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ICARUS

INTEGRATED COMPONENTS FOR ASSISTED RESCUE AND UNMANNED SEARCH OPERATIONS

ICARUS: PROVIDING ROBOTIC SOLUTIONS FOR SEARCH & RESCUE

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ICARUS — PROBLEM STATEMENT

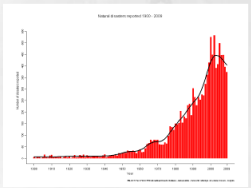
- Disasters disrupt our society
- Disasters are very difficult to manage

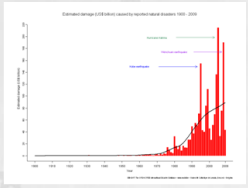

2012 Costa Concordia Disaster


2011 Tôhoku Earthquake and Tsunami

ICARUS — PROBLEM STATEMENT

- There are more and more disasters
- They cost more and more to the society

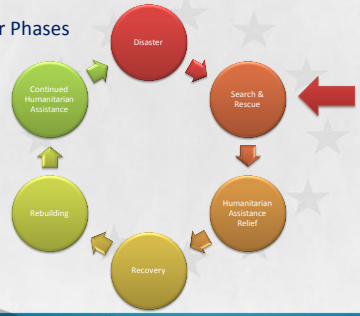




Source: Emergency Events Database (EM-DAT)

ICARUS — CURRENT SAR WORKFLOW

- Disaster Phases



ICARUS — CURRENT SAR WORKFLOW

- Search & Rescue actions:
  - Labour-intensive
  - Slow

Source: WikiMedia Commons

ICARUS — ICARUS

- Integrated Components for Assisted Rescue and Unmanned Search operations
- Participants:
  - 24 partners
  - 10 countries
  - 2 end-users:
    - B-FAST
    - Portuguese Navy
  - NATO / NURC
  - 3 large industrials (including Calzoni)
- Total Budget: 17.5 M€

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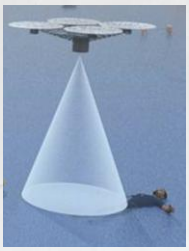
ICARUS - OBJECTIVES

- Objective 1: Development of a light sensor capable of detecting human beings
  - Based on QCD technology
  - Minimal levels of weight (500 g), dimensions (12x12x6 cm) and total power consumption (5 W) are targeted
  - Image and video processing algorithms for detecting human survivors will be developed and combined to obtain sufficient detection performance
  - **UNINE**, TUV, IZM, ETHZ, *EPFL*, RMA, UKL



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ICARUS - OBJECTIVES

- Objective 2: Development of cooperative Unmanned Aerial System (UAS) tools for unmanned SAR
  - Used for:
    - Mapping of topography and scenario
    - Target observation
    - People search outdoors
    - Kit delivery
    - Communication relay
  - **ETHZ**, CTAE, SBX, JTH

Source: ETHZ, JTH

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ICARUS - OBJECTIVES

- Objective 3: Development of cooperative Unmanned Ground Vehicle (UGV) tools for unmanned SAR
  - Development of a large UGV which can be used as a mobile base
  - Development of a small UGV which is able to enter collapsed buildings to search for human victims
  - **UKL**, META, AV, RMA, SPACE, BFAST

Source: META, AV, ESRI

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ICARUS - OBJECTIVES

- Objective 4: Development of cooperative Unmanned Surface Vehicle (USV) tools for unmanned SAR
  - Used for:
    - Sensing and perception for target detection and tracking.
    - Mission planning and control for operations with single or multiple vehicles.
    - Capsule deployment system (life-rafts).
  - **INESC**, NURC, CAL, CINAV

Source: INESC, CAL

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ICARUS – USV OBJECTIVES

1. ***Adaptation of existing USV platforms*** *operated by the participants in this WP so that they can act as carriers of first aid devices to the area of the accident;*
   - *Sensor Integration (RADAR, LIDAR, IR, visual)*
   - *Data Fusion for obstacle detection & identification*
   - *Obstacle Avoidance*

