

The logo for INGENIOUS features the word in a bold, black, sans-serif font. The letter 'O' is replaced by a stylized circular graphic consisting of concentric blue rings and a central red dot, with dashed lines extending from the center to the edges of the rings.

INGENIOUS

# The First Responder of the Future

A Next Generation Integrated Toolkit (NGIT) for Collaborative Response, increasing protection and augmenting operational capacity

Presenter

Organization

SafeCorfu 2019

6 - 9 November 2019

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 833435



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# Facts & Figures



## INGENIOUS partners



- SU-DRS02-2018 topic: **Technologies for first responders**
- Duration: September 2019 – August 2022
- Overall budget: €8.961.111,25
  - EU contribution: €8.616.111,25
  - KR contribution: € 345.000,00
- Requested funding: *funded as requested*
- Consortium: **23 partners** and covers a large portion of Europe (12 MS and associated countries as well as the Republic of Korea, at a total of **13 countries**)
  - **6** End-users/First Responders
  - **7** Specialised SMEs and Industries
  - **1** Legal, privacy, ethical and social, human and security factors expert
  - **9** RTOs and UNIs
- Training, Testing and Validation Programme: **24** Laboratory sessions, **24** small scale field tests, **2** large scale field demonstrators/exercises

# Challenges & Motivation



- Today's First Responders (FRs) are using **technology of the past**.
- FRs deal with life-threatening situations, hazardous environments, uncharted surroundings and **limited awareness**.
- **Threats and hazards evolve rapidly**, crossing municipalities, regions and nations with speed and ease.
- They are often faced with "silo-ed" operations and **overwhelming information flows**. This should be **dramatically reduced**.

- **Armouring public safety services** with all the tools that modern technology has to offer is critical.
- Tools should holistically enhance protection and augment operational capacities, **assisting them in saving lives and ensuring their safe return**.
- In the field:
  - Intelligent, integrated, interconnected and seamless tools & services that **add layers of protection** against the dangers of their working environment and
  - **augment their situational awareness** rather than distracting them from their mission.



# At a glance



INGENIOUS will develop, integrate, test, deploy, demonstrate and validate a **Next Generation Integrated Toolkit (NGIT) for Collaborative Response**, which ensures **high level of Protection & Augmented Operational Capacity** to respond to the disaster scene.

Armours FRs with novel, affordable and reliable tools and services as part of their **uniform** and as part of their **operational assets**.

INGENIOUS Technology



1. The NGIT builds upon the concept of **“smart” first responders** by holistically equipping them to protect them and assist in conducting their response duties, empowering and enhancing their **helmet, uniform, boots** and accompanying **K9 units** with **wearables, communication and localisation components, sensors and add-ons** delivering augmented reality functions.

2. The NGIT comprises of **smart devices in the air and on the ground**, that are essentially external response modules operated by first responders to **monitor, map, analyse and assess the incident scene**;

- the fully customisable self-exploring drones - **Multi-purpose Autonomous eXploring drone** and **Micro Indoor drone**,
- the standalone components for delivering **ubiquitous worksite comms**,
- the **indoor and outdoor localisation modules** used to track & trace FRs and their proximity to team members, victims, assets, risks, hazards in real time.



3. The NGIT supports FRs with **multi-fusion and expert reasoning modules** for improving **situational awareness and threat and hazard detection**, a **C3 and a COP platform** with augmented reality capabilities as add-ons for **Command, Control and Coordination** and with **mobile applications** to improve response activities.



*fully aware, fully connected and fully integrated*

# “Smart” First Responders



Tools & Services to protect them and enhance operational tasks

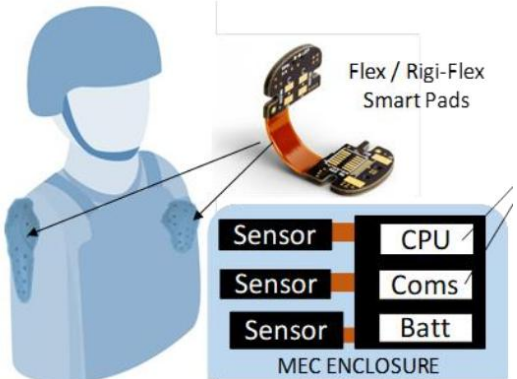
## FRs NGIT Components

- Helmet
- Uniform & wearables
- Boots
- K9 Units

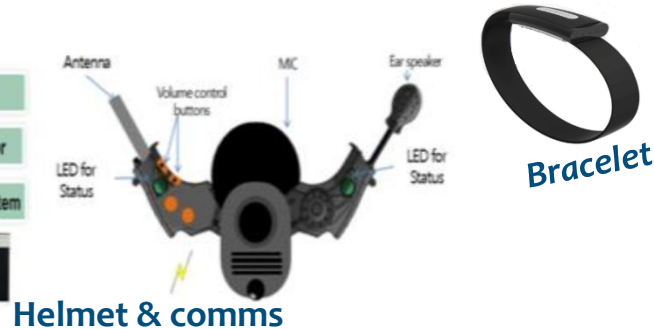
- **Protecting FRs:** Cameras (HD, Thermal/IR), Gas sensors, Environmental sensors, Acoustic sensors, Vital sensors (monitoring biometrics), Location sensors, On board processing power, multi-RF comms,...
- **Augmenting their situational awareness:** Knowing position of hazards, team members and assets, communications between members and victims, connected with AR glasses, various tools and services (MAX, MIN)
- **Allowing them to collaboratively respond:** Common Operational Picture, FR mobile applications and C2



- Vitals sensors (temperature, heart rate, oxygen levels)
- Microphone & loudspeakers and siren
- HD optical camera (day & night vision) (incl. gimbal)
- Thermal/IR camera (incl. gimbal)
- First-aid kit
- Battery-pow. Processing unit (PAN & LAN)



Uniform integration platform



Helmet & comms



Insole boot component



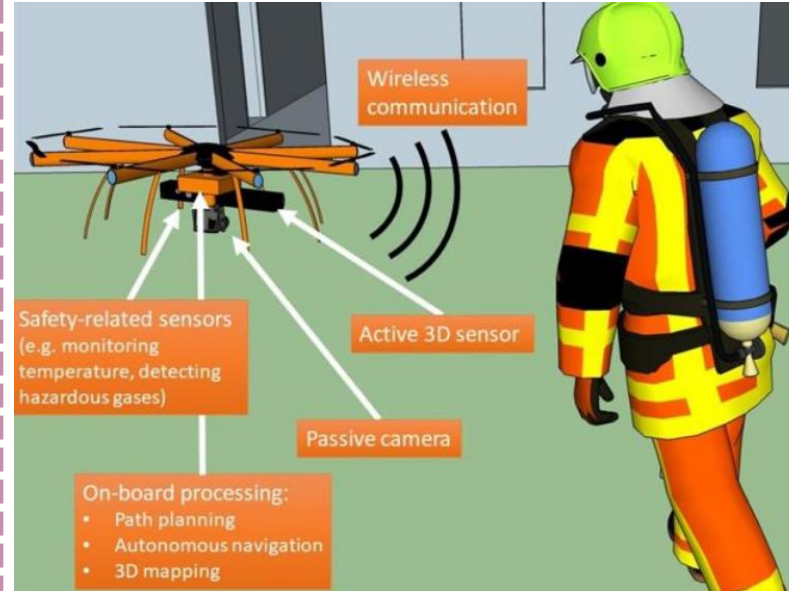
# “Smart” Devices in the Air and on the Ground

Tools & Services operated by First Responders to protect them and enhance operational tasks

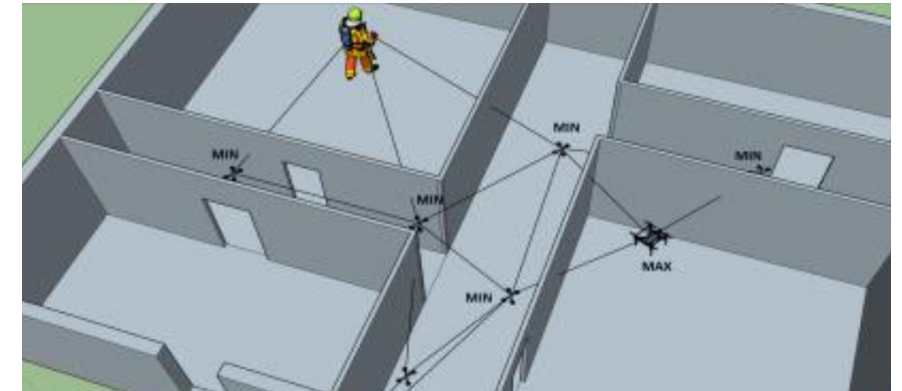


## Smart devices in the air and in the ground

- Micro Indoor droNe (Deployable Positioning System)
- Multi-purpose Autonomous eXploring drone (monitoring & detecting)
- Field comms



High level design of MAX



MINs swarm formation to improve indoor localisation

MAX platforms will be able to enter from openings of various structures and **navigate autonomously** indoors, collecting 2D and 3D data of unexplored areas. MAX offers multi-task exploration at the worksite(s) level – **indoors and outdoors** as it delivers: A multitude of sensors.



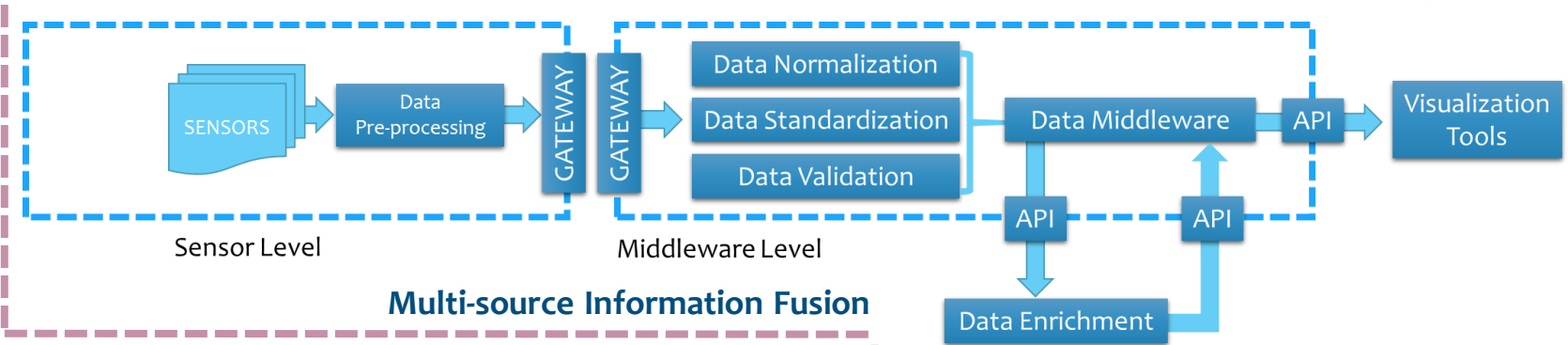
Collision based navigation in cluttered, unknown environments

**Personal Area Networks** (low-power, short-range to interconnect FRs with their body gear and with team members and assets in proximity),  
**Local Area Networks** (low-power, mid-range interconnecting FRs and assets with the local command-post) and  
**Wide Area Networks** (wide range to interconnect worksite resources and local command-post with the C2 centre)

# Information Management, Augmenting the Common Operational Picture, C2 & FR Apps (1/2)

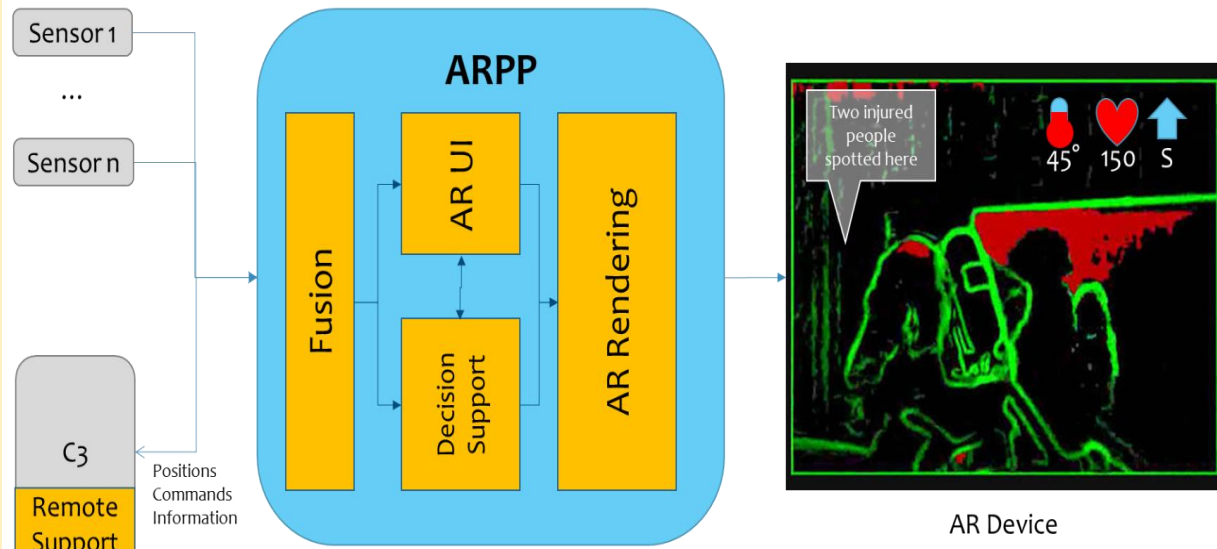


- Multi Information Fusion Module (*Data exploitation and decision making*)
- Augmented Reality Environment Services



## Intuitive contextual notifications

- Display of sensor values and situational information
- Location of team members, hazardous areas, practitioners, mission target
- Visualisation of AR checklists pinned to the worksite location
- Remote assistance by an expert



**Augmented Reality (AR) functions**

- Define and implement the **integration of multiple sources**, fusing data at different abstraction levels to **achieve context awareness and detect patterns** that suggest more complicated circumstances.
- INGENIOUS **Early Warning System (EWS)** providing real-time situational awareness and decision support (extraction of **conclusions** concerning environmental and first responder's behaviour aspects, **early detection** of unusual events or patterns).



# Information Management, Augmenting the Common Operational Picture, C2 & FR Apps (2/2)



- Mobile Application Kit: Face recognition, Triage & Patient tracking, Multilingual, Social media and Worksite Operations Applications
- Common Operational Picture (COP) & Command & Control (C2)

**Social Media App:** Crawl data from social media and online content to assist FRs. Spot nearby **critical situations that have been reported** (filtering out fake news).

**Multi-lingual operations App:** Development of a multi-lingual communication support application that will comprise a **speech-to-speech translation module** to enhance voice communications (multilingual COPs, FR teams, different FR teams).

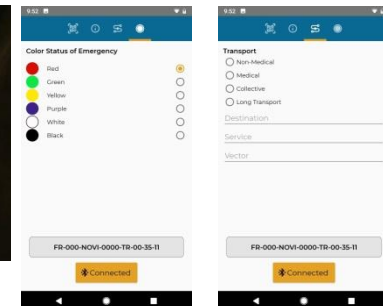
**Worksite App:** A mobile app digitising **worksite operations** (INSARAG compliant forms with appropriate classification levels and forms completion) for making them faster, organized and more efficient (**day-to-day logistics and resources management, casualty management** and exploiting machine learning algorithms to train the system providing **state-of-the-art decision support** functionalities).

**Face Recognition App:** Based on cutting-edge deep learning technologies. **Patient recognition and correlation to the medical data** (within the triage app, for quick triaging). Input data through the AR glasses (from the helmet) or the cameras (uniform and UAVs). **Resilient to face injuries.**

Create an innovative **COP** to be **shared by all involved actors**. The COP will be generated assimilating **information from all sensors as well as from data fusion and expert reasoning engines**. COP is part of a modern **C3**.



**Triage and Patients Tracking App:** It concerns the development of a mobile app coupled with the appropriate hardware (RF-based – NFC, BT- changing colours via LED bracelets ) for **assisting FRs conducting triage and pre-hospitalisation support** of the affected population in a worksite. Unique identification of patients/victims **from extraction time to transport at the nearest hospital**.



# Toolkit Integration, Testing & Field Validation and Knowledge Capitalisation



A rich programme that contains:

- 24 Laboratory Integration and Testing sessions (LITs),
- 24 Command Post/Small Scale Field Tests (CP/SSTs) and
- 2 Large Scale Field Validation demonstrators/exercises (FSXs)

of the Toolkit's integrated components, platforms, modules and applications, promoting **close collaboration of technologists with practitioners**

**FRs will have to respond to several combinations of cases in several scales - standalone or in parallel – with or without cascading effects**

- [Industrial accident, Building fire]
- [Earthquake/Explosion damaged building, Flooded enclosed space/Maritime SAR]
- [Earthquake/Explosion damaged building, Fire covering large rural/forestry area]
- [Earthquake/Explosion damaged building, Flooded enclosed space]
- [Earthquake/Explosion damaged block of buildings, Flooded wide area and enclosed space]
- [Absence of comms after disastrous event, worksite and indoor comms between FRs, with victims to the HQ/Maritime SAR]
- [Earthquake/Explosion damaged building]
- [Triaging after large earthquake/explosion]
- [Attack in public space, Patient biometrics after triaging in earthquake]
- [Large earthquake near shore with cascading effects, e.g. chemical leakage, comms failure]
- [\* attacks in multiple locations]

# Target Markets/Stakeholders



A search team managed to rescue an earthquake survivor who needs to be brought to hospital immediately (exercise in Bulgaria). © European Union/ECHO

**Practitioners** (civil protection, fire brigades, emergency medical services and police services)

*to be trained and validate INGENIOUS*



ERCC operations, training exercise © European Union/ECHO

**EU (ERCC, ECHO, JRC, CoU) & MS Ministries** (Ministry of Interior, public order, civil protection)

*to update policy framework and buy INGENIOUS*



**The general public** (citizens, volunteers, special groups)

*to be aware and benefit from INGENIOUS*



**EU Projects SU-DRSo2-2018-2019-2020** (ASSISTANCE, CURSOR, FASTER, RESPONDRONE, etc.) and **EU Crisis Management Projects**

*to exchange knowledge and interface with INGENIOUS*



Example systems from IN-PREP partners

**Technology providers**

*Liaise with INGENIOUS (new business opportunities for INGENIOUS partners)*





Thank you for  
your attention  
Any Questions ?



INGENIOUS

“ **INGENIOUS** /ɪnˈdʒiːniəs/ {adjective}: Clever, original, and inventive.  
Cleverly and originally devised and well suited to its purpose. ”



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