Resilient communications and UAV fleet for future Search & Rescue operations

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Hellenic Rescue Team of Attica – H.R.T.A

- HRTA is a volunteer-based citizen association – NGO
- HRTA was founded in 2000, more than 700 members have been trained for participating in **S**earch **A**nd **R**escue (SAR) operations
- Average participation in SAR operations per year: 10-15 (mountains, swift water, rivers, canyons, sea, urban environments)
- Close cooperation & field training with state services and official rescue Teams and competent state units (incl. Hellenic Cost Guard, “EMAK” Team - Special Unit for Disaster Response). Part of Civil Protection general plan (when needed)

HELLENIC RESCUE TEAM

ATTICA

Hellenic Rescue Team of Attica – H.R.T.A

- Collaborative training, synergies and participation in real SAR field deployments
- Emergency response, first-responders, safety, SAR, humanitarian aid, training
- **Operational sectors (SAR):** Mountain Rescue, Water rescue, Mass Disaster Rescue & Relief

LAND SAR: Wilderness, non-urban
(mountain, canyon/river, forest)

WATER SAR: Surface, underwater, shore
(sea, large river, lake)

URBAN SAR: emergency response, disaster relief
(earthquake, flood, fire, large-scale accidents)

Presentation Context

- Worksite Communications and Aerial Assets
- Portable and resilient worksite communications
- Multiple-source Data Fusion Engine (MDFE)
- UAV: Drone Fleet (DF)
- Conclusions

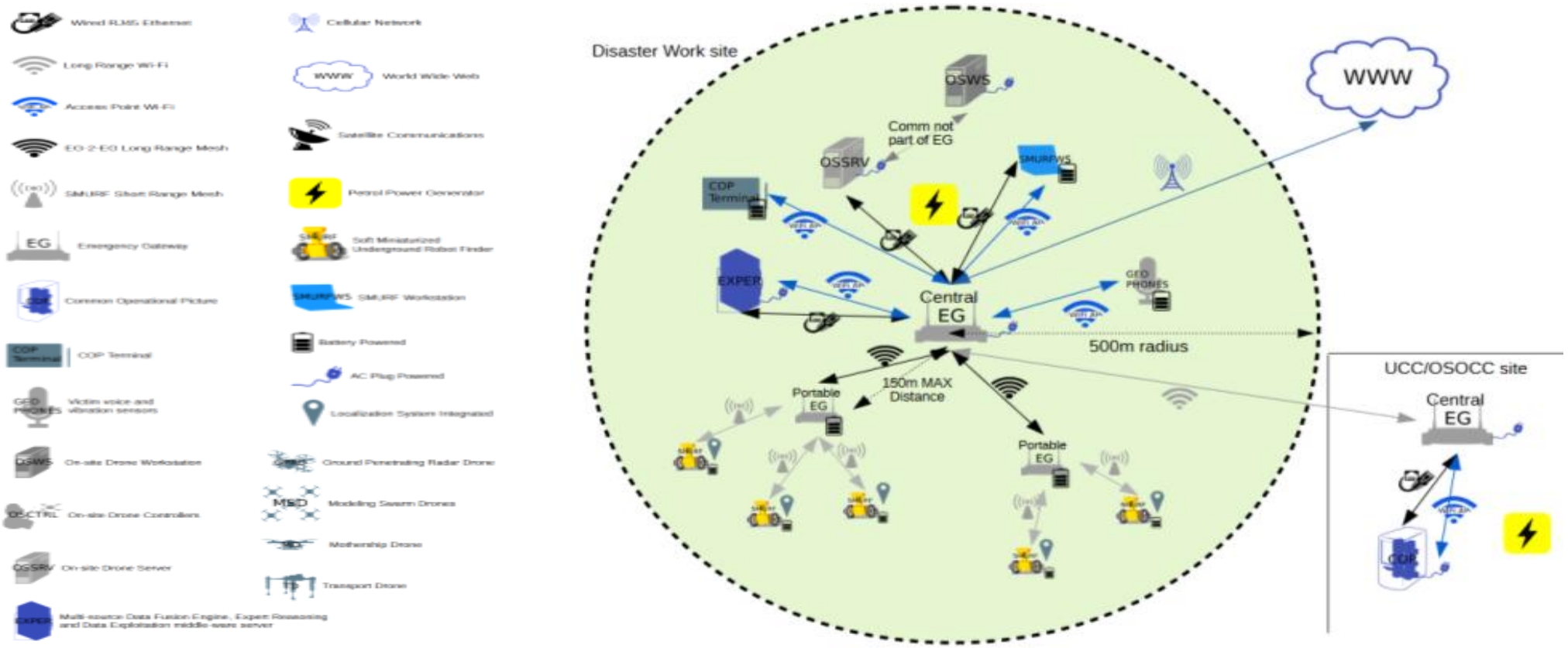
Portable and resilient worksite communications

- In disaster events emergency response relies on portable, reliable and efficient communications technologies between the FRs and the Command Center
- Technologies that require stable and high-capacity data links, such as aerial drones, extend these requirements even more
- The communications between the disaster worksite components and the Command Center is performed by the Emergency Gateway (EG) in the SAR Kit of the CURSOR project

Portable and resilient worksite communications

- The EG is a modern computing platform that incorporates various network communication technologies required by the deployed components, packed in a portable computing platform
- The EG design is targeted for rapid deployment, ease of use and robustness at all levels
- Some functionalitites of EG are:Seamless interoperability and ubiquitous connectivity via Wireless Ad-Hoc Networking,Security-by-design on all offered communication channels (authenticated and encrypted), Resilient operation in the harsh environment and degraded R/F signal in a disaster worksite, Gateway to the World Wide Web (internet access) and other local services & deployed components

Portable and resilient worksite communications



Overview of multiple Emergency Gateway deployments with a central EG and multiple portable EGs, providing resilient data links between all the deployed SAR Kit components inside the worksite area.

Multiple-source Data Fusion Engine (MDFE)

- A fusion framework is established for collecting, parsing, integrating, and fusing heterogeneous data of different size, type, velocity and veracity
- A data publication process to a middleware stack via Message Brokers
- A 3-level fusion architecture, machine learning (ML) algorithms are applied to evaluate the high quality of collected data (signal level data fusion), extract features (feature level information fusion) and support a data-driven decision making (decision level fusion).

UAV: Drone Fleet (DF)

- The DF system enables crisis management
- Identification of risks and emergencies due to damaged structures
- Detection of survivors under rubble (e.g., radargram)
- Communication services (e.g., alerting via megaphone; WiFi access point)
- The different types of data provided by the DF are integrated into the Common Operational Center for the mission area
- Creation of a 3D model from aerial photogrammetry

UAV: Drone Fleet (DF)

- **Mothership Drone (MD)**: a tethered drone with HD zoom video camera, flood lights, megaphone and WiFi access point, serving as 24/7 “Eye in the Sky” over the disaster area

Mothership Drone

- **Modeling Swarm Drones (MSD)**: five drones in swarm formation, generating a photogrammetric 3D model of the disaster zone, as well as a 2D orthomap; in “FR mode” individual drones can provide local situational awareness

Modeling Swarm Drone (MSD

UAV: Drone Fleet (DF)

- **GPR-equipped drone (GPRD)**: a ground penetrating radar (GPR) unit mounted to a drone, identifying alive buried victims
- **Transport Drone (TD)**: a heavy-lifting drone, carrying a container filled with sensor-equipped UGVs (SMURF units) or other equipment and tools to deployed FR teams.

GPR Drone (GPRD) and Transport Drone (TD)

Conclusions

- Modern technological advancements in field communications and aerial drones will enable the use of such assets in an autonomous and effective way within the context of real-world SAR operations
- The highly demanding environment of such missions requires improved performance and autonomy, as well as complementarity with the standard operational procedures applied by FRs
- The CURSOR SAR Kit will provide such technologies, which are already prototyped and at the beginning of field tests.

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Thank you for your attention

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