eu/) [www.cosmic-cbrn.eu/](http://www.cosmic-cbrn.eu/) and <http://eu-sense.eu/> (SERSing and EU-Radion are so new they don't have websites yet!).

ENCIRCLE has been instrumental in identifying the gaps in CBRN defence for the Part B calls, and while it is not involved in the bid process it will re-join once the contract is awarded to act as valued assistant to the consortium. With ENCIRCLE coming to an end next year the question is what will replace us? There are a number of options on the table, and Clive Goodchild goes through them in his article.

One of the ways that the consortium provided assistance to the entirety of the CBRN community was through the dynamic catalogue. This is designed to allow the industry and the user community to come together to discuss requirements, capability and best practice. The catalogue is optimised to allow ease of use and has been regularly updated by the consortium and improved in numerous ways. You can find more information via [www.encircle.eu/](http://www.encircle.eu/)

Improved communication and understanding of user requirements will result in early and better identification of market needs and the solutions needed to fill it. The products that result from this mechanism should provide a faster route to market for the SME and allow a more competitive and vibrant CBRN industry. These improved

products should also result in an evolution of tactics, techniques and procedures, which will advance user response and help keep Europe safe from terrorist attacks and other incidents (criminal acts, accidents or emerging infectious diseases etc).

Like many projects we have been adversely impacted by the Covid pandemic, and with the finish line in sight, and three new projects under our belt, it has been a disappointing sudden loss of pace.

Please keep updated on our activities via <http://encircle-cbrn.eu/> and the Linked In Encircle group. Here you will find valuable information on other EC projects and the way to register for the catalogue. If you have any queries please do not hesitate to contact me on [zoe.rutherford@cbrnworld.net](mailto:zoe.rutherford@cbrnworld.net)









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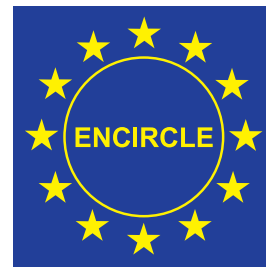
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# Meet the team

## ADS

ADS is the premier trade organisation for all companies operating in the UK Aerospace, Defence, Security and Space industries globally. CBRN-UK is an ADS Special Interest Group representing UK industry's CBRN capability to government, emergency responders, the military and Critical National Infrastructure operators. The group represents the full spectrum of suppliers, from large multi-nationals to SME's and academic start-ups. The aim of CBRN-UK is to act as a focal point to represent the interests of its members to domestic and international Government and other organisations or companies concerned with the CBRN sector of business.

## BAE Systems

BAE Systems is an international company engaged in the development, delivery and support of advanced defence and aerospace systems. BAE Systems has, via its extensive business portfolio, an immense breadth and depth of Electronic Systems expertise and experience in the land, air, sea and metropolitan domains. This experience includes development of Crisis Management solutions at a technology, product, platform and system-of-systems level, as well as core skills in knowledge management, systems integration and project management.

## EnviroNics

EnviroNics is a Finnish company with 30-year experience and the world's leading supplier of Chemical, Biological, Nuclear and Radiation (CBRN) detection devices and monitoring integrated solutions, ranging from personal safety to national security. We provide innovative solutions for different safeguarding organizations in 50 countries, from civil defence and homeland security to the military. Behind our comprehensive range of products and solutions is a highly competent team of experts having years of experience in the implementation of demanding projects in CBRN fields.

## European Virtual Institute for Integrated Risk Management (EU-VRi)

EU-VRi is a European Economic Interest Grouping (EEIG), which aims to facilitate or develop the economic activities of its members by pooling of resources, activities and skills, thus yielding new opportunities, not or hardly achievable for members when acting alone. In 2016 EU-VRi has 48 (6 founding / 36 associate / 6 honorary) members coming from 21 countries and from various sectors. EU-VRi promotes the integration of Safety and Security in industry and research and supports the identification and facilitation of standardization opportunities within European research with dedicated services and activities.

## Falcon Communications

Falcon Communications Ltd. is a UK based SME and involved in publishing, consultancy and conference activities. It publishes the world's leading magazine on CBRNE matters, *CBRNe World* ([www.cbrneworld.com](http://www.cbrneworld.com)) and also produces the largest events in the field, the CBRNe Convergence series. In addition to this the company has provided technical and commercial consultancy to some of the largest companies in the CBRN sector and has been engaged in a variety of EC consortiums

## Istituto Affari Internazionali

Istituto Affari Internazionali (I.A.I.) is one of the major Italian think tanks in the fields of foreign policy, security and defence issues and EU affairs. An independent approach characterises policy-oriented research of the I.A.I. S&D Programme at the crossroad of four strands: the policies adopted by national and international institutions and organizations in the security and defence field; the relevant industrial and technological dynamics; the operational developments in the military and civil security areas; the politico-strategic interaction in the Euro-Atlantic framework. In several EC-funded project S&D Programme has developed a significant expertise in organizing and bringing security end user and stakeholders communities into technological projects and in managing feedback collected in workshops / interviews in compliance with the classification and confidentiality rules set by the EC

## Miksei

Mikkeli Development Miksei Ltd. (Miksei) supports local and regional companies in creating jobs and innovations, increasing sales and exports, and developing new lines of business. They support local and regional companies every step of the way, from start-up to growth and internationalisation. Typical development issues involve business models, financing, and sales and exports. Business training is also an important part of our services – Miksei has a network of experts in most aspects of business. Mikkeli is a home to CBRNE Finland, a group of companies representing Finnish CBRNE expertise. Miksei manages several national-level CBRNE related projects and also participates in EU-level safety and security programmes

## Ouvry

OUVRY is an SME Company, based in Lyon – France, which specialises in the study, research, development and manufacturing of CBRN personal protective equipment and related concepts. They offer concepts across the full spectrum of CBRN protection: ranging from impermeable solutions through to wholly air permeable solutions. We manage the entire supply chain: feasibility, development, manufacturing, quality control, logistic and after-sales service based on a Quality system management ISO 9001- MQRP 2010 compliant. OUVRY has developed a good experience as prime contractor for complex programs with the European Defence Agency, the National Agency for Research ANR and the Defence procurement Agency DGA in collaboration with various foreign partners.

## Przemysłowy Instytut Automatyki i Pomiarów

PIAP is a leading Polish research institute active in the fields of robotics, automation, machine vision and measurements systems, with a vast experience in developing unique solutions in the field of industrial automation, security and defence technologies, information technology, industrial and mobile robotics as well as measuring devices. For over 15 years PIAP is a successful developer of mobile robots used in EOD/IED and SAR missions. Research performed at PIAP facilities is concentrated on mobile autonomous systems, innovative human machine interfaces, data fusion, image processing and CBRN detection and environmental sampling systems. PIAP's experience in designing and production of CBRN payloads dates back to 2009.



### Smiths Detection

Smiths Detection designs, manufactures, sells, and services advanced products for detection and identification of hazardous chemicals, explosives, and narcotics for the military, emergency response, transportation, ports & borders, and critical infrastructure security markets

### Tecnoalimenti

Tecnoalimenti (TCA) is an Italian consortium of industries for research and innovation that integrates horizontally and vertically the main industrial players of the agro-food chain. As a non-profit research organisation, Tecnoalimenti S.C.p.A. is composed of 28 food sector industries and one financial institution, Intesa, as trustee of Ministerial funds. TCA acquired a wide experience in carrying out collaborative innovation and dissemination activities at national and international level, becoming today the leader organisation at national level within the agro-food sector. It has a wide experience as coordinator and partner in over a dozen of European projects and national projects, a selection of which is here reported: TRACEBACK, eMensa, HighQ RTE, Bioactive-net – Healthgrain – Baseline – <http://rditac.com> – Einstein II – TRISK .

### Università Cattolica del Sacro Cuore

The UCSC research program closely collaborates with 16 internal colleges, 62 departments and 93 research centres. Their common goal is the understanding and study of those topics that have proved vital to the well-being of each human being: the new frontiers of economics, bioethics, environmental recuperation, developments in the judicial fields, family dynamics, major mass phenomena, the evolution of political systems, new horizons in medicine, the technological applications of physics and mathematics, and the most recent discoveries in environmental research. Within EU Project EDEN (FP7) UCSC is provided ethical monitoring and supervision through the evaluation of different tools and demoed the ethical review of selected deliverables. Most of these EDEN activities were handled through an Ethical Helpdesk.

### Université Catholique de Louvain

UCL-CTMA (Centre for Applied Molecular Technologies) is a mixed academic-clinical-military biotechnological platform. It hosts at a single location, a joint civilian-military clinical and research staff of ~34 people with multidisciplinary expertise and acts as reference biotechnological platform specialized in genetics and molecular genetics for IREC/UCL as well as a reference CBRN-biological platform for the BE-Armed Forces. UCL-CTMA is a technological transfer-applied science research unit specifically acting as "Biothreat control unit of Defence Laboratory Department (DLD-Bio)" for the BE-MOD, as well as for the CUSL. One of

the main tasks of UCL-CTMA is to develop clinical and emerging DNA- and protein-based methods for a rapid diagnosis of genetic disorders and for rapid, specific, sensitive detection, identification and monitoring of infectious agents.

### Université de Nice-Sophia Antipolis

Nice-Sophia Antipolis University (UNS) is the second largest multi-disciplinary French university with 26,000 students and more than 2,500 staff members. The university, research oriented, is developing innovative pedagogic and research actions with many international collaborations.

In 2016, UNS has been awarded with IDEX label on JEDI project for research activities and as one of the 10 major research center in France. Polytech Nice-Sophia has developed during the last years an exceptional network of industrial partnerships – more than 350 companies – mainly focused on innovation and ICT adapted to various sectors. The exceptional international environment of Sophia Antipolis strongly reinforces this dynamic.

### Wojskowa Akademia Techniczna

The Wojskowa Akademia Techniczna (WAT) is a public and military polytechnic university under supervision of MoD and Ministry of Science and Higher Education. The WAT is the largest military university in Poland and the most important provider of scientific and research support for Polish Armed Forces. The highly skilled research staff combined with many newly developed and well-equipped research facilities, an appropriate education environment and modern accommodation facilities have earned the WAT highly distinguished credentials both at home and abroad. The main emphasis is on applied research, which results in wide co-operation with Polish and international companies leading to developing products and technologies that are often commercialized.





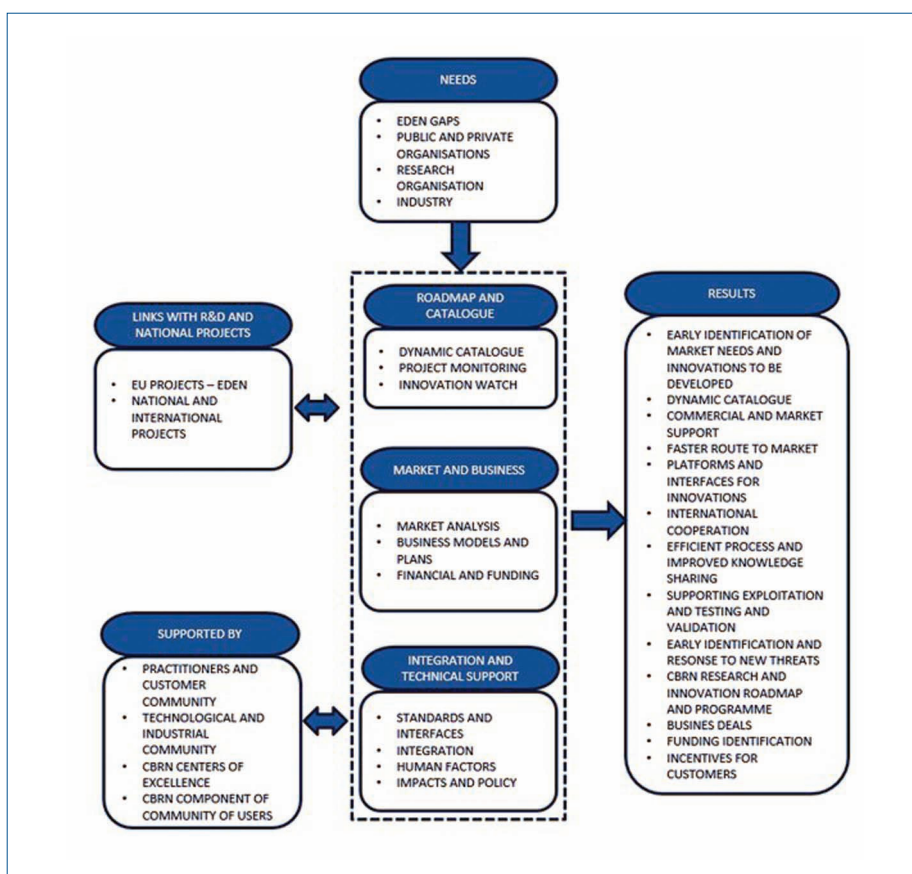
# About the Project

Learn more about the ENCIRCLE project, what it will do, how it will do it and when!

European Cbrn Innovation for the market CLustEr (ENCIRCLE) is a four-year coordination and support project to address the European commission's Horizon 2020 security topic: Chemical, biological, radiological and nuclear (CBRN) cluster. It will support the commission by identifying research gaps and proposing sensible and innovative research and development projects to fill them. This will be achieved by bringing together CBRN practitioners and industry professionals to create an organisation that can get to the heart of the real CBRN needs and gaps and bring to

market new technology to assist and benefit those on the ground.

To improve its resilience to new CBRN attacks and threats, the EU needs a specialized, competitive, efficient and sustainable industry. Capitalizing on its experience in the EDEN Demonstration Project, other CBRN relevant projects, and in the CBRN market and supply chain, the ENCIRCLE consortium proposes an innovative approach to reach this goal in a short to long term perspective. Once achieved it will allow SMEs and large



How the project meshes with other elements ©Encircle





industries to deliver and invest in the best innovations on the market.

ENCIRCLE has five key objectives aimed at promoting innovation and business development to fill market gaps in the project timeframe:

1. Create an open and neutral EU CBRN cluster,
2. Provide a sustainable and flexible vision and roadmap for the development of the European CBRN market and innovations,
3. Provide integration with platforms (systems, tools, services, products) by proposing standardized interfaces and future EU standards to integrate CBRN technologies and innovations developed from the Part b projects of the H2020-SEC-05-DRS CBRN Cluster call,
4. Support CBRN safety, security and defence commercial and market services,
5. Improve and facilitate European CBRN dissemination and exploitation.

The project is conducted by a consortium of specialized industries, trade associations and research organisations with flexible and lean procedures under the advice of the EC Community of Users. It will rely on two large

interactive communities: practitioners and customers, and industrial and technological providers: the latter including many SMEs. To optimize the needs and gaps assessment, as well as innovation development, acceptance and success, ENCIRCLE will establish formal links with other consortia such as future Part b projects.

The main expected impact is the enhancement of the EU CBRN industry's competitiveness. This will allow it to enlarge its market share while increasing the benefits of the EU research and innovation to improve CBRN preparedness, response, resilience and recovery efficiency.

#### Pret a Porter

The ENCIRCLE Dynamic Catalogue is an open and neutral platform associated with commercial and technical services. The Dynamic Catalogue provides a platform for industry and technological providers to showcase European CBRN capabilities as well as provide a knowledge source for practitioners and policy makers.

You need to be first registered as an ENCIRCLE Community Member to access the catalogue.

You can register in a Community at different levels associated with different "rights":

Practitioner and Customer community member:

- On behalf of your Organization or as an "individual",
- With or without (operational) systems and tools, Technological and Industrial community member:
- On behalf of your Organization or as an individual expert,
- You need to register at least one tool or one project to be accepted.

#### Registration Process

- You can access the ENCIRCLE Dynamic Catalogue page either directly at <https://www.encircle.eu/> or via public page of ENCIRCLE project at <http://encircle-cbrn.eu/catalogue/>
- Click either on "Register as Practitioner and Customer community" or on "Register as Technological and Industrial community",
- Fill in the organization, points of contact, functions compulsory fields,
- For the Technological and Industrial community, fill at least one tool or project,
- Electronically sign the Letter of Intent (LOI) by ticking the box when prompted
- After receiving your LOI, your request will be approved by the project Management Board
- At the end of this procedure, you will receive a link to activate your account and choose your password.

Once you have received your registration confirmation you will be able to access the catalogue and begin to contribute to the content and community networks. The objective is to gather users, tools and needs and for the CBRN community to work together through the catalogue.

The catalogue has been designed in an easy to use format and, importantly, it is secure. It contains a variety of resources such as tools, projects, conferences, community networks and 'market place' functions where users will be able to place their needs in front of other users who may be able to help fulfil them.

Other functionalities of the catalogue will be a technical support section which will contain sections on integration and standards, an innovation watch summary and a roadmap summary and a funding, procurement and business section, this will provide information on sources of funding, procurement agencies and cluster business discussions.

The catalogue currently contains over three hundred needs and gaps which will continue to grow with use and input from the community.

# Catalogue model

## Lian Guey Ler from University of Nice Sophia Antipolis on the development of the ENCIRCLE Catalogue 2020

The ENCIRCLE Dynamic Catalogue is a secure and sustainable web portal that hosts databases, community networks and various functions that includes Innovation Watch and a marketplace. The extensive list of tools, services and products in the catalogue is maintained in an open, flexible, and interactive manner with crowd sourcing employed. The catalogue entries are contributed by community members, and then validated by the ENCIRCLE consortium before being published in the catalogue. In addition, needs and gaps that are collected from the communities and collated by the ENCIRCLE consortium are shared on the catalogue. This function has proved especially useful when selecting priority topics for future calls for projects.

As of August 2020, the ENCIRCLE catalogue has published 277 tools (including 170 chemical, 142 biological, 186 radiological/nuclear, 78 explosive and 61 combined) as well as identified 302 gaps and 347 needs, since it became operational in June 2017.

In the past year, a marketplace function has been added to the ENCIRCLE catalogue. Its aim is to facilitate direct interaction between the practitioner and tool provider communities, allowing them to obtain relevant information based on their search

requests. For example, the user can search for tools related to any chosen keyword, and the search results show a list of tools and projects related to the search keyword in their descriptions and titles. Together with these lists of tools and projects a list of associated contacts is also displayed.

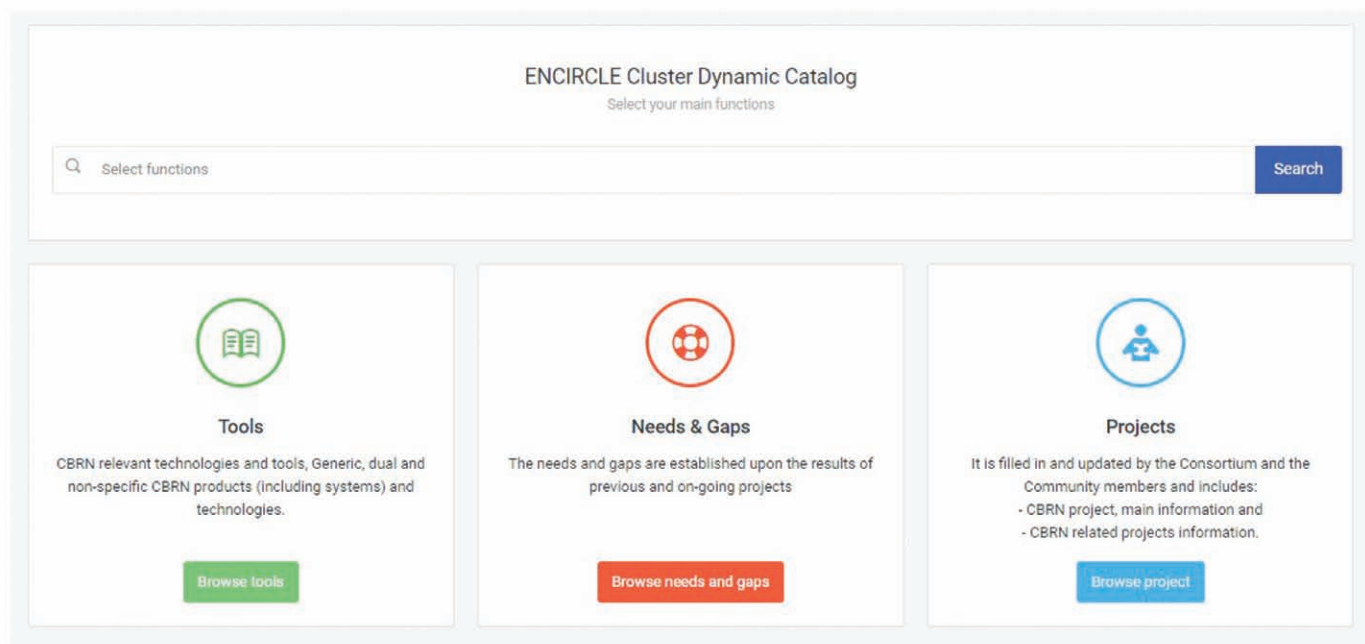
These results provide the practitioners with a list of available services and solutions and the respective points of contact. Tool providers, benefit from these results by gaining an overview of the tools and services available for specific domains, which will be helpful in deciding on the direction and planning of their research. The research community gains an insight into the available projects on specific domains and the respective point of contacts. They will also be able to get in contact with the tool and service providers that are relevant for their calls for future projects.

Another function that was launched in 2019 was the Innovation Watch. In the Innovation Watch catalogue, users can obtain relevant reports on CBRN matters that are collected, vetted, and posted by the ENCIRCLE consortium. In addition, two widgets, developed by the European Virtual Institute for Integrated Risk Management (EU-VRI), were added to this section of the catalogue.

They are the Innovation Watch widget, which presents potentially interesting novel innovations, and the Radar widget that provides a pre-analysis of activities in the field of CBRN. Using these it is possible to obtain web links to relevant articles and reports (including Twitter, journal reports and news articles). Users can also access all the collated articles in the form of a network map, which groups the articles into categories that include detector, equipment, repair, training, tool, vehicle and wear.

Lastly, in the Network and Groups function of the catalogue a new section category - ENCIRCLE Resources - was created to house the ENCIRCLE project resources which will be useful for the communities. Currently, the uploaded resources include reports on first market analysis, human factors analysis, business maturity model and best practices.

Although all the proposed functions of the ENCIRCLE catalogue have been implemented, the ENCIRCLE project will continue to provide updates to the existing functionalities with the help of feedback from the catalogue users, communities and the ENCIRCLE consortium partners.





# Only the freshest products available!

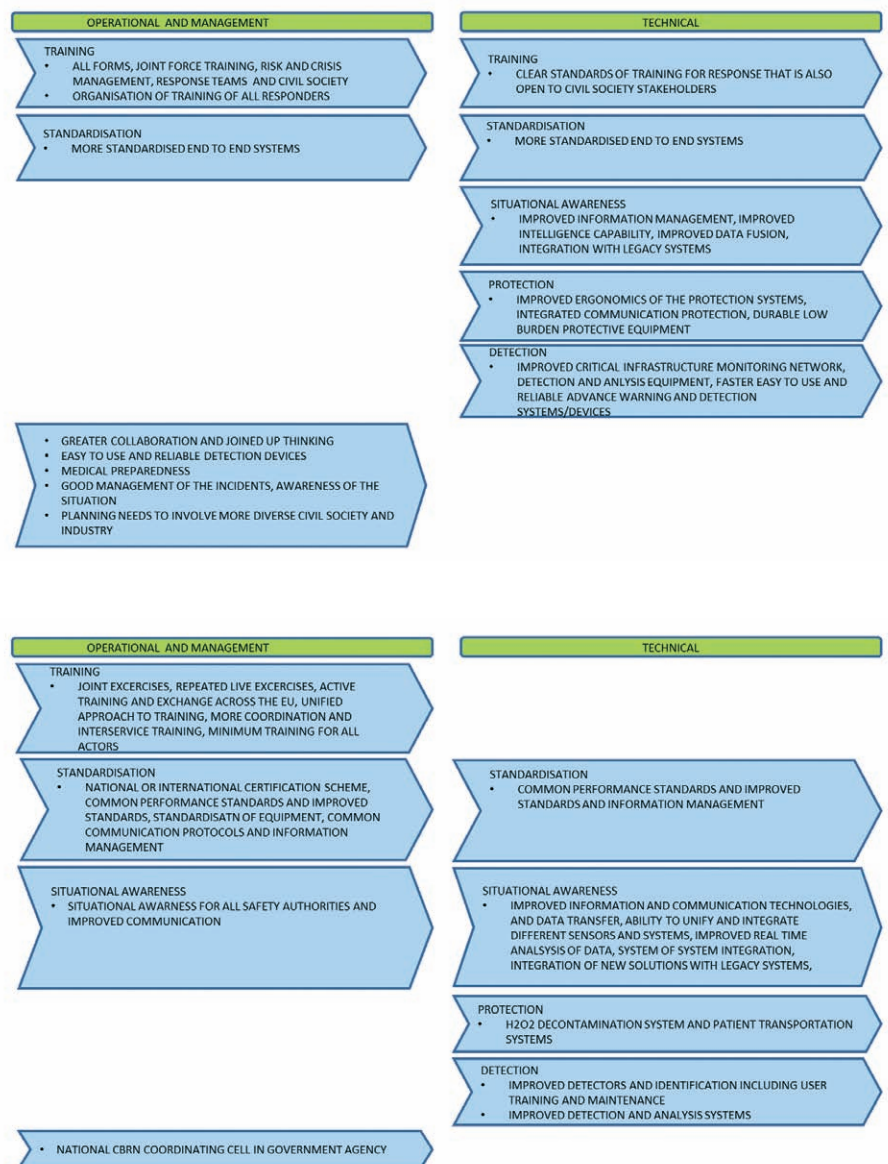
## Clive Goodchild on the market analysis refresh

The ENCIRCLE project has run a number of surveys during its lifetime, and in years one and two (2018 and 2019 respectively), such surveys concerned the security market, standards and interoperability. These surveys have been shortened and combined so we can compare progress and identify any changes in the CBRN landscape. The current survey was targeted at both the practitioner and the technological and industrial communities, and took the form of 18 multiple choice questions and two open questions, which were issued on the SLIDO platform in four languages, namely English, French, German and Italian. A summary of some of the key messages is given below.

**Needs and gaps:** For both communities information management, which includes warning and reporting, and detection, identification and monitoring (DIM) are seen to have the biggest capability gaps with biological and hybrid threats considered to be the greatest risk over the next five to ten years. As part of the market needs and gaps analysis the communities were specifically asked about areas for improvement in the interoperability and first responder protection categories within the technical and operational/management areas. Their views were also sought on where within those areas there is a need for research and development for implementation in the next five years. The results are summarised below.

### First responder protection / Improved interoperability

For the operation and management area the responses were generally clustered around the need for more and better training and standardisation. For the technical area, again the responses clustered around standardisation as a key area, but they also gathered around improved situational



awareness through to improved information management, better link protection and detection. From the first responder's

perspective, the technical areas of improvement are also compatible with the capability needs as identified under the

International Forum to Advance First Responder Innovation (IFAFRI) initiative.

**CBRN specifications and standards:** Both communities believe that standards help in the promotion and uptake of innovations and help new market entry. While there would appear to be considerable scope for standardisation among CBRN products and services in the CBRN community, this has to be tempered with the responses stating that standards are poor and outdated and have little relevance to current capabilities. According to Tom Flynn of TFC Research and Innovation Limited, and a member of the No-FEAR Project (see <http://no-fearproject.eu/>), the results are not surprising.

He believes that if the same survey was to be conducted in three years' time the same results or even worse, would be recorded, depending on your perspective. Reasons stem from the time involved in producing a standard, lack of knowledge and understanding of the process necessary to deliver a standard and the effort involved. To these might also be added the facts that several standards require compliance testing at Notified Bodies in order for companies to obtain certification, and the cost and time taken to get this certification can often be brutally expensive and lengthy. Both factors tend to act to the disadvantage of SMEs.

Underlining all this is the interest in the subject matter within the community, as well as cost. Gaining a practitioner's attention when speaking directly with them about standardisation is rarely as simple as it sounds, however, discussions with practitioners regarding better practice have proved more achievable, and there is a greater appetite for more information. Knowledge exchanges through the development of the Stair4Security platform (<http://cen-stair4security.eu/>) on standardisation will also help in the future, but perhaps a more flexible approach is needed and the development of a model designed specifically for the needs of the community is the way forward.

**Market:** The majority of the respondents believed that they will have business growth in the next five years and this compares favourably with the 2018 survey. As regards awareness of innovations, a key message is the importance of having these innovations involved in joint exercises or training. This has taken on a far greater importance in 2020 when compared with 2018.

**Civil protection and defence perceptions:** The 2018 survey questions concerning perceptions of the communities' views of the civil protection and defence markets was re-run in 2020. While both communities are seen as

equally risk adverse, the perception of the defence community is that it is seen to be more integrated and coherent, more willing to support innovations, and given a higher priority when it comes to funding. The civil protection community on the other hand is seen as much more willing to engage in discussing future capability needs and gaps.

The full results of the revised ENCIRCLE market analysis report, which also includes procurement and policy, will be available in the resources folder of the ENCIRCLE Networks and Groups Forum (at <https://forum.encircle.eu/index.php>). It is freely available to everyone who registers on the ENCIRCLE Catalogue and Forum, together with other ENCIRCLE resources.

As a general comment applicable to all surveys conducted by European funded projects, the number of responses received is a challenge and more work is required on how to best gather information from the practitioner and technological communities. This is especially the case in these challenging times, in which a lot of the projects are operating virtually. A possible way forward would be for the communities as a whole to consolidate and cooperate with surveys, which may result in a higher buy-in from the networks.

# The First European CBRNE Standard

## Toni Leikas, from Environics Oy, on providing frameworks for improvement

The European Committee for Standardisation (CEN) and its technical committee, TC 391 Societal and citizen security, have strengthened their activities in recent years. This enables them to pursue the development and publication of new standards on the CBRNE glossary, on training for security professionals on CBRNE and guidelines for handling crowds during major events.

The publication of the glossary on CBRNE (European CBRNE glossary, EN 17173:2020) will be one of the major achievements of TC/391. Inspired by the glossary of the

European Commission's Joint Research Centre (JRC), this publication includes a set of around 600 terms and definitions to be used by security professionals when responding to emerging threats related to the management of dangerous substances. It has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Common understanding and communication is important in the implementation of an effective CBRNE response, and this communication will be most effective when there is common understanding of the

terms used. Many of the terms and definitions listed in this European CBRNE glossary have been widely used for years, while others are the result of experience gained across a number of different areas of CBRNE. The gradual evolution of our understanding of CBRNE and response measures means that CBRNE terminology will continue to develop. This standard is dedicated to first responders, administrative staff, industry representatives and researchers.

The CEN is publishing the standard during the year 2020.



# Serve the public trust

**Rachele Brancaleoni, Health Visitor at the Emergency Surgery Department of the Catholic University of Sacred Heart on human factors in robots and PPE**

The fields of human factors and ergonomics aim to reduce human errors, increase safety, comfort, and productivity by considering the interaction between the user and the object.

In the ENCIRCLE project we have dedicated work to this area that is led by Università Cattolica del Sacro Cuore (UCSC) together with Sieć Badawcza Łukasiewicz – Przemysłowy Instytut Automatyki i Pomiarów (Ł-PIAP).

As human factor lead we are at the disposal of all Part B projects to assist them in the development of their solutions, we also collaborated in the definition of Part B topics together with the rest of the ENCIRCLE consortium. We have produced two non-deliverable documents, namely "ENCIRCLE Human Factors Questionnaire – Analysis" and "ENCIRCLE PPE Human Factors linked to COVID-19".

For the first document we started with a literature search, we then drafted a questionnaire that focused on 4 main areas (PPE, Detector, Drone and Robot) and disseminated it. The questionnaire published on an EU survey platform received answers from very skilled personnel (average experience being 11.5 years) and was analyzed in the document. The responses were interesting and included:

- PPE: without taking into account the various level of protection, responders have

suggested the following areas as a priority: ergonomics; thermal burden; ease of communication; and versatility (use for chemical, biological, radiological protection). Responders expressed their concerns on glove thickness, the height difference between old and young soldiers and ballistic protection (suits and plates) for women.

- Detectors: responders assigned a high priority to user-friendliness/intuitiveness of detectors and presence of alarms. For this last item they would appreciate a detector that, when it alarms, displays information as well as having a flashing light and vibration. They would also like detectors to have buttons or switches that are easy to use when wearing PPE.
- UAVs or drones: responders have suggested the following areas as priority: user-friendliness/intuitiveness of device; modularity; interoperability; fast deployment; ability to operate in various weather conditions. The word most raised by responders in terms of the usage of UAVs was 'trust.' Most of the responders currently use UAVs rarely.
- UGVs: responders assigned a high priority to the following areas: ability to operate in various weather conditions; use with other devices (controllers, displays, audio, ...); controller's usability; possibility of decontamination. The words most associated by responders with their

attitude towards the UGV are 'trust, efficiency, simplicity.'

On March 13 the head of the World Health Organization (WHO) reported that Europe was becoming the new epicenter of the COVID-19 pandemic and as group we felt the need to give our contribution to the discussion. The non-deliverable document was designed to discuss some of the considerations that were already made by different entities (e.g. The Royal College of Nursing), and to organize them in a useful way for stakeholders. We considered PPE availability, problems associated with PPE, badly fitting PPE and the procedures that the healthcare workers (HCWs) are asked to perform while donning PPE as well as other factors implicated. The current document is not expected to be exhaustive and fully comprehensive since the COVID-19 pandemic is still ongoing, we expect many contributions on this in the future. To conclude, the scope of PPE is to provide protection, but thanks to new materials and expertise we might expect an improvement of ergonomics thereby helping HCWs to carry out their activities with more ease. The process of PPE re-design should involve all actors from end-users to manufacturers, taking into account users' needs and new technologies that may be useful.

All the documents are available on ENCIRCLE Forum, accessible upon registration.

# Train now departing

## Toni Leikas from Environics Oy on platform Integration

The concept of CBRNE is quite complex since it involves various end user groups – the main division being between the civil and military domains – technologies, and remarkably varied terminology. In particular, the term platform integration has a wide range of definitions.

The ENCIRCLE project has generated a guidance document on the subject of platform integration, which provides a comprehensive description and definition of this term in a CBRNE related context. The existing CBRN integration applications, their requirements, and main standards are also introduced in the document.

Within the ENCIRCLE project this is the basis for the preparation of research and innovation actions (RIA) aimed at research and development of novel CBRN technologies and innovations providing solutions for the gaps and needs identified in the security market by end users. The document is based on CBRN applications on the market and in use, not forgetting innovation and CBRN integration applications under development. The document also provides guidance to innovators on what should be considered to allow cost effective integration of their solutions with systems and platforms. The latest version of document can be found in the ENCIRCLE repository.

The main ISO standard definition for the term 'integration' is this: "Integration is [a] system condition or activity to realise the condition in which components of a system are organised to collaborate, coordinate and interoperate while exchanging items, as needed, to perform a system's task." On a technical level, integration is the implementation of specific processes and procedures to enable communications between different systems/units/devices.

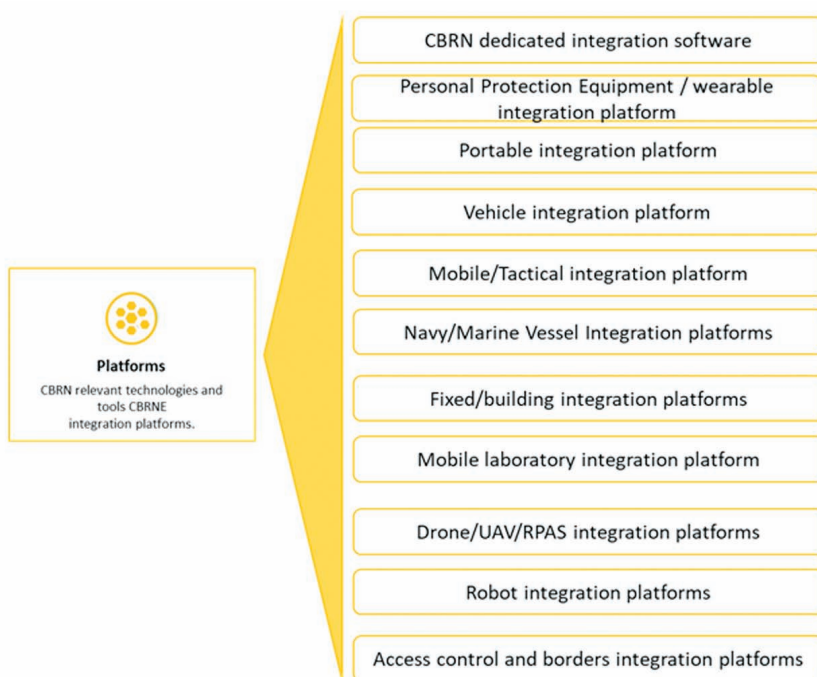
A platform is a structure which supports a sensor, or sensors. And a sensor network integration platform is middleware which integrates any given sensor network into a wider IT system using an abstraction layer, controls the interaction between sensor networks and existing enterprise infrastructures and supports intra corporate and cross company integration. Then, again, a platform is an operating system (OS) and hardware that executes the OS.

Integrating CBRN equipment into a system (integration platform) is a complex process. To accomplish this, the CBRN system integrators need to synchronise the system and equipment, technical and tactical experience, and their understanding of the CBRN system user's capabilities, access and placement. A collaboration between various functions refers to related actions, capabilities, and activities like communication, management, control, detection, monitoring, protection, prediction, and sustainment to help synchronise, integrate and direct the overall CBRN situation and incidents.

A CBRNE system platform incorporates various device integrations, data communications, databases, system services and controls with user interfaces. The platform is structured to support the seamless use of the system, system components and platforms. The system provides an indication (detection) and warning of emergency situations involving hazardous materials or CBRN substances and the fact that responders are operating in a CBRN environment. The CBRNE system is dedicated to providing indication (detection) and warning of emergency situations involving hazardous materials or CBRNE substances, and incorporates various sensor integrations, data communications, databases, system services and a control panel with user interface.

Future chemical detection systems [must be] capable of accurately detecting, identifying, quantifying and classifying relevant toxic industrial materials, low-volatility, and liquid and solid chemical warfare agents at the lowest levels of military operational significance. [It is essential to] develop personal detection devices that can be worn by response personnel and inform responders and command health centres of hazard levels. Detectors [must be developed] with sufficient sensitivity to confirm that decontamination processes have neutralised or eliminated contamination on personnel and equipment so that operations can resume without the use of protective equipment. Detectors [must also be developed] capable of operating at ranges significant enough to provide warning to forces in the field. Sensor data must be relayed to and integrated with other information systems to support operations and enable additional analysis.

Future integration goals are early warning (range), remote unmanned, and multi-modal sensor integration, integrated sensors for early warning, wearable chemical and biological agent detectors and physiology monitors, data fusion and decision support tools integrated with situational awareness tools, and ad-hoc sensor integration.





# Only forwards

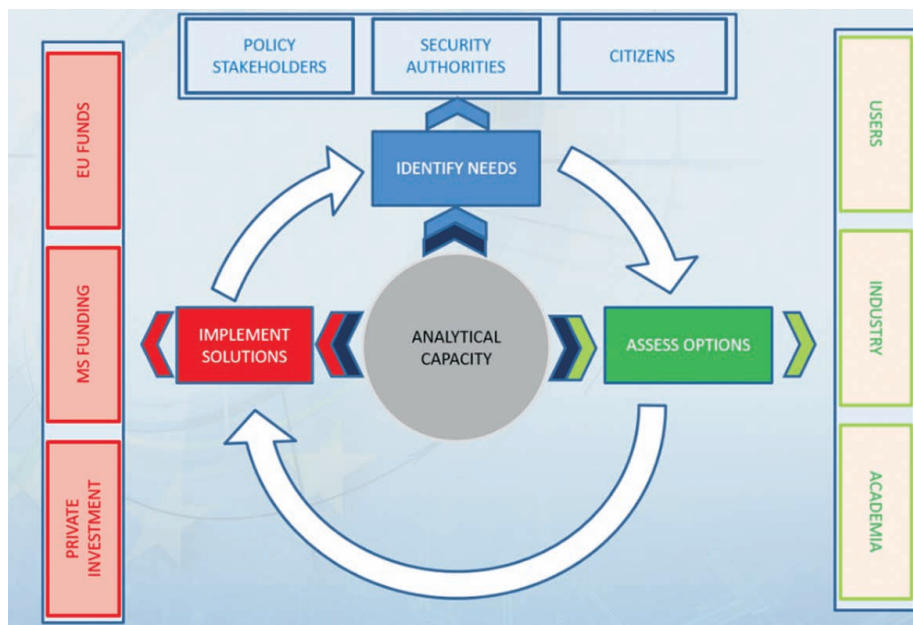
## Clive Goodchild on ENCIRCLE Sustainability and the way forward

ENCIRCLE has been addressing potential sustainability options over the past six months as part of early preparations for the completion of the project in August 2021. Within this analysis the project has considered a number of options and the latest thoughts in the area are summarised below. It should be noted that these are still under development and the project welcomes inputs and comments in this important area.

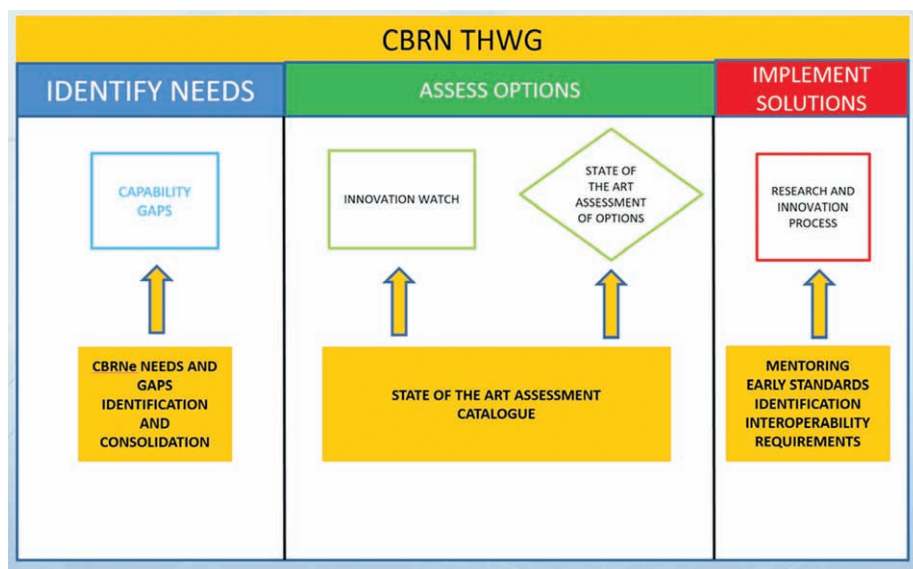
The ENCIRCLE catalogue will be maintained in its current form for a period of two years beyond the completion of the project at the end of August 2021. Before then, the intention is to progress to a point at which a neutral management board can be put in place to manage the catalogue and ENCIRCLE is looking at options as well as welcoming requests in this area.

The project has already decided to close the Networks and Groups Forum Resource in the catalogue. It is considered that there are far too many different networks and group forums across all the security projects, which is creating too much duplication. As a result the project will be looking at whether this function can be taken up by another resource and therefore start to reduce duplication in this area. In an ideal world, practitioners and innovators should only need to register with a single platform. This will make sustainability easier and means GDPR is controlled and maintained in a single sustainable platform. A toolkit of resources is being prepared to help support the SME-led DRS04 Part B projects.

Concerning the sustainability of the ENCIRCLE cluster a number of options are currently being explored. These include the potential progression of ENCIRCLE into a new CBRNE Thematic Working Group (THWG) or cluster network comprising CBRN experts from all communities. This cluster could form part of the next generation of the Community of Users (COU) or be an independent group that can be consulted as part of the COU. ENCIRCLE has already considered how CBRN could be part of an overall capability based approach for security research planning. These thoughts were inspired by discussions with DG HOME and it is important to note that the research planning process being considered by ENCIRCLE does not reflect



Capability Planning Model ©DG-HOME



any actual or planned implementation. It is a conceptual model that could serve as a reference for a potential future workflow to be supported by the COU. So let's consider an example capability planning model as illustrated above.

The type of inputs that the CBRN network of experts/THWG might make to this planning

process could be as illustrated above. More information on this process is included in the ENCIRCLE year four discussions report, and ENCIRCLE welcomes views on and inputs concerning the catalogue and cluster sustainability as well as this planning process. To express any such opinions you are invited to make contact at [zoe.rutherford@cbrneworld.net](mailto:zoe.rutherford@cbrneworld.net)

# All disasters start

**Philippe Quevauviller Research Programming and Policy Officer at European Commission on moving CBRNE civil research forward with the community of users**

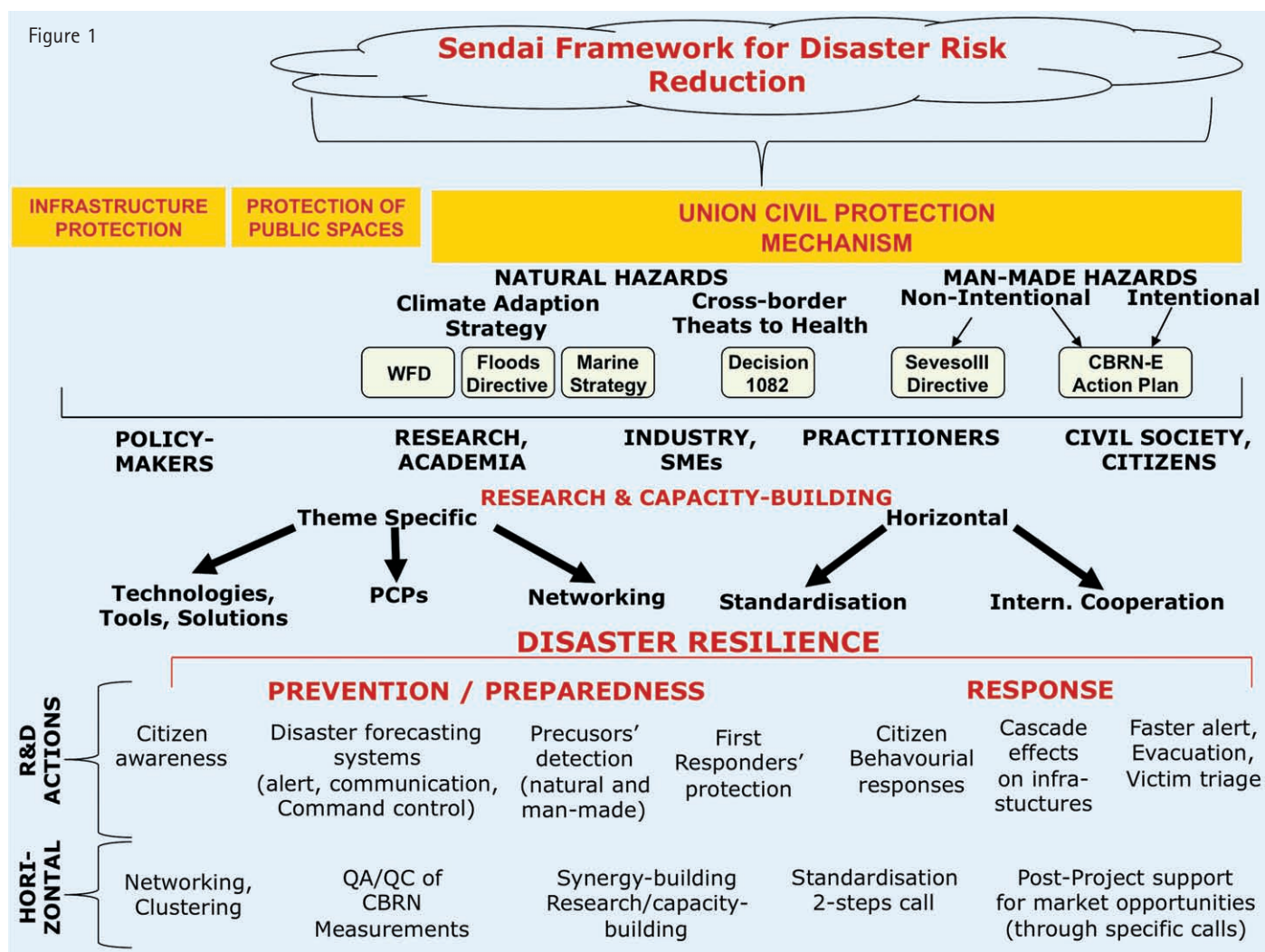
Numerous sectors and policies cover the issues relevant to secure, safe and resilient societies directly or indirectly with a reference to CBRNE, by providing legally binding frameworks in the form of international conventions and EU policies with strong links to supporting research programmes. At the international level, the Sendai framework for action sets priorities for the period 2015-2025. Among these are the promotion of a better understanding of disaster risk management through the building, sharing and development of knowledge and the strengthening of the policy/science interface at local, national, regional and global levels.

This framework is closely interrelated with a wide range of EU policies that are depicted

in figure 1. Some are directly relevant to the CBRNE sector, namely the union civil protection mechanism and parent policies, in particular the CBRN action plan and the Seveso III directive on major accident hazards involving dangerous substances (linked at international level to the UN convention on transboundary effects of industrial accidents), and the new approach to the European programme for critical infrastructure protection, etc. Environmental policies are of less direct concern as regards CBRN issues, with the exception of water safety (and security) aspects and deliberate pollution of freshwater and marine ecosystems. Health policies, in particular the decision on serious cross border threats to health, have a clear CBRN dimension in relation to pandemics.

Implementation of these policies presents a complex and ambitious challenge as they involve a wide variety of actors, namely policy makers, research/academia, industry/subject matter experts, practitioners and civil society. Member states often follow specific national approaches or action plans for dealing with crises and are also differently organised in terms of disaster risk management capabilities. The EU framework amounts to a means and opportunity to discuss possible ways to improve coordination among the various national approaches, and develop a common EU vision strengthened by a joint strategy. This is actually what the CBRN action plan is seeking.

In parallel with politics and diplomacy, EU research provides an informal exchange platform for identifying cooperation and





# at the local level

coordination opportunities, thus helping decision making at the political level. In this respect, the EU has invested over €3bn in security research since 2007. To date this has yielded over 600 projects supported through EU funding in areas related to disasters risk reduction, infrastructure protection, the fight against crime and terrorism and border security, part of which dealt with CBRNE

Project outputs have materialised in different ways, including scientific findings, the maturation of promising technology areas, the operational validation of innovative concepts or support for policy implementation. Over the years, a strong security research community of highly committed stakeholders has been consolidated. Policy makers, practitioners, industry, scientists and citizens are the pillars on which a sound security research agenda is built that then feeds into action programmes. The dialogue between those who define the security priorities and those with production capacity is what guarantees that research addresses real needs, and that investment in research will deliver tangible results.

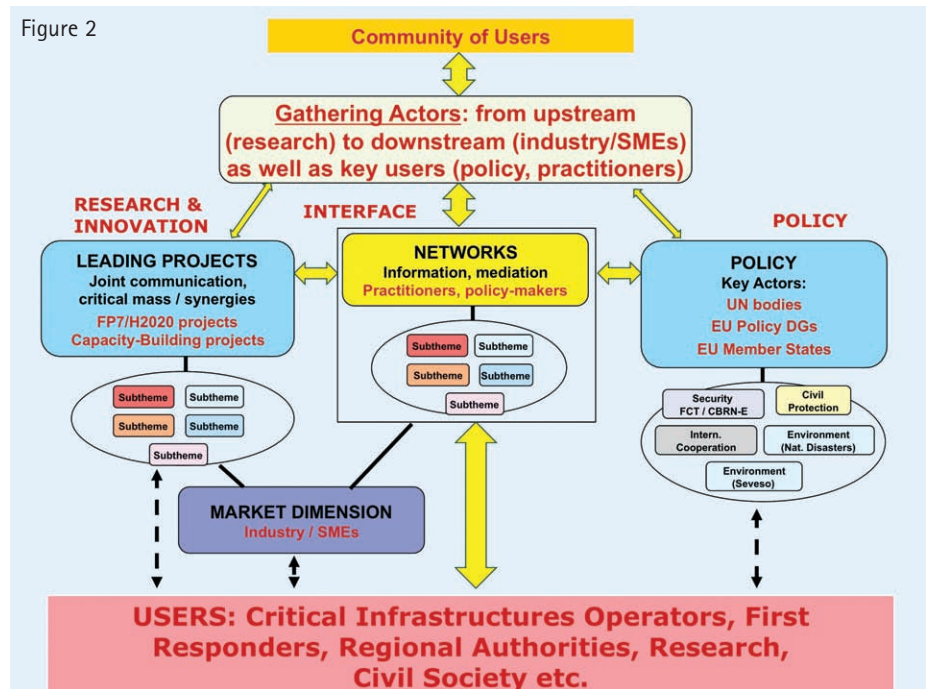
## The policy/science landscape

In 2014, the commission established the community of users for safe, secure and resilient societies (CoU) to facilitate interaction within the research community. This informal platform currently reaches out to around 1,500 members and regularly holds thematic events on various topics, including CBRNE. The initiative brings together key scientific, policy and industry actors, as well as other stakeholders, for instance first responders, police, firefighters and civil protection units, around a common vision and strategy. It ensures that research programming takes practitioners' needs into account, and promotes research results that are relevant to them, while making their expertise available to policy makers, thereby facilitating the policy making process, and supporting policy implementation. The network also aims to identify the most promising tools, particularly those developed in FP7 and H2020 projects, that could potentially be taken up by practitioners.

## CoU interactions

In 2019 CoU activities were structured around a number of specific thematic groups, consolidating the developments since 2014.

Figure 2



These groups were established to serve homogenous security related topics, one of which deals with disaster resilient societies. CBRNE issues are covered by this thematic area from a disaster risk perspective, as well as by the fight against crime and terrorism in its forensics dimension. Notwithstanding the added value this approach provides regarding the dialogue established among various actors, further fine tuning was necessary to ensure that the platform's activities meet the capacity necessary to look structurally into future challenges, anticipate research needs and propose innovative technology solutions. As such, former CoU thematic groups lacked topdown direction in terms of objectives to be met and issues to be addressed, a formal channel of communication between the CoU and entities receiving recommendations stemming from the thematic group discussions, and a process enabling the groups to work in a continuous, regular and structured manner. The commission is hence developing a governance mechanism that is progressively taking shape for an expected launch in 2021, coinciding with the start of the Horizon Europe Framework Programme.

While the developing activities will keep existing elements alive, there will be a strong shift in emphasis and *modus operandi* of the CoU's work. Up until now this was mainly based on *ad hoc* workshops taking place

once a year (in a number of different sessions) in which members discussed current trends and presented projects within their respective thematic areas (eg CBRNE). The updated approach anticipates the development of a permanent CoU expert group, with members invited by the commission through a call for expressions of interest due for publication at the end of 2020/early 2021. The expert group will be structured as different thematic working groups related to thematic areas of Horizon Europe's security research programme<sup>1</sup>, with specific tasks and mandates.

Members of this CoU expert group will operate as a coordination board for the CoU, involving representatives of relevant international and EU policy entities, with clear missions turned towards concrete outputs from the CoU activities, eg recommendations for research programming, market analyses, state of the art reports etc. One of the areas to be considered will naturally focus on CBRNE, in full continuation with former CoU developments. In this respect, key projects with networking potential such as ENCIRCLE, eNOTICE and other areas will have strong roles to play. The next steps, expected in early 2021 are the adoption of the Horizon Europe work programme and the consolidation of the CoU as described above.

<sup>1</sup> Namely, Infrastructure Protection (INFRA), Disaster Resilient Societies (DRS), Fight Against Crime and Terrorism (FCT), Border Management (BM) and Strengthened Security Research and Innovation (SSRI).

# Top of the class

## Dr Tomas Rindzevicius of Silmeco ApS on exploiting Surface Enhanced Raman Spectroscopy (SERS) and Advanced Algorithms for Guiding Responses to Potential Chemical Threats

Despite sustained efforts over the past decade or more, effective instrumentation for detecting and guiding responses to CBRN threats in public spaces has yet to be developed. The proposed project entails the development of novel handheld or robot-mounted instrumentation for near real time or on demand detection/identification of chemical threats coupled with advanced algorithms to aid responders and incident commanders in hazard assessment and decision making.

The SERSing project involves a team of four leading European academic groups, two high tech companies (SMEs) with demonstrated expertise in advanced sensing and lab-on-chip (LoC) technologies, as well as two stakeholders (end users) responsible for CBRN and civil protection.

The vision and the overall goal of the project encompass a novel class of robust, lightweight, miniaturised, simple to use and cost-effective plug and play microfluidic surface enhanced Raman spectroscopy (SERS) platforms. Upon interrogation by an adapted handheld Raman spectrometer they can provide a timely, comprehensive picture of chemical hazards at the incident scene to improve real time situation awareness and decision making. Gas and liquid samples are collected and delivered to the microfluidic platforms on demand or

by a triggering signal; SERS analysis is performed and chemicals are rapidly identified. The results are then fed into a remote monitoring station equipped with fusion algorithms that provides options for response/action. We have coined the term 'SERSing' to represent this new sensing, evaluating, responding, securing (SERS) based approach.

The main objective of the SERSing project is to develop and validate on-field detection and identification for relevant chemical threats, ie chemical warfare agents and toxic industrial chemicals. The Raman-SERS kit will comprise ultra-sensitive SERS LoCs configured as ready to use add-ons for gas and liquid sampling and detection and a customised Raman instrument equipped with geo-location and communication technologies for the rapid screening of the incident scene.

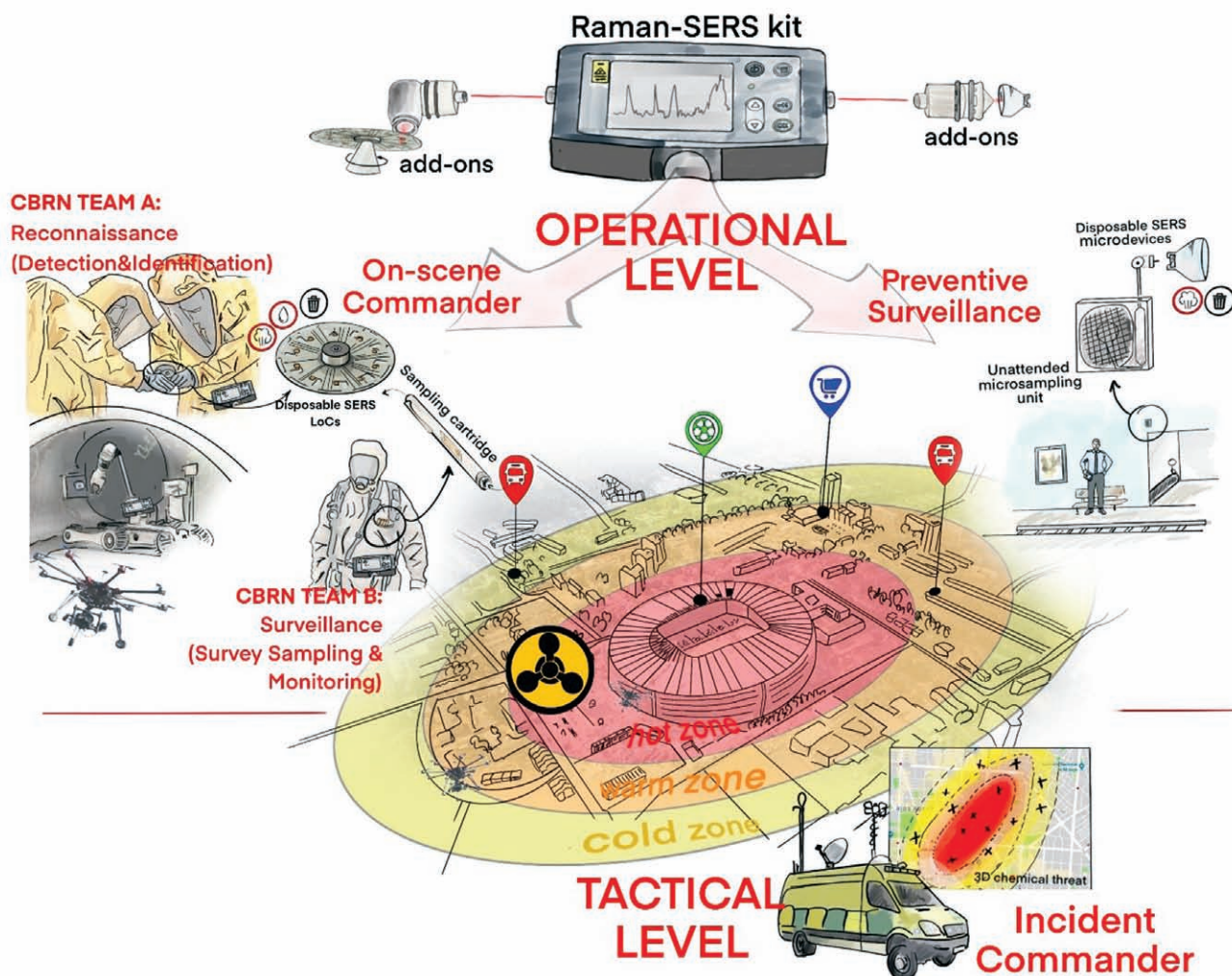
The kit has been conceived to overcome the common operational limitations of first responders, to be compatible with personnel protective equipment (PPE) and respirators, and easy to use and maintain with low cost consumables. Thus, SERSing responds to some of the existing capability gaps and specific needs already identified by ENCIRCLE and the International Forum to Advance First Responder Innovation (IFAFRI) in the domain of chemical threats.

The 2017 EU CBRN Action Plans to enhance preparedness against CBRN security risks and support the protection of public spaces it emphasises the need to strengthen chemical security with a focus on preparing for, and responding to chemical incidents and terror attacks. The tactical importance arises from shorter response times, shorter on-site assessment times, and faster recovery and restoration times. Research and innovation is essential to keeping up with evolving security needs.

According to IFAFRI, first responders need technologically advanced tools and equipment that are affordable and innovative to rapidly identify, detect and analyse threats and hazards. These solutions may also include subsequent software or devices enabled to display data and analysis on an intuitive user interface. In order to improve responder safety, efficiency and effectiveness, responders need the ability to rapidly identify hazardous agents and contaminants, and understand pertinent information regarding protective actions or treatments for these threats to improve response situational awareness at incident scenes and decision making.

The commonly used cumbersome chemical detectors are mostly based on ion mobility/mass spectrometry techniques and their acquisition prices start from \$30,000





excluding data libraries. Miniaturised sensors are gaining importance but efforts on multi-sensor integration and analyses are still required to provide reliable measurements.

This project yields a rugged, easy to use, handheld Raman-SERS kit that can be operated by first responders wearing PPE, mounted on a robot/drone, or emplaced on a network of fixed locations. The instrument can provide fast, trace level detection and unequivocal identification of a wide range of chemical threats in air or

liquid media encountered in real world environments. The geo-located data are transmitted to a smart, online platform for rapid processing, and the information derived from the data is immediately accessible to authorised personnel for decision making and response actions/alerts. Pre-operational validation of the prototypes by means of field exercises is also addressed to provide input for the iterative and continuous upgrading of the SERSing technologies. Commercialisation is facilitated by involvement of SMEs and end users throughout the development,

implementation and outreach phases of the project.

The project is coordinated by Dr Tomas Rindzevicius of Silmeco ApS, in collaboration with eight partners across Spain, The Netherlands, Denmark, Sweden, and the Czech Republic. Partners include: Technical University of Denmark, University of Zaragoza, University of Vigo, University of Twente, Serstech AB, Swedish Defence Research Agency (FOI), The National Institute for Nuclear, Chemical and Biological Protection (SÚJCHBO).

# Better, faster, CBRN-ER

## Rob Munro of ARTTIC on tools for more effective recce

The first hours of response to a CBRNe incident, and especially a radiological event, are particularly critical. The need is to contain the most severe consequences, stop the ongoing criminal/terrorist threat, save victims, manage the crime scene and organise an effective response by all stakeholders concerned – firefighters, health responders, forensics, police, decontamination units. These are also the riskiest moments for the first responders, as the nature, extent and intensity of the contamination is still unknown and booby traps and contaminated objects may be present.

The solutions provided by the TERRIFFIC project are tailored to the needs of practitioners and will allow for reduced human intervention in the operation, due to a higher number of automated processes and improved and extended mobile detection capabilities in the hot zone.

Improved situational awareness and the delivery of near real time data within the TERRIFFIC System will result in a better common operational picture. This will enable the incident commander to gain a better comprehension of the nature of the threat and therefore make better informed decisions.

### Project objectives

The project has five key objectives.

**Objective 1.** Deepen the shared understanding between practitioners and (technological) solution providers on the needs/requirements during the first hours of response and the technological possibilities and features matching them.

**Objective 2.** Create the open architecture of the TERRIFFIC System, which promotes (future) integration of (existing) solutions and develop an innovative user interface enabling practitioners to easily deploy the system during immediate response.

**Objective 3.** Adapt promising existing solutions from previous research initiatives, convert them into TERRIFFIC core components and integrate them the system.

**Objective 4.** Develop novel solutions on mobile sensing, measurement devices and dispersion models and integrate them as core components.

**Objective 5.** Successfully test the system and its core components under demanding lab conditions and within field trials to demonstrate the reduction of response time within the first hours of an RNe incident.

### A step change in first responder efficiency

The system consists of a set of complementary, interconnected and modular software and hardware components, which represent both novel developments of innovative technologies as well as enhancements and optimisations of existing solutions.

The system and its core components are highly mobile and suitable for rapid deployment. The tactical incident management system installed on the mobile van will be initiated while en route. The van will also be equipped with easy to set up ground detectors for immediate deployment on site, as well as having handheld detectors for use once the initial assessment of the risks has been completed.





Specialist UAVs, able to fly in rain and gusts of up to 90kph (56mph), with the world's smallest gamma cameras and new sensors attached can be operational within minutes, and used to visualise and identify the location, size and type of the source. They will also be able to spot possible victims and communicate visual data about damage and people needing assistance.

UGVs with sensors and cameras can be sent in to obtain further data. The data that these sensors provide are used to create a plume modelling forecast, which will give a more accurate and dynamically updated determination of the contaminated area and the control area. The plume modelling algorithms have been specifically designed for use in complicated urban environments and take into account the wind, weather and surrounding buildings, which will all affect the spread of radiation.

All of these tools send information into the augmented reality solution and the incident management software concurrently. This greater knowledge results in a reduced risk profile and a higher level of safety for first responders.

It has never before been possible for a CBRNE incident commander to access so much data in near real time. We have the potential to have a significant and genuine impact on how an RNe incident is managed by first responders and to save lives both of practitioners and members of the public.

#### Project achievements to date

- **Bruhn NewTech.** Development of established incident management software that can accept and share data from various external tools and solutions, including detectors, sensors, cameras, plume modelling and mixed reality, providing improved situational awareness in a user friendly format.

- **École Centrale de Lyon.** Development of established incident management software that can accept and share data from various external tools and solutions, including detectors, sensors, cameras, plume modelling and mixed reality, providing improved situational awareness in a user friendly format.

- **Luxembourg Institute of Science and Technology.** Innovative, bespoke CBRNE mixed reality solution, allowing 3D visualisation of the incident; data from the UAV or UGV-mounted sensors are fed into the software, which can also be used to draw on cordons or other key information. This is integrated into Bruhn NewTech's incident management software solution and is dynamically updated during the incident.



#### – The French Alternative Energies and Atomic Energy Commission (CEA).

Development of the world's smallest Nanopix gamma camera that weighs just 268g (0.59lb), which can be mounted onto UAVs and UGVs. A new handheld gamma detector that will be able to detect beta contamination in a high gamma background.

- **AERACCESS.** Adaption of the Hawker Q800X, a ruggedised UAV, which can fly in higher winds (70kph with gusts up to 90kph), rain and other weather conditions, to take the gamma camera and sensor as additional payloads and feed data back into the incident management system; successfully used in trials. In addition, the smaller NanoHawk UAV was flown in tests inside a building with a camera and located the radiation source; a larger drone was used to relay comms to NanoHawk.

- **Nexter Robotics.** Adaption of the Nerva XX UGV to take the gamma camera and gamma detector, providing more accurate data and imagery from inside the hot zone.

- **ARKTIS Radiation Detectors.** Successful integration of the TERRIFFIC System inside the MODES mobile detector van. A high sensitivity SiPR gamma detector was developed and tested on UAVs and UGVs.

#### Exploitation update

A dedicated exploitation working group

has been set up, which is exploring the most appropriate and most impactful ways to exploit the results of the TERRIFFIC project. Identified possible routes include being involved in further research, providing input to policymakers, and the partners working closely together to add value to their existing customers by encouraging them to procure one or more of the TERRIFFIC components alongside the solution they already own. It is also feasible that this route could attract further external development funding in due course.

An independent CBRNE market analysis has been commissioned by TERRIFFIC and ENCIRCLE to research the overall market and to identify key trends and market opportunities. Following two interim review sessions, the final report was scheduled for delivery on 21 September. This key piece of work will provide great assistance to the working group and individual partners, and enable them to focus on the sectors with the greatest potential for exploitation.

The project partners are also working in parallel on their own exploitation plans. A dedicated session was scheduled to be held during the general assembly meeting on 21 September to discuss these, after which they will be incorporated into a formal report for the European Commission.

# Star gazing

## Darío Ruiz López, Daoiz Zamora Perez and the Cosmic consortium look at cargo screening

### Objectives and concept

Modern customs officers deal daily with tens of thousands of containers, potentially containing CBRN threats. They currently open some containers for inspection, sometimes basing their choices on the cargo manifest and additional knowledge from customs administrations. The H2020 Profile project (<https://www.profile-project.eu/>) is currently working on the automatic analysis and incorporation of data from different sources, resulting in an improved selection of containers for inspection.

But even with this automatic profiling of cargos there are still several challenges to face. Manual inspection of containers remains very expensive in terms of both the resources and the time necessary to do this, and smugglers and terrorists may still succeed in hiding their threatening content in cargos.

Hence, it is necessary to equip customs offices with more effective threat detection technology and an inspection mechanism that is much more cost effective than the current one. The COSMIC consortium has rethought the whole customs operation from scratch, and is proposing the following three phase procedure for processing containers through customs. Customs operator may decide to take any container directly for manual inspection at any time.

- In the first phase, customs operators will run an initial screening of each container using low cost sensors of average precision and fast response times to detect any potential threat from explosive, chemical and radiological types. After this the containers that do not trigger an alarm are released, incurring very little cost.
- In the next phase, containers that triggered an alarm proceed to a second row (leaving the rest of the containers to continue through the process) and are screened with more accurate sensors. This is more expensive and takes more time

than the initial screening, but as it is applied only to the second row, it does not cause any significant delay in the processing of the entire chain. If the second phase sensors detect any threat, the container proceeds to the third phase for manual inspection.

- In the manual inspection phase, containers are opened to physically locate and isolate the threat, and to further clarify the nature of the threat in the case of biological threats.
- Detecting threats by using sensors presents some challenges. X-rays are limited in their capabilities, radiation detection results obtained when investigating RN threat material are matrix dependent and shielding/masking is seen across the organic/inorganic/metal material spectrum.

No sensor is 100% accurate, especially when attackers do their best to hide threatening materials. Sensors normally produce detection probabilities, using probability thresholds for triggering the alarms. Besides collecting measurements from the sensors in each phase, COSMIC will combine these measurements with information from the manifest to automatically obtain the profiling that was traditionally done manually. All this involves refining the probability obtained from sensors while still using the knowledge of the customs authorities.

This optimised process requires a graphical tool to allow the customs operators to follow the whole process and assess the risk for each container. We have developed an advanced, user friendly graphical tool that allows customs operators to easily follow the progress of each container, its measurements, possible threats detected and evolution through the process.

### Progress to date

#### Explosives detection

An explosive detector from SEADM includes the following upgrades:

- High voltage system redesign.
- Cold trap redesign: new cold trap materials and a new cold trap heating system.
- Addition of improvements in flow control and measurement.
- Additional functionality in monitoring and control software has been developed.

#### Nuclear and radiological detection

For the primary phase, NR detection relies on an existing device, the radiation portal monitor and high energy x-rays.

For the secondary phase, the x-ray image will be analysed for high Z objects or high density alarms, producing alarms inspected by the muon scanner, and generating a 3D matrix of the sensed densities, which will be displayed for the users later in the graphical tool.

#### Biological detection

In collaboration with Yale University we have provided an improved differential mobility analyser provisionally named Perez-DMA. The project has addressed some issues from previous versions and implemented solutions, improving the resolution of the instrument achieving a resolution of 4.37% (22.9) using the Israeli acute paralysis virus (25nm), as the following figure represents. This improved resolution compared to typical instrumentation (GEMMA) also allows the study of different techniques of sample preparation. An iteration process of three steps of dialysis provided the maximum reduction of background signal.

The consortium has developed a new version of the instrument with improved resolution (~50, which improves the instrument's ability to discern a virus from another of similar size) and size range increased up to 120nm. It is capable of analysing the SARS-CoV-2 (100nm) virus, allowing for further improvement of current sample preparation techniques due to its unparalleled resolution, and also can





# “They’re swarming!”

## Adam Smolinski on EU-RADION: A novel solution in CBRN threat detection and elimination

The EU-RADION project is a joint operation by eight European institutions active in various fields of endeavour, ranging from research facilities, through academic entities to governmental bodies. The consortium members are focused on developing a novel system for CBRN threat detection and elimination that is intended to significantly improve the capabilities and safety of first responders and emergency response teams.

The development process benefits from the wide range of experience and knowledge that the consortium members bring to the project, along with close cooperation with potential end users. By voicing their needs and suggestions during multiple workshops and consultation sessions during the project, these end users have contributed to ensuring a finished product with real applications.

The project is focused on designing and developing a fully operational system for detection and identification of radiological and nuclear (RN) materials with the added value of improved situational awareness and safety for on-site personnel and dispatch teams. At the conceptual stage, the project consortium members established the following high level objectives to serve as a reference point for the work carried out under the project:

**High level objective 1.** To cover selected capability gaps for European first responders and CBRNE practitioners as indicated in the ENCIRCLE catalogue and International Forum to Advance First Responder Innovation (IFAFRI) study by development of relevant technologies.

**High level objective 2.** To enhance the situational awareness of first responders/CBRNE practitioners during preparedness and response missions.

**High level objective 3.** To boost European CBRNE market innovation and support its competitiveness.

**High level objective 4.** To showcase the operational EU-RADION solution to first responders, CBRNE practitioners, and European stakeholders in relevant conditions. In order to achieve that, the EU-RADION consortium is focusing its efforts on providing both hardware and software solutions tailored to preparedness and the response actions of practitioners in the RN domain.

The main hardware components of the system are as follows:

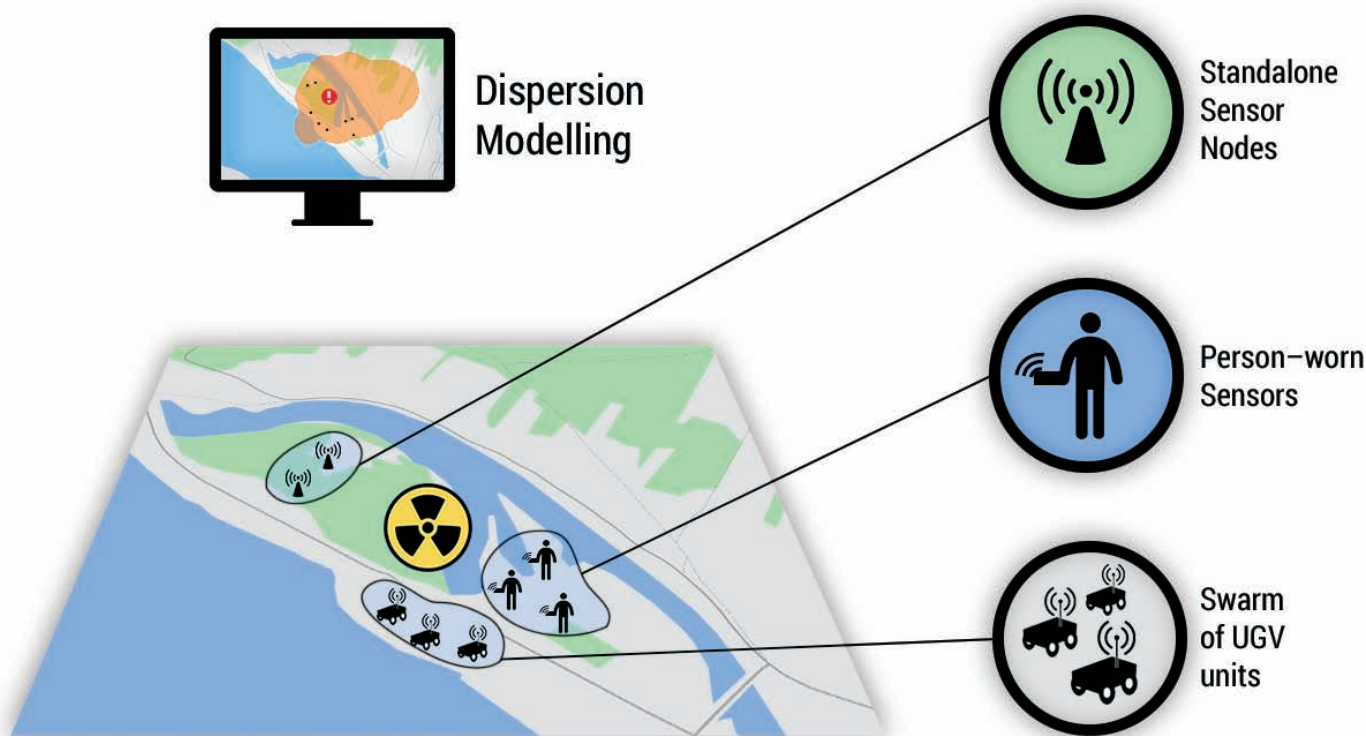
**Sensor integration unit (SIU).** A modular device supporting wireless connection and comprising three sensors (Geiger counter,

cadmium zinc telluride (CZT) detector, gas sensor) allowing the SIU to identify the agent and the radiation dose rate. Each unit is adapted to both stationary and mobile (person-worn or mounted on unmanned ground vehicles – (UGVs)) operation, which allows for the creation of a tight-knit network able to monitor any given area thoroughly and reliably. As a result of a consultation with the potential end users, each unit will be powered by a non proprietary, easily replaceable power source, which can be replaced with off the shelf batteries.

**UGV swarm.** A novel solution in terms of situational awareness in the form of three UGVs, where one is controlled remotely by a qualified operator and the other two move autonomously in relation to the remotely controlled UGV and constantly adjust their movement in order to scan a large area in a much shorter time. Each UGV will be equipped with an SIU and a navigation unit with a positioning module, which would allow for unmanned probing of the environment. This is especially useful when there is a suspicion of high radiation dose rates in the area of interest/incident zone.

**Navigation unit.** A tracking module that is based on both inertial and global navigation satellite system (GNSS) sensors developed to





allow for determining precise location and navigation of the on-site personnel and EU-RADION assets. This is a tool that will significantly increase the real capabilities of dispatch teams and operators, directly translating to improved efficiency and safety of the operation.

In terms of software, the main components are: **Unified data model.** Developed on solutions from the EU-SENSE project in order to provide interoperability and scalability of the network system. The proposed standard is based on XML files allowing for network configuration flexibility and is necessary for the initial setup of the entire network.

**Tactical command tool (TCT).** The highest layer of the system serving as an intuitive user interface and integrating data from measurement and computational components. It will display a map of the area of interest with geo referenced information from the system components, estimated hazard and source areas, and offer means of commanding the system elements along with a display of their technical status.

**Dispersion modelling.** A novel technological solution able to handle complex geometry along with particle-inherent properties (density, spatial

dimensions, static forces) in order to perform deposition simulations beyond standard modelling tools. It will allow for improved source estimation by application of adjoint dispersion models and the method of regularisation, with adaptation of parameter selection methods not yet used in this type of application, eg unbiased predictive risk estimation, generalised cross-validation and discrepancy principle.

The successful development of the above mentioned solutions will directly translate to a significant improvement in terms of effective and time efficient operation of dispatch teams and emergency management bodies. More importantly, it will result in providing much safer working conditions for the first responders and on-site personnel.

Implementation of the EU-RADION's results will allow for a more thorough monitoring of the area of interest. The process of detection and identification of dangerous CBRN materials will be performed with the use of the following sensors:

**Stationary:** cadmium zinc telluride and gas sensors supported by a Geiger counter; implemented positioning module; non proprietary battery or AC power supply (depending on available infrastructure);

wireless communication (processed data are displayed in the TCT).

**Person worn:** As above but also: dedicated user interface and display; generates alerts when close to detected hazards (based on threat map in TCT); mobile collection of data.

**UGV-mounted:** As above but without the alert generation.

Using a combination of the above mentioned sensors will allow response teams to paint a full picture of the area of interest and, with the use of the dispersion modelling software developed in the project, determine the exact area of the threat as well as its source and type. Moreover, this three way approach is safer for the on-site personnel either by alarming them directly of the proximity of the threat (alerts on the person worn sensors) or by keeping them away from the threat by sending the UGV swarm to monitor the area.

With a unique combination of multiple detection technologies, various sensor applications, and novel software, the EU-RADION system is bound to revolutionise the CBRN threat detection market and significantly improve the safety and efficiency of the emergency operators.

# The social network

## Adam Smolinski on EU-SENSE: A modern network of sensors for chemical detection

Chemical agents have been used against military personnel in warfare for generations, however, with increased terrorist activity in recent decades, the scope of the defence effort has broadened to include a significant threat posed to civilians. Both military and civil defence require fast and reliable methods for detecting agents at health risk levels, for accurate assessment of the severity and extent of the hazard and efficient use of countermeasures. Civil defence resources also face the threat of industrial incidents resulting in dangerous contamination of the environment.

The consortium that makes up the EU-SENSE project took on the task of developing a novel network of sensors capable of detecting a large spectrum of chemical agents. The objectives of the project are primarily to:

- Contribute to better situational awareness for CBRNe practitioners through the development of a novel network of chemical sensors, which will provide a technological solution to relevant gaps presented in the ENCIRCLE catalogue of technologies.
- Improve the detection capabilities of the novel network of chemical sensors through the use of machine learning algorithms to reduce the impact of environmental noise and the application of contaminant dispersion models.
- Showcase the usability of the EU-SENSE network to CBRNe practitioners in order to validate the system and maximise its exploitation potential. The objective also entails the preparation of training sessions with CBRNe practitioners in relevant conditions.

The main concept of the project involves three layers. The network layer, which consists of heterogeneous sensor nodes that

combine the detection capabilities of four different technologies. These are Proengin's AP4C flame photometric detector, Aircsense's IMS detector with integrated electrochemical cell and their IMS photon ionisation detector, and TNO's SRD metal oxide detector. These sensors are integrated through the network of sensors controller.

The computational layer is constructed in compliance with the system-of-system approach through the use of these independent tools:

- Source location estimation tool, which runs a dispersion engine to assess the location and strength of the hazard's source.
- Hazard prediction tool, which performs dispersion calculations to predict the behaviour of the incident.
- Environmental noise learning tool, which utilises machine learning to minimise the false alarm rate.

The final layer is the situational awareness layer consisting of the main access point to the system through the users' perspective – the situational awareness tool, with the graphical interface that renders visualisation and control functionalities – as well as the integrated training module.

The project is currently in an advanced stage of development. In recent months work we concluded the second iteration of the sensor node. Finished hardware was also tested in an integration session with the sensors. Design and development are progressing for the hazard prediction tool and the source location estimation tool, as well as the situational awareness tool. The consortium partners are currently working on improving the computational tools and integrating them with the developing graphical user interface.

Despite the immediate impact of the coronavirus pandemic on the project, there has still been significant progress on the project's dissemination efforts. The main area affected was the field measurements necessary for machine learning to progress in the environmental noise learning tool. The planned conferences and publications, however, were made possible through the efforts of the respective organisations, such as the International Society for Optics and Photonics, organisers of SPIE Defense + Commercial Sensing, where ITTI presented the project, as well as the publication of an extensive paper on the system's architecture and ambition.





# news

The CBRN Warning &  
Reporting System of the  
German Armed Forces

# heat

CBRN Hazard Estimation

# mlk

Command & Control  
Software for German CBRN  
Reconnaissance Vehicles

Research & Development in CBRN





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