Source: CAL

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ICARUS – USV OBJECTIVES

1. ***Adaptation of existing USV platforms*** *operated by the participants in this WP so that they can act as carriers of first aid devices to the area of the accident;*
   - *Autonomous behaviors (e.g. grid search)*
   - *Integration in High-level mission planning tools*
   - *Robotic deployment system*

Source: INESC

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ICARUS – USV Objectives

2. ***Instrumentation of survival capsules*** *(sensors, actuators, power and computational power) to allow their motion (autonomously or remotely operated) towards survivors.*
   - *Design*
   - *Navigation & Control System*
   - *Interaction functionalities with survivors*
   - *Energy management*
   - *Deployment system*

Source: WikiMedia Commons

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ICARUS - Objectives

- Objective 5: Heterogeneous robot collaboration between Unmanned Search And Rescue devices
  - Robot Interoperability
  - Coordination between multiple UXV
  - Heterogeneous operations UAS + UGV in a SAR context
  - Heterogeneous operations **UAS + USV** in a SAR context
  - **CTAE**, ETHZ, INESC, IMM, RMA, SPACE

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ICARUS - Objectives

- Objective 6: Development of a self-organising cognitive wireless communication network, ensuring network interoperability
  - Focus:
    - Mobile and wireless ad-hoc communications in combined land-air-sea environments.
    - Self-coordination and optimisation of spectrum resources by using cross-layer cognitive radio techniques
    - Self-managed network able to adapt to varying and extreme conditions by using power-efficient, failure-resilient protocols.
    - Flexible security scheme.
    - Harmonised management and control overlay, able to encompass several data-link technologies (WLAN, GSM).
  - **ISYS**, RMA, QUOBIS

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ICARUS - Objectives

- Objective 7: Integration of Unmanned Search And Rescue tools in the C4I systems of the Human SAR forces
  - 3 objectives:
    - Collection of data/information from the robots, operators, human teams deployed, …
    - Collation and merging of data from different sources, including allowing for differing reliability of sources and integration with GIS information;
    - Monitoring and control interfaces that can provide high level command capabilities to appropriate users
  - **SPACE**, ATOS, CTAE, ISYS, INESC, IMM, E-GIS, UKL

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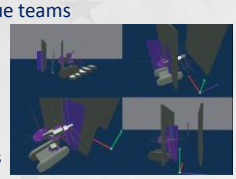
ICARUS - Objectives

- Objective 8: Development of a training and support system of the developed Unmanned Search And Rescue for the Human Search And Rescue teams
  - Development of PC-type trainers-simulators for training operators of SAR robots
  - Development of an e-learning methodology
    → training tool with virtual robots
    → use of semantic information in a human-machine-interface
  - **IMM**, ISYS, INESC, ESRI



Source: IMM

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ICARUS - Objectives

- Objective 9: Communication and dissemination of results
  - Ensure that the outcomes, results and benefits of the project are made visible to the actors involved in search and rescue operations and to the final beneficiaries
  - Increase overall visibility of the EC's research and develop-ment activities among the search and rescue community.
  - Support user engagement activities
  - Production of printed and multimedia material;
  - Networking activities among the end-users and beneficiaries
  - Development and implementation of a campaign in media
  - Development of a project website;
  - Shooting of video material to promote the results of ICARUS
  - **STP**, ATOS, JTH, QUOBIS, RMA

ICARUS — End-User Involvement

- End-User-Board
- Scientific & Technical Advisory Board
- Website
- Questionnaire

ICARUS — End-User Involvement

- The Questionnaire collects data from the end-user community
- This will steer all our developments
- ➔ it is an opportunity for you to direct scientific research in this field

ICARUS — Conclusions

- Disasters pose a huge problem for our society
- The current disaster management tools can be improved by adding technological aids
- ICARUS proposes a comprehensive solution to this end
- We're very open to comments / advice from the end-user community

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Thank you

Any Questions?

ICARUS: Providing Robotic Solutions for Search & Rescue

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