TIEMS
The International Emergency Management Society

THE INTERNATIONAL EMERGENCY MANAGEMENT SOCIETY

Newsletter - Special Edition - ISSUE 3 - July 2016

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A TIEMS Special Issue Covering

The Asia Emergency Management Conference (AEMC) & The Pahros EU Project

The Asia Emergency Management Conference AEMC

The Pharos Eu Project

The International Emergency Management Society Newsletter – Special Edition

TIEMS network constitutes a large international multidisciplinary group of experts, with different educational backgrounds and various experiences. Their knowledge and experience are important to share with other experts worldwide. TIEMS has therefore decided to issue this additional newsletter, which we now call TIEMS Newsletter – Special Edition. This is the third issue, which we have dedicated to presentations from the Asia Emergency Managment Conference – AEMC and to articles from the Pharos EU project. We invite other conferences and workshops, and RTD projects to use the opportunity to present the conference and workshop presentations and RTD projects to present articles of their results in the upcoming Special Edition Newsletters. We plan to have an issue three times a year. Please, give us feedback, and send us new articles for publication.

Alex Fullick

TIEMS Scientific Newsletter Editor

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Articles in this issue

This issue is dedicated to

The Asia Emergency Management Conference (AEMC)
http://www.aemconference.asia/
&
Pharos EU Project
http://www.pharos-fp7.eu/

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Message from TIEMS President

TIEMS participates at present as a partner in two EU RTD projects, ASSET and HERACLES. In addition, TIEMS representatives participate in advisory and user boards of several EU projects. In addition, TIEMS arranges every year 5 – 10 conferences and workshops worldwide, and TIEMS support other organizations events, where international experts present ideas and findings of important emergency and disaster response issues. All above is a voluminus source of important information for the international emergency management and disaster response community. Howevver, sometimes this vital information is not always shared with the worldwide community.

Dissemination and publication of the results of RTD projects is as important as the research itself. It is important to share the results and conclusions of RTD projects with other experts in the emergency management and disaster response community. We need to learn from each other and share experiences to be able to progress with excellence in global emergency management and disaster response. The same goes for presentaions at conferences and workshops worldwide on these issues.

This is the third issue of this newsletter, which we now call TIEMS Newsletter - Special Edition no 3, because it does not only contain scientific articles, but also important presentaions from confernces and workshops.

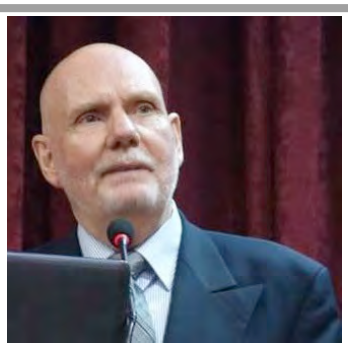
This third issue is dedicated to presentations from the Asia Emergency Management Conference – AEMC, and the EU Project Pharos. A summary and some important presentations from the Asia Emerency Management Conference, and four scientific articles from the results of the PHAROS EU project.

I hope this newsletter is welcomed by the emergency management and disaster response community, to learn more about the PHAROS project and the results of the project, and get access to some important presentations from the AEMC. Likewise, it is an additional publication channel for the PHAROS project and the AEMC to reach further out to the global emergency and disaster management community.

We reach today approx. 100 000 experts worldwide with the distribution, and we hope this could lead to improved contacts and exchange of expertise between worldwide experts and lead to more cooperation and new and excellent ideas to be explored in the emergency management and disaster response field,

The articles are reviewed only by the editor, but depending on the response, we will consider to establish a review panel and have a peer review of the scientific articles in the future.

Our readers decide the future of this TIEMS Newsletter – Special Edition, so please, send us feedback and constructive critics and also articles for publication.



Oslo 31st July 2016
K. Harald Drager
TIEMS President

Editor's Message

It's Great to Be Back!

Well, it seems I've been here before dear readers. After roughly six years of being the editor of the TIEMS newsletter, I had to step away due to personal commitments and things that required my full attention. Having gotten a hold of the craziness and taken control, I'm back with TIEMS as the new editor of the special edition. So I've come home in way and it's great to be back. The main TIEMS newsletter is now being handled by my well-versed colleague, Joseph Pollack, who is doing a great job! Between the two of us, I know we're going to take these newsletter to greater heights.

This edition of the TIEMS Special Newsletter focuses on two areas. The first half is dedicated to the May 2016 Asia Emergency Management Conference (AEMC) held in Macao and the second half contains some contributions from participants in the PHAROS project. (Ed. I won't spoil the articles by telling you what they are.)

All the articles contain wonderful new ways of thinking and provide some great new insights on Disaster and Emergency Management and even a bit of Business Continuity Management (BCM), which just so happens to be my passion and area of expertise.

I'm very excited about these TIEMS Special Edition Newsletter and I can't wait to read more about new ideas from upcoming and ongoing projects within future editions.

My stance has always been and will always be, that the newsletters contain your voice not mine. So if you have any ideas for the Special Edition newsletter and/or would like to have an edition dedicated to your conference or project, please feel free to reach out to myself at alex@stone-road.com with any queries. The TIEMS newsletter now reaches over 100,000 people (when I started it was around 10,000) so there's lots of opportunities to get your message out there.

Of course, if you have any general questions about either newsletter, please feel free to contact myself or the editor of the general TIEMS Newsletter Joseph Pollack at josephrichardpollack@gmail.com.

In the meantime, happy reading – and have a safe and happy summer.

Regards,

A.Alex Fullick

TIEMS Special Edition Newsletter Editor - TIEMS Editorial Advisory Board

July 2016

Asia Emergency Management Conference & Expo

The Asia Emergency Management Conference (AEMC) ended with success on 12 May 2016 at the Venetian Macao. AEMC 2016 has attracted participants from 20 countries and regions, among others USA, Canada, United Arab Emirates, UK, Norway, Germany, Australia, New Zealand, Thailand, Indonesia, Japan etc. to exchange valuable experiences, share lessons learned and explore new business opportunities.

The theme of AEMC 2016 was "Prepare for Tomorrow, Today". 33 international speakers from 16 countries and regions have held their presentations during the 3-days program, featuring thought leadership speeches and panel sessions. Three workshops, conducted on the second day of the conference, have allowed attendees to gain practical insights that can be directly put into action in Crisis Management, Event Security and Social Media Crisis Communications.

AEMC has been supported by professional organizations and institutes from all over the world including ASIS International Hong Kong Chapter, Business Continuity Institute BCI, International Association of Emergency Managers IAEM, Institute of Crisis and Risk Management ICRM, Korean Society of Disaster Information KOSDI, Korean Society of Disaster Medicine KSDM, Taiwan Association of Disaster Prevention Industry TADPI, the International Emergency Management Society TIEMS etc.

The visitors and delegates came from a broad range of industries, such as transport and aviation, entertainment and events, public relations, marketing, health and safety, government institutions and many more. The companies represented were among others Administration of Airports Ltd., Air China, Asia World-Expo Management Limited, Australian Consulate-General Hong Kong, Cathay Pacific, CNOOC Safety Technology Service Co. Ltd., Companhia de Electricidade de Macau, Galaxy Entertainment Group, Mead Johnson Nutrition, Melco Crown Entertainment, Prime Marketing & Promotional Service Co. Ltd., Singapore Technologies Electronics Limited etc.

Two further highlights of the event have been the International Dinner and the Networking Cocktail, bringing together the speakers, exhibitors, visitors and delegates to mingle and expand their global network.

For more information and further updates, please visit www.aemconference.asia.

Prepare for Tomorrow TODAY!

K. Harald Drager, TIEMS President & Kay Goss, TIEMS USA Chapter President

AEMC
Asia Emergency 亞洲應急
Management Conference 管理會議

"We cannot eliminate disasters, but We can mitigate risks, We can reduce damage, and We can save more lives"

Ban Ki-moon, UN Secretary General

World at Risk

- During 1980-2013, weather-related disasters accounted worldwide for 87% of total disasters, 74% of total losses, and 61% of lives lost
- Climate Change may increase the frequency and consequences of such events
- Between 2010 and 2040 the number of people over 65 in less developed countries is expected to nearly triple
- By 2030, 60% of the world's population will reside in cities
- 80% of the ten largest cities are at risk of being severely affected by an earthquake, and 60% are vulnerable to storm surge and tsunami waves
- Vulnerability introduced by local conditions such as poverty, government corruption, poorly planned development, and environmental degradation are adding to the risk

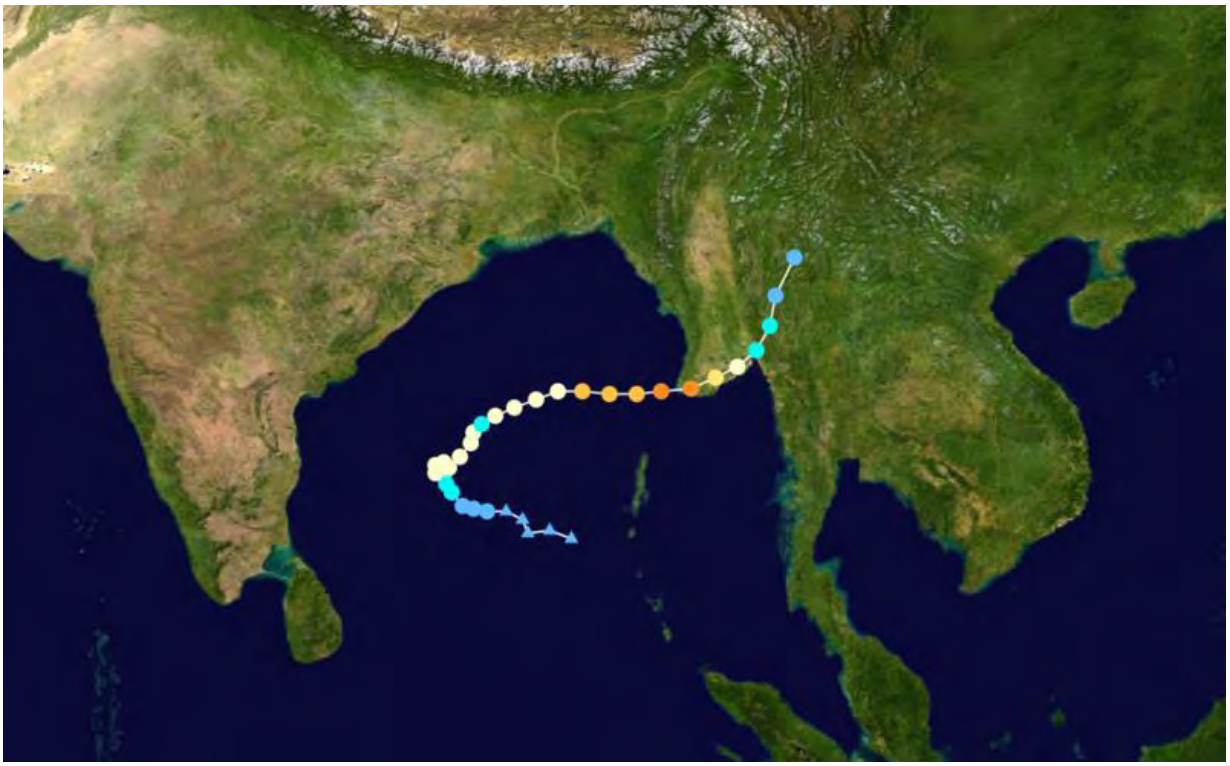
Cost of Disasters

- In the 10 years since Hurricane Katrina, the world has seen an annual average of 260 major natural disasters, with average annual economic losses of US$211 billion, insured losses of US$63 billion, and 76,000 lives lost
- In 2014, 72 percent of global disaster losses were caused by extreme weather events

- In 2015 the devastating Nepal earthquake resulted in close to 9000 lives lost alone
- These figures do not include any of the many smaller-scale floods, storms, earthquakes and other localized disasters

Some past disasters to remember!

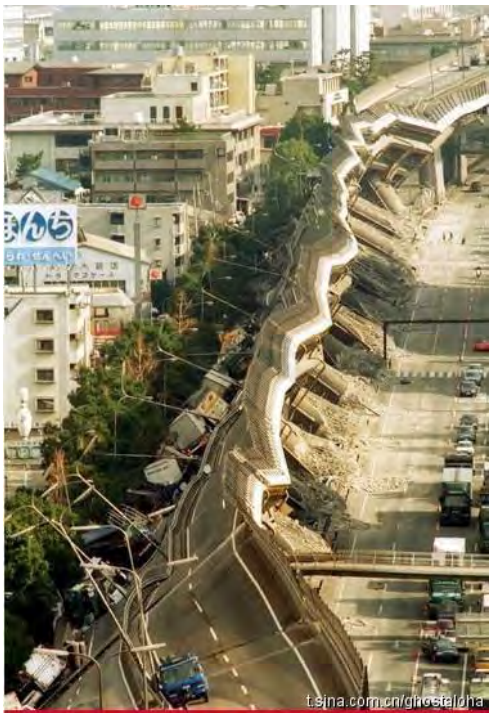
Sumatra Tsunami 2004 – 240 000 deaths



Nargis Cyclone 2008 – 120 000 deaths

Sichuan Earthquake 2008 – 80 000 deaths

Haiti Earthquake 2010 – 316 000 deaths

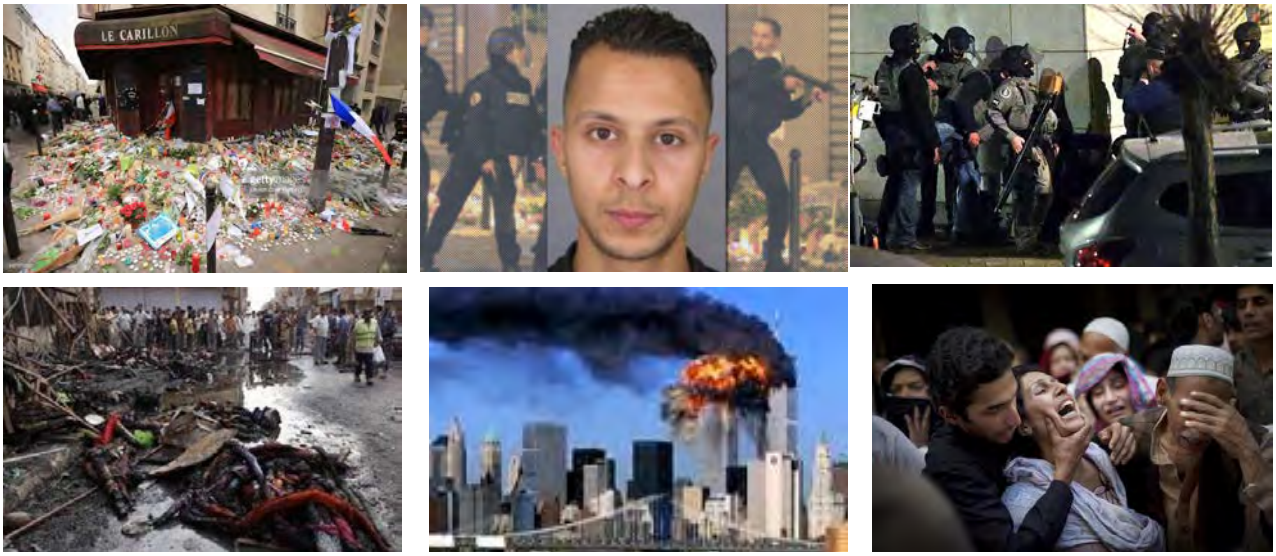


Japan Earthquake and Tsunami 2011 – 23 000 deaths

Philippines Taifun 2013 – 6 000 deaths

Ebola Outbreak 2013 – until now 11 300 deaths

Nepal Earthquake 2015 – 8 896 deaths



Terrorism 2015 – 2016
Paris, Iraq, Pakistan, Belgium etc.

Tianjin Explosion 2015 – 173 deaths

How to Prepare

Move Focus from Response to Preparedness!

- Learn from Others
  - Example from USA Emergency Management/State of Preparedness
- Research and Development Projects
  - Example of EU R&D Projects
- Education & Training
  - TIEMS Education Programs, GENERATE & QIEDM Certification

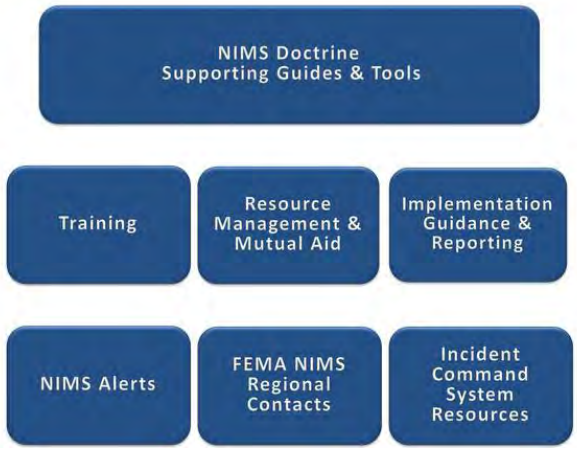
Emergency Management – USA State of Preparedness

Preparedness is the foundation of emergency management.

In assessing the current levels of preparedness in USA, examples from FEMA's full set of Preparedness Frameworks for Mitigation/Prevention, Response, Protection and Recovery is presented

The National Preparedness Goal includes a set of 32 key core capabilities intended for the "Whole Community"

- Planning
- Public Information/Warning
- Operational Coordination
- Forensics/Attribution
- Intelligence/Information Sharing
- Interdiction/Disruption
- Screening, Search, Detection
- Access Control/Identity Verification
- Cybersecurity
- Physical Protective Measures
- Risk Management/Protection Programs/Activities
- Supply Chain Integrity/Security
- Community Resilience
- Long-Term Vulnerability Reduction
- Risk/Disaster Resilience Assessment
- Threats/Hazards Identification
- Critical Transportation
- Environmental Response/Health/Safety
- Fatality Management Services
- Fire Management/Suppression
- Infrastructure Systems
- Logistics/Supply Chain Management
- Mass Care Services
- Mass Search and Rescue Operations
- On-Scene Security, Protection, Law Enforcement
- Operational Communications
- Public Health, Healthcare, Emergency Medical Services
- Situational Assessment
- Economic Recovery
- Health and Social Services
- Housing
- Natural and Cultural Resources



National Incident Management System (NIMS)

NIMS is intended to be used by the whole community, individuals, families, communities, the private and non-profit sectors, faith-based organizations, and local, state, tribal, territorial, insular area, and Federal governments.

The National Incident Management System (NIMS) is a systematic, proactive approach to guide departments and agencies at all levels of government, nongovernmental organizations, and the private sector to work together seamlessly and manage incidents involving all threats andhazards—regardless of cause, size, location, or complexity—in order to reduce loss of life, property and harm to the environment

FEMA's Annual National Preparedness Report

Shows strengths and opportunities for improvement. FEMA's preparedness cycle's diagram delineates the sequencing of the traditional, continuing, and future preparedness steps.

Incorporating Emergency Preparedness into Technology Platforms: Businesses and public-private partnerships are increasingly incorporating emergency preparedness into technology platforms, such as Internet and social media tools and services.

Challenges Assessing the Status of Corrective Actions: While Federal departments and agencies individually assess progress for corrective actions identified during national-level exercises and real-world incidents, challenges remain to comprehensively assess corrective actions with broad implications across the Federal Government.

Response Coordination Challengs for Events that Do Not Receive *Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act)* Declarations: Recent events, including the epidemic of Ebola virus disease, have highlighted challenges with coordinating the response to and recovery from complex incidents that do not receive Stafford Act declarations.

Training and Higher Education

FEMA's National Training Program (NTP) supports the National Preparedness Guidelines, providing policy, guidance, and tools that address training design, development, delivery, and evaluation, as appropriate.

FEMA's training centers include the Emergency Management Institute (EMI), the Center for Domestic Preparedness, and the National Fire Academy.

The FEMA Higher Education Program is an extremely fast-growing instrument for building the emergency management profession. After 20 plus years, it now collaborates with about 300 degree and certificate programs around the country, which depend upon FEMA for a weekly update on related activities in higher education institutions and related research and activities in the practice area, as well as an annual conference on the EMI campus, attended by hundreds of academicians and practitioners, as well as students and government officials

Exercises

The FEMA Emergency Planning Exercises web page offers free, downloadable table top exercises for reviewing, sharing and using by the public, especially the private sector. The National Exercise Program is primarily for members of the emergency management professionals.

The NEP uses the Homeland Security Exercise and Evaluation Program (HSEEP) methodology and related tools and resources provided by the National Exercise and Simulation Center (NESC). HSEEP provides guiding principles for exercise programs, as well as a common methodology for exercise program management, design and development, conduct, evaluation and improvement planning. HSEEP exercise and evaluation doctrine is flexible, scalable and adaptable to the needs of stakeholders and is applicable for exercises across all national preparedness mission areas—prevention, protection, mitigation, response and recovery. These HSEEP templates and guidance may be accessed on the FEMA Exercises webpage.

Non-profit Collaboration

FEMA decided to bring back the American Red Cross to head the Mass Care Emergency Support Function about five years ago, signing a Memorandum of Agreement and forming the National Mass Care Council.

The Council is Co-Chaired by the American Red Cross, FEMA, the National Emergency Management Association (NEMA) and the National Voluntary Organizations Active in Disaster (National VOAD) and is comprised of Council members from Big City Emergency Managers, Department of Health and Human Services, Feeding America, North American Mission Board – The Southern Baptist Convention and The Salvation Army.

The Council serves as the steering body and focuses on:

- Sheltering (including household pets)
- Feeding
- Distribution of emergency supplies
- Family reunification services
- Immediate health, emotional and spiritual health services
- Access to information

Certifications

The International Association of Emergency Managers, founded originally by US local emergency managers primarily and now attracts international participants as well as professionals from every level and the private sector, has for 30 years served as the credentialing of emergency managers through their Certified Emergency Manager administered through their CEM Commission, comprised of professional emergency managers who have obtained the CEM, some for multiple times. The certification is for five years and requires a test, an essay, as well as three years of membership in a professional organization, attendance at a professional

conference, six public service contributions to the profession, and 100 hours of emergency management training or education plus 100 hours of general management training.

Accreditation

The Emergency Management Accreditation Program (EMAP) provides guidance and assessments for states, localities, tribes, territories, and campuses, with plans for expansion internationally and private sector.

EMAP has a set of general areas of program evaluation, including the following:

1. Emergency Response
2. Mitigation
3. Prevention
4. Recovery
5. Protection
6. Threats and Hazard Identification
7. Operational Coordination
8. Risk and Disaster Resilience Assessment
9. Planning
10. Public Information
11. Operational Communications

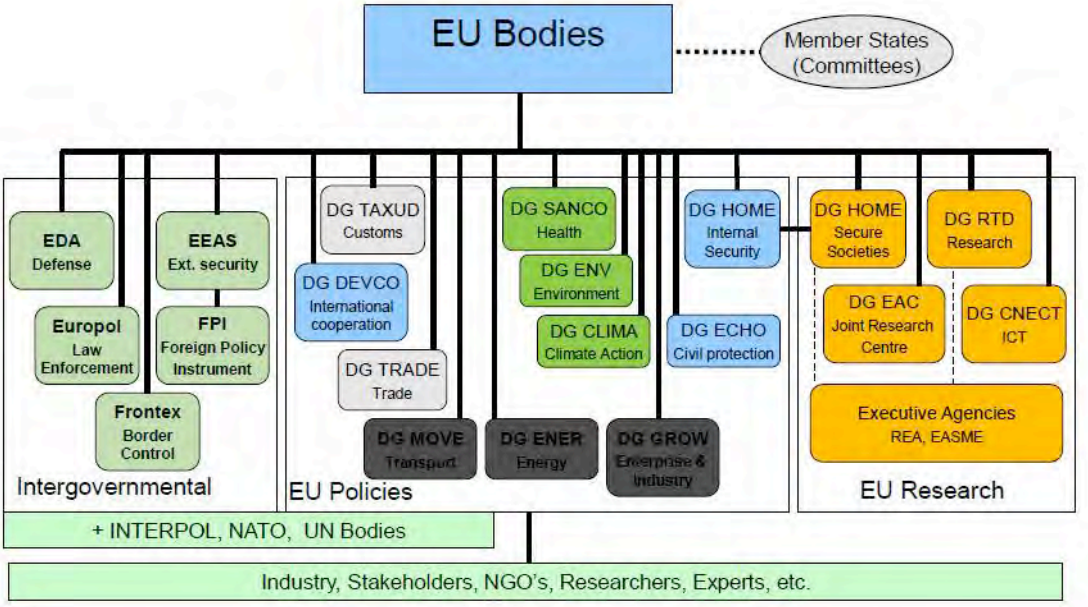
National Emergency Management Association

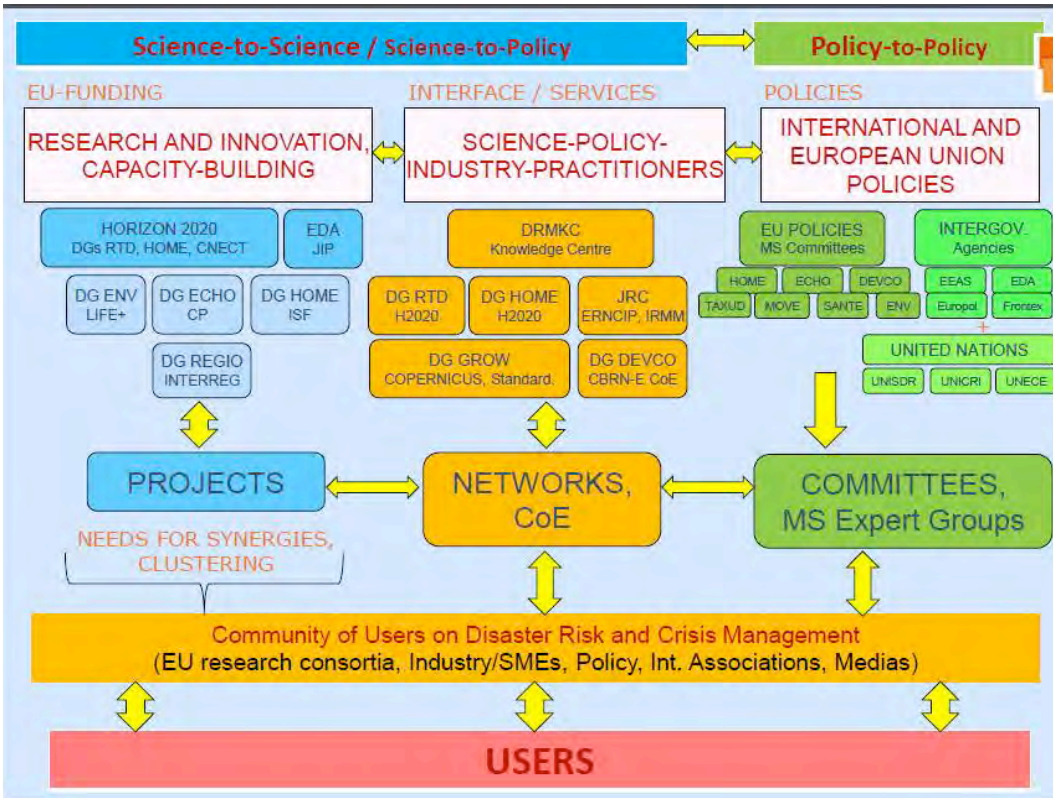
Is the professional organization started by those who serve as State Directors of Emergency Management but now includes professionals throughout the emergency management community and include the following committees:

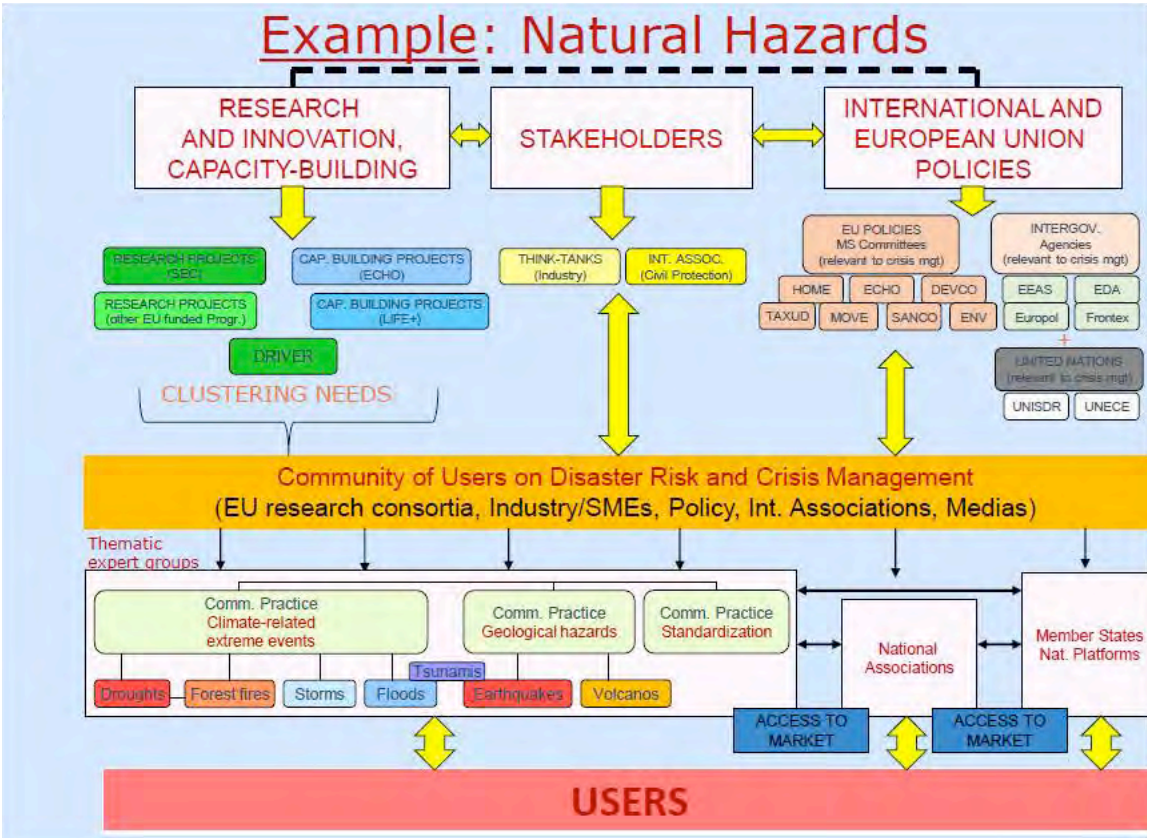
- Emergency Management Assistance Compact (EMAC) Committee
- Mitigation Committee
- Private Sector Committee
- Preparedness Committee
- Response & Recovery Committee
- Legislative Committee
- Homeland Security Committee
- Legal Counsel Committee

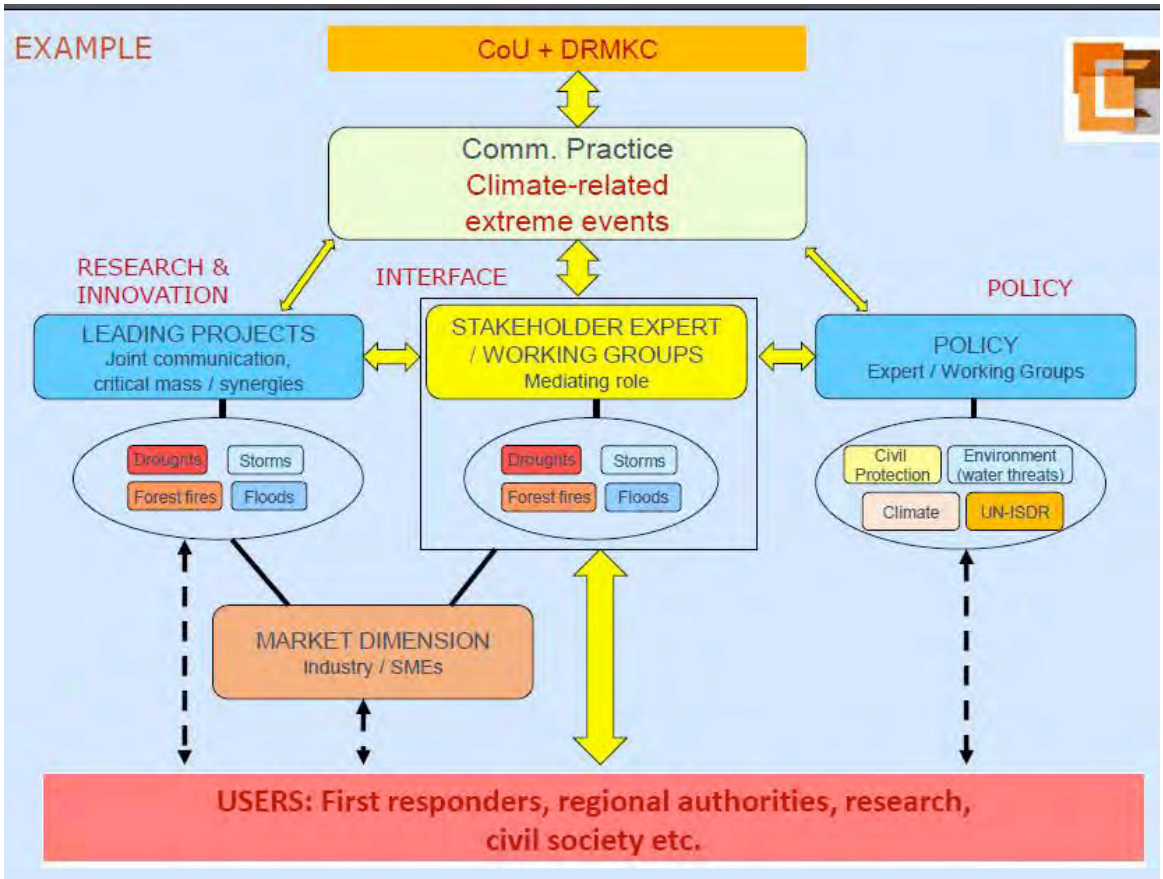
The State of Preparedness in the US has never been stronger. Emergency Managers at all levels of government, the private/nonprofit sectors, and the general public have united under the Whole Community organizing principle, accepting the challenge of working together to insure a strong emergency preparedness for the nation.

European Commission - How to best build up bridges for improving crisis management from EU to regional levels






Example: Natural Hazards
RESEARCH AND INNOVATION, CAPACITY-BUILDING
STAKEHOLDERS
INTERNATIONAL AND EUROPEAN UNION POLICIES
RESEARCH PROJECTS (SEC)
CAP. BUILDING PROJECTS (ECHO)
RESEARCH PROJECTS (other EU funded Progr.)
CAP. BUILDING PROJECTS (LIFE+)
THINK-TANKS (Industry)
INT. ASSOC. (Civil Protection)
EU POLICIES MS Committees (relevant to crisis mgt)
HOME
ECHO
DEVCO
TAXUD
MOVE
SANCO
ENV
INTERGOV. Agencies (relevant to crisis mgt)
EEAS
EDA
Europol
Frontex
UNISDR
UNECE
DRIVER
CLUSTERING NEEDS
Community of Users on Disaster Risk and Crisis Management
(EU research consortia, Industry/SMEs, Policy, Int. Associations, Medias)
Thematic expert groups
Comm. Practice Climate-related extreme events
Comm. Practice Geological hazards
Comm. Practice Standardization
Droughts
Forest fires
Storms
Floods
Tsunamis
Earthquakes
Volcanos
National Associations
Member States Nat. Platforms
ACCESS TO MARKET
ACCESS TO MARKET
USERS


EXAMPLE
CoU + DRMKC
Comm. Practice
Climate-related
extreme events
RESEARCH & INNOVATION
INTERFACE
POLICY
LEADING PROJECTS
Joint communication, critical mass / synergies
STAKEHOLDER EXPERT / WORKING GROUPS
Mediating role
POLICY
Expert / Working Groups
Droughts
Storms
Forest fires
Floods
Droughts
Storms
Forest fires
Floods
Civil Protection
Environment (water threats)
Climate
UN-ISDR
MARKET DIMENSION
Industry / SMEs
USERS: First responders, regional authorities, research, civil society etc.

EC's Research Funding

Between 2014 and 2020, the EU will provide almost **€80bn** in funding for research, mainly through its flagship research programme Horizon 2020. This funding usually takes the form of grants, to part-finance a broad range of research projects.

The ASSET EU Project

TIEMS is a partner in the EU project ASSET (Action plan in Science in Society in Epidemics and Total pandemics), which is a 48 month Mobilisation and Mutual Learning Action Plan (MMLAP), which aims to:

- Forge a partnership with complementary perspectives, knowledge and experiences to address affectively scientific and societal challenges raised by pandemics and associated crisis management
- Explore and map SiS(Science in Society)-related issues in global pandemics
- Define and test a participatory and inclusive strategy to succeed
- Identify necessary resources to make sustainable the action after the project completion

ASSET combines public health, vaccine and epidemiological research, social and political sciences, law and ethics, gender studies, science communication and media, in order to develop an integrated, transdisciplinary, strategy, which will take place at different stages of the research cycle, combining local, regional and national levels.

The HERACLES EU Project

HERACLES main objective is to design, validate and promote responsive systems/solutions for effective resilience of Cultural Heritage (CH) against climate change effects, considering as a mandatory premise an holistic, multidisciplinary approach through the involvement of different expertise (end-users, industry/SMEs, scientists, conservators/restorators and social experts, decision, and policy makers).

This will be operationally pursued with the development of a system exploiting an ICT platform able to collect and integrate multisource information in order to effectively provide complete and updated situational awareness and support decision for innovative measurements improving CH resilience, including new solutions for maintenance and conservation.

HERACLES system will be designed and developed by accounting for the economic sustainability and future acceptance by the market and for the social and economic impact for public and local communities while respecting the integrity of CH and the value it hold for communities.

The TARGET EU Project

The mission of TARGET is to develop, trial and assess **a comprehensive open distributed pan-European Platform for serious gaming**leveraging state-of-the-art decision support tools, **for the training and competence assessment of Security Critical Agents (SCA)** including counterterrorism units, border guards and first responders (police, firefighters, ambulance services, civil security agencies or critical infrastructure operators). TARGET favours joint development of serious gaming Training Content (TC) and **collaborative**transnational training. TARGET will trigger the emergence of a **marketplace**for sharing, licensing and paying for serious TC between SCA, leveraging the existing European wealth of exercises.

The POP-ALERT EU Project

POP-ALERT is a two-year project financed by the European Commission's Seventh Framework Programme. It has carried out behavioural research and a series of empirical studies, taking into account new issues related to targeting both local populations and visitors such as expats or tourists (cultural differences, language barriers, etc.). A portfolio of case studies on social networking and community self-reliance initiatives has been developed and POP-ALERT has identified the best ways to blend contemporary tools with existing practices in order to create flexible and easily deployable toolkits for preparing and alerting the European population in case of a crisis. The project has focused on improving current practices around the use of messaging and cultural sharing technologies that offer the best form of accessibility and use by citizens and authorities.

The DRIVER EU Project

1) Improving civil society resilienceso that local communities are better prepared to respond to, and recover from, a disaster

2) Strengthening first respondersin terms of the crisis management solutions they have available to them

3) Training and learning solutionsdesigned to enhance the capacities and capabilities of trainers and human resources professionals dealing with those involved in crisis management

The DRIVER consortium consists of 36 organizations from 13 EU Member States and two associated countries

EU Security Call 2016

TOPIC : Integrated tools for response planning and scenario building

Topic identifier:	SEC-01-DRS-2016		
Publication date:	14 October 2015		
Types of action:	IA Innovation action		
DeadlineModel:	single-stage		
Opening date:	15 March 2016	**Deadline:**	25 August 2016 17:00:00

1. **List of countries and applicable rules for funding:** described in part A of the General Annexes of the General Work Programme.
   Note also that a number of non-EU/non-Associated Countries that are not automatically eligible for funding have made specific provisions for making funding available for their participants in Horizon 2020 projects (follow the links to China, Japan, Republic of Korea, Mexico, Russia, Taiwan).

People's Republic of China - Country Page

1. **Available local programs or funds that could provide support to Chinese Horizon 2020 participants**

Under the co-funding mechanism (CFM), up to 200 million RMB, or 28 million euro, will be made available annually by the Chinese Ministry of Science and Technology (MOST) on the Chinese side for the benefit of China-based entities that will participate in joint projects with European partners under Horizon 2020. The European Commission expects to continue spending over 100 million Euros per year for the benefit of Europe-based entities in joint projects under H2020 with Chinese participants.

TIEMS

- TIEMS was founded in 1993 in Washington, USA, and is today registered as an international, independent, non-political, not for profit NGO in Belgium
- TIEMS is a Global Forum for Education, Training, Certification and Policy in Emergency and Disaster Management
- TIEMS provides a platform for all stakeholders within the global emergency and disaster management community to meet, network and learn from each other and exchange knowledge and experience
- TIEMS aims to influence policy makers worldwide to improve global cooperation and to establish global standards within emergency and disaster management

TIEMS Activities

- International Conferences, Workshops and Exhibitions, focusing on different Emergency Management and Disaster Topics
- Electronic Newsletter with latest News and Articles of Interest and Monthly Messages from TIEMS President
- Research & Development Project Initiatives and Coordination of RTD Projects
- International Education, Training and Certification Programs (GENERATE)
- Global Young Scientist Network
- Local Chapter Activity to Stimulate Local Initiatives and Build a Global Expert Network where different Cultural Practises are added value
- Task Force Groups

TIEMS Education, Training and Certification Program Objectives

- Put International Focus on the Profession of Emergency Management and Disaster Response
- Contribute to an Internationally Shared Understanding in Education, Training and Certification in Emergency Management and Disaster Response
- Contribute to Education in Emergency Management and Disaster Response in order to Promote the State of the Art in Technology, Systems and Methods available in the Field
- Contribute to Education at all Levels, fromPolicy Documents to Courses in Primary School Education
- Establish a TIEMS Certification of Qualifications in International Emergency Management and Disaster Response (TIEMS QIEDM)
- Contribute to Capacity Building in Countries where little or no Education and Training in this field is available

- Recruit International Teachers and Trainers in this field to TIEMS Pool of International Teachers and Instructors

A TIEMS RTD Project Proposal - GENERATE (Global Education Network for Emergency Resilience and Training Excellence)

Developed and Sponsored by:


Thomas Robertson


K. Harald Drager


Connie White

Thinking Teams

QUASAR

ITSFEM

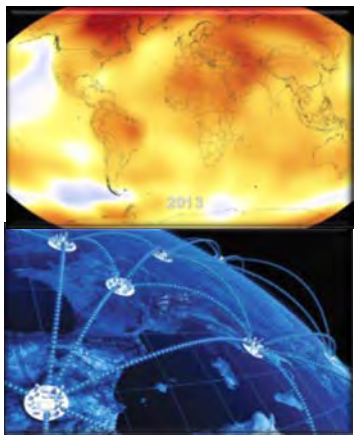
ITSFEM

Increasing Need for Disaster Preparedness Worldwide

- Resilience to Emergencies is a Global Problem
- Education is the Foundation for Resilience
- A RTD Proposal to Improve Access to Education
- Resources to Build Upon
- Extreme Events will Happen every 5 Years instead of every 20
- Between 2010 and 2040 the Number of People over 65 in Less Developed Countries is Expected to Triple
- 80 % of the most Populous Cities in the World are at Risk being Severely Affected by an Earthquake
- And 60 % are Vulnerable to Storm Surge and Tsunamis

We are interconnected

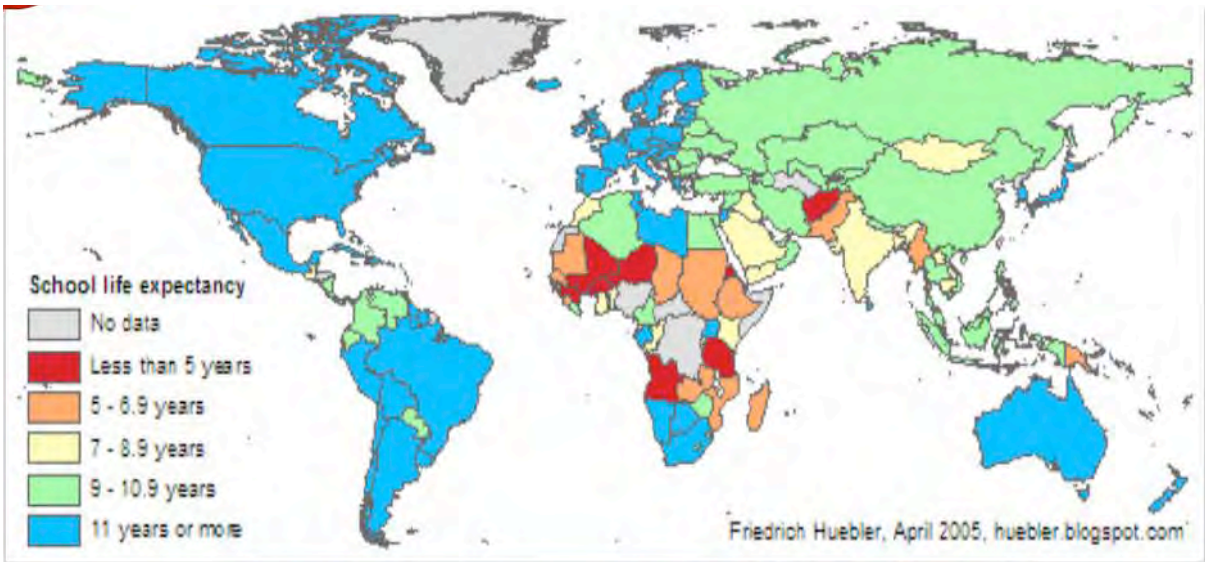
- Climate Change
- Global Economy
- Energy Interdependence
- Cyber Connectivity
- Global Travel and Epidemics and Pandemics



We can learn from each other

- Some Nations may have more Experience with the Disasters we may Face in the Future than Others
- Vast Worldwide Experience can be used to Develop an Education and Certification Scheme Useful to All
- Shared Knowledge and Terminology makes International Cooperation Easier
- New Lessons are Learned every Day

The Education Access Problem



GENERATE Project Objectives

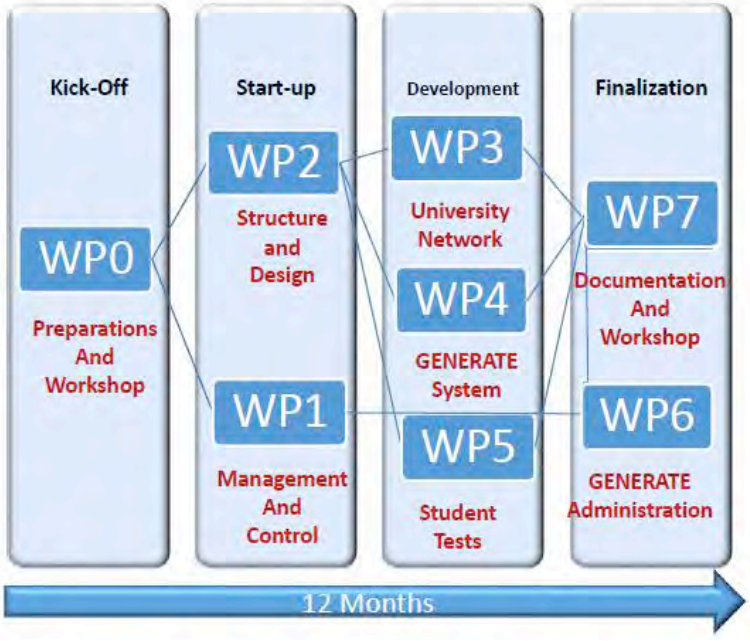
- Develop an Internationally Shared Understanding of Emergency Management Elements, Qualifications and Terminology
- Help Students Find and Connect with Useful Online and Live Education Resources
- Make Increasing Amounts of Emergency Management Knowledge Available Online, Especially to Vulnerable Societies
- Provide a Platform to Share Critical Lessons Learned

What is GENERATE?

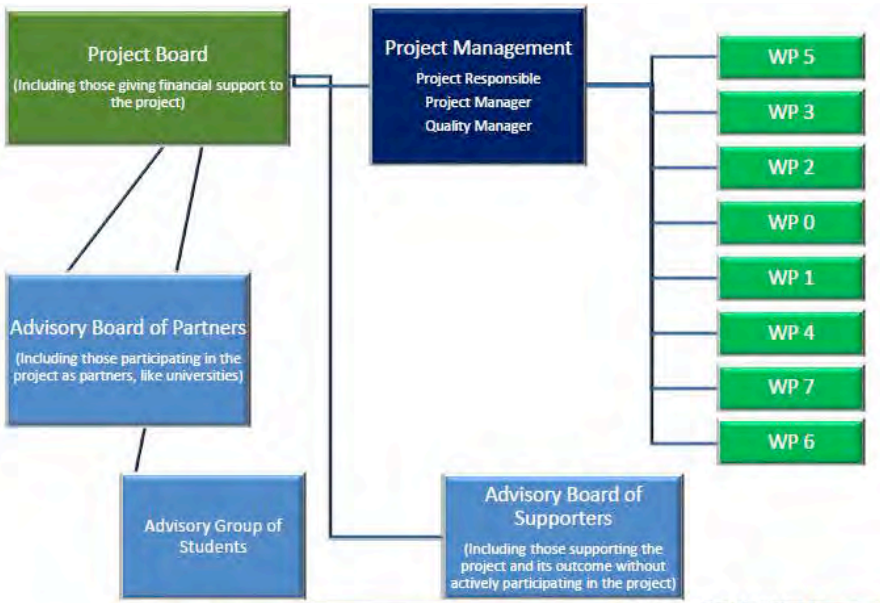
- An **International Community**of emergency management organizations, educators, practitioners, and students
    - GENERATE Centers of Excellence
- An **eLearning and Certification platform**promoting shared understanding of EM elements, standards and terminology

- A **Directory**of live and online degree programs, courses, workshops, and knowledge bases
- An online **Community of Practice** to share lessons learned

GENERATE Development Plan



GENERATE Project Organisation Structure



TIEMS QIEDM Certification Application Requirements

- QIEDM –Qualifications in International Emergency and Disaster Management
- Being Certified in Emergency Management/Disaster Response or Similar by Another Certifying Institution Approved by TIEMS

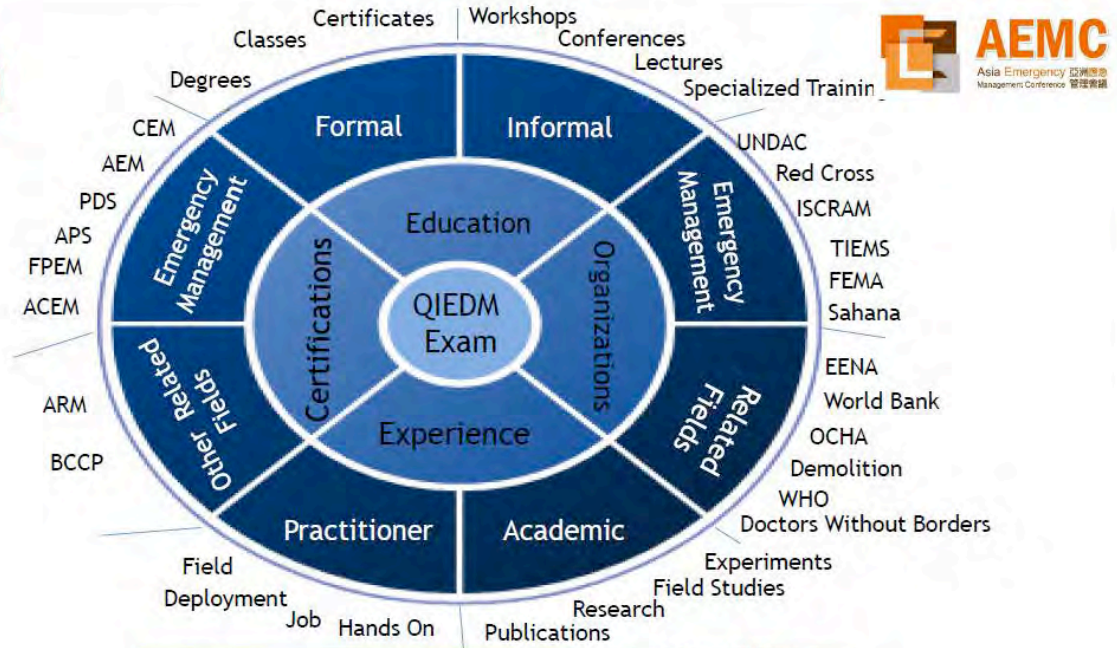
  OR

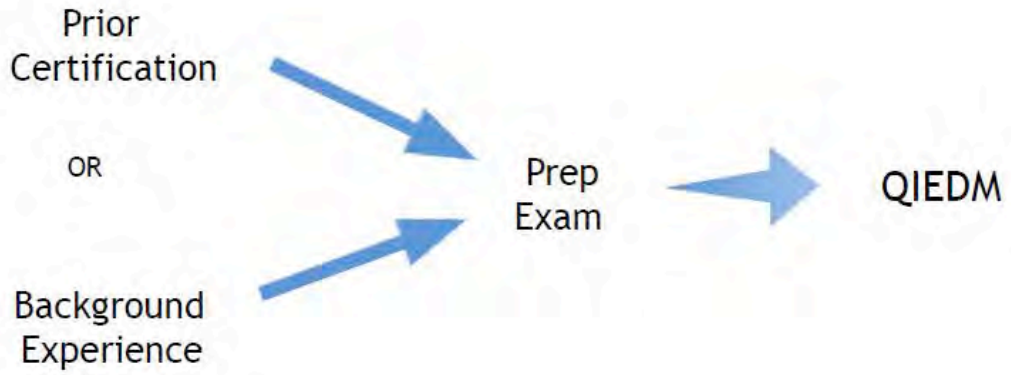
- Document a Practical or Theoretical Background in Emergency and Disaster Management for a minimum of 4 years
- Provide a Letter of Recommendation to TIEMS QIEDM Program from a Current or Former Employer

Emergency Management Certifications in the USA

- National Level
  - FEMA (Federal EM Agency)
    - PDS (Professional Development Series)
    - APS (Advanced Professional Series)
- State Level
  - FEPA (Florida Emergency Preparedness Association)
    - FPEM (Florida Professional EM)
  - ADEM (Arkansas Department of EM)

- Both based off courses and an exam
    - IAEM (International Association of EM)
        - AEM (Associate EM)
        - CEM (Certified EM)
- Exam, training, experience, contributions, essay, (CEM only) degree
        - ACEM (Arkansas Certified EM)
    - Many other states
        - Some have levels:
            - Basic
            - Advanced
            - Professional





QIEDM CERTIFICATION OBJECTIVES

- Availability Globally
- Web-based On-Line
- Low Cost
- A Common Understanding of Emergency and Disaster Management
- The Common Language is English, but local language adaption in TIEMS Chapter Countries
- Lessons Learned Focus
- State-of-the-Art and Up-to-Date

EXAMPLE OF ANOTHER CERTIFICATION

- IAEM –CEM Certified –Certified Emergency Manager
- Emergency Management Experience (3 years full-time equivalent minimum)
- Three Professional References
- Actual Disaster/Contingency Experience or Substantive Role in Managing a FullScaleExercise
- Education (any 4-year BA/BS degree)* * (2 additional years of "applicable" full-time job experience may be substituted for each year of college education
- 100 hours of Emergency Management Training and 100 hours of General Management Training (No more than 25 hours in any one subject matter area, and needs to show training in all phases of CEM)
- Contributions to the Profession (minimum of 6 out of 12) Examples include speaking, teaching, publishing, service on a Board, Commission, leadership role, memberships, etc.
- Comprehensive Management Essay CEM® Certification Requirements
- Comprehensive 100-question Multiple-Choice Examination (Applicant must get 75% or better to PASS. Test is multiple choice and administered through a variety of methods)
- Recertification Requirement every 5 years

TIEMS QIEDM Certification Competence Requirements

1. Global Overview of International Emergency and Disaster Management (EDM)
2. International Emergency and Disaster Management Definitions, Tools and Techniques
3. International Emergency and Disaster Management Planning and Operations

4. International Emergency and Disaster Management Research and Development Worldwide
5. International Emergency and Disaster Management Miscellaneous Issues of Importance

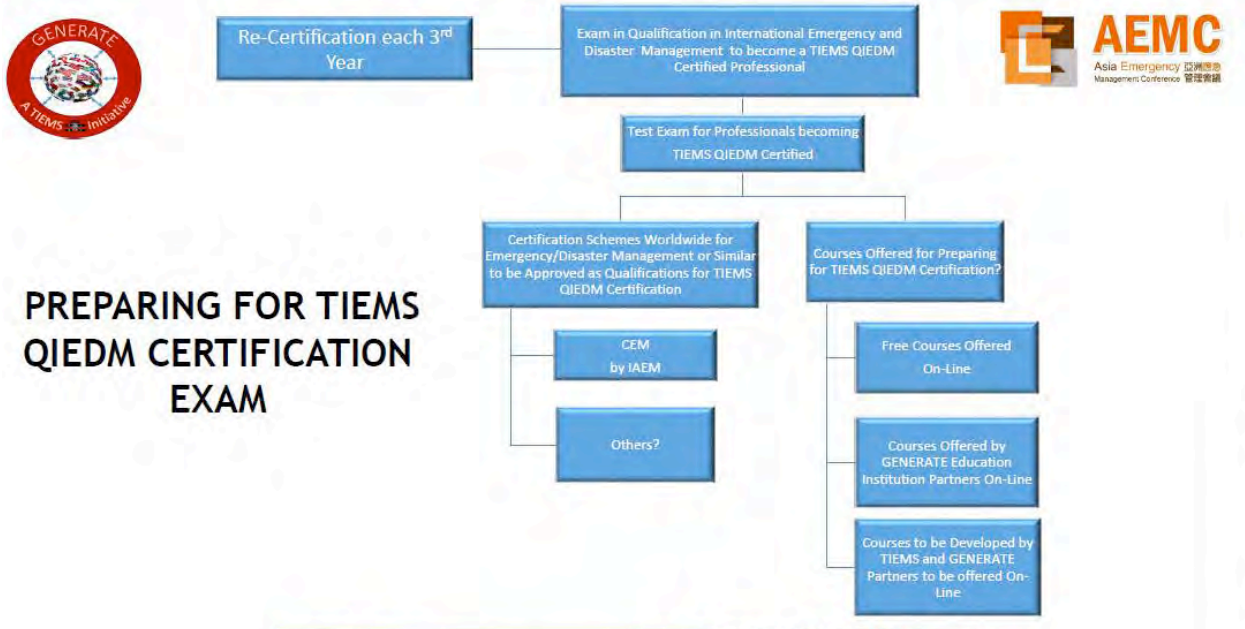
Global Overview of International Emergency and Disaster Management (EDM)

	EDM Global Differences and Different Focus	International EDM Organizations	National EDM Organizations of Importance	International Humanitarian Aid Organizations	EDM Stakeholder Categories	Natural Disaster Types	Man Made Disasters	Statistics
Global Overview of International Emergency and Disaster Management (EDM)	USA/Canada	UN OCHA	FEMA USA	Red Cross	First Responders	Earthquakes	Terrorism	World Disaster Report
	Latin America	EU Civil Defence	Homeland Security USA	etc.	etc.	Tsunamis	Transport Accidents	etc.
	EU/Europe	TIEMS	EU Civil Protection			Floods	Fires & Explosions	
	Australia/New Zealand and Oceania	IAEM	etc.			Droughts/ Food Insecurity		
	Asia	ICDO				Volcanic Eruptions		
	Africa	UNISDR				Extreme Temperatures		
		etc.				Windstorms		

Emergency and Disaster Management Definitions, Tools and Techniques

	Definitions of EDM terms and expressions	Emergency and Disaster Phases Characteristics	Risk And Damage Assessments Techniques	EDM Tools, Methods and systems	Social Media in EDM	International Standardization	Emergency Communication
Emergency and Disaster Management Definitions, Tools and Techniques	Emergency	Mitigation			Facebook	ISO	TETRA
	Disaster	Preparedness Planning			Twitter	etc.	etc.
	Resilience	Incident			Snap Chat		
	Preparedness	Response			Instagram		
	Business Continuity	Recovery			etc.		
	Vulnerability						

Preparing for TIEMS QIEDM Certification Exam



Example of Free/Low Cost Courses in Emergency Management Offered On-Line

Disaster Preparedness

About this course:

Have you ever viewed a news report depicting the aftermath of a devastating natural disaster? The damage to human life and property are both staggering and heartbreaking. All parts of the world face the possibility of floods, hurricanes, tornados, fires, landslides, earthquakes, tsunamis, and other natural phenomena. Are you prepared if disaster would strike you? This course will help you prepare! The course is appropriate for any learner who is proactive about developing the core competencies of disaster readiness and survival planning. It is especially useful if you are seeking techniques that can ensure your personal protection, as well as the safety of your family, property, and belongings, during a natural disaster. In addition, it offers essential preparation for a variety of emergency situations and inconveniences, even if you do not live in major tornado, flood, hurricane, tsunami, or earthquake zone.

QIEDM Exam

- Essay questions, e.g.,
    - "Describe how the United Nations has worked to bring about a reduction in global disaster risk"
    - List and briefly explain the five overarching international disaster trends.
- Fill-in-the-blank questions, e.g.,

  "In May 1994, UN member states met at the World Conference on Natural Disaster Reduction in _____, Japan, to assess the progress attained by the IDNDR. At this meeting they developed the _____ Strategy and Plan of Action for a Safer World"
- Multiple choice questions, e.g.,

  "Which of the following UN Agencies typically coordinates the response to major disasters:
    - UNHCR
    - UNOCHA
    - WFP
    - UNDP"

Example Essay Question

Question: List and briefly explain the five overarching international disaster trends.

Answer:

- The number of people affected by disasters is rising
- Overall, disasters are becoming less deadly
- Overall, disasters are becoming more costly
- Poor countries are disproportionately affected by disaster consequences
- The number of disasters is increasing each year

Another Example Essay Question

Knowledge Area: Climate Change/Disaster Trends

Given the sophistication of present day data gathering techniques implemented around the world, a clearer picture of disaster activity has been identified by past patterns providing trends that are occurring with disasters. Discuss some of the reasons for disasters occurring more frequently, with deadlier, costlier outcomes. Discuss a few of the trends that have been identified. (300 words per trend).

Example Fill-in-the-Blanks Question

Question: In May 1994, UN member states met at the World Conference on Natural Disaster Reduction in _____, Japan, to assess the progress attained by the IDNDR. At this meeting they developed the _____ Strategy and Plan of Action for a Safer World"

Answer: In May 1994, UN member states met at the World Conference on Natural Disaster Reduction in __**Yokohama**__, Japan, to assess the progress attained by the IDNDR. At this meeting they developed the ___**Yokohama**__ Strategy and Plan of Action for a Safer World"

Example Multiple Choice Question

Question: Which of the following UN Agencies typically coordinates the response to major disasters:

- UNHCR
- UNOCHA (**Answer**)
- WFP
- UNDP

Example Multiple Choice Question

Question: Which of the following is the primary reason for the drastic drop in the number of earthquake deaths in the developing countries in the last century:

- Nonstructural mitigation
- Building codes (**Answer**)
- Public education
- None of the above

GENERATE PROJECT CONCLUSIONS

- Interconnection makes Resilience to Emergencies to an International Problem
- Interconnections can make us more Resilient if we share Knowledge and the latest Lessons Learned and make this information more accessible
- On-Line International Education and Certification will Promote sharing Best Practices and Collaboration
- GENERATE will realize these Goals by Creating a Networked Coalition
- TIEMS looks forward to Ideas and Participation

- TIEMS QIEDM Certification is a certification for all working within emergency management, for ex. practitioners, academics, medical personnel, authority personnel, etc.

- TIEMS QIEDM exams includes questions in the prep course and exam about a comparison between the way emergency management is done nationally in the country of the candidate, with the global trend and way of doing it. This is what TIEMS chapters will add into the exam and the prep course. This will be a two way learning, and capacity building

Welcome to San Diego by the City Mayor

On behalf of the citizens of San Diego, I would like to welcome you to The International Emergency Management Society 2016 Annual Conference.

San Diego has worked diligently at fostering communication, collaboration and sharing best practices among our countless professionals in the fields of healthcare, public health, emergency medical services and emergency management. As we are often reminded, ensuring disaster readiness and building healthier, safer and more resilient communities must be a top national priority.

San Diego is a shining example to the nation in the field of emergency preparedness, drawing on our thriving defense industry, expertise in innovation, and cross-border collaboration.

San Diego is known for its world-class restaurants, beautiful beaches and thriving neighborhoods. While visiting, I hope that you have the opportunity to experience some of the attractions that America's Finest City has to offer.

Please accept my warmest wishes for an enjoyable event in San Diego.

Best personal regards,

Kevin L. Faulconer

San Diego City Mayor

Planning for Un-Plannable Risks

Alternative Resiliency Services Corp

700 NW Gilman Blvd
E103 #423
Issaquah WA 98027
www.alternativeresiliency.com
Inquiries@alternativeresiliency.com

Problem Statement: We as humans have built-in cognitive biases and psychological flaws that impede our understanding of Risk and Probability. We are therefore surprised by unforeseen events, including Black Swans. Building innovative controls and practices into our Risk Management, Cyber-Security, Business Continuity and other programs can compensate for these flaws and make our programs tolerant of the Unforeseeable.

Black Swan Defined

- Unpredictable
- Massively game-changing
- In hindsight foreseeable

- 9/11: successful asymmetrical attack on a world superpower through a known threat vector
- 2003 US Northeast blackout: widespread power outage caused by one overheated wire shorting out on a tree: 55MM impacted across 7 states and Canada, $6B economic impact
- 2010 Eyjafjallajokull volcano: presence of ice cap boosted impact of minor eruption to shut down European airspace and cripple global travel: $5B economic impact
- 2010: Fukushima quake and tsunami overwhelmed Japan defenses, causing nuclear reactor catastrophe. $25-250B economic impact
- 2011: Super Storm Sandy, less-than-hurricane on US Northeast coast. $65B economic impact

Trends and Drivers Influencing 21st Century Risks

Exponential explosion of data	Disintermediation of technology	Technical interconnectedness (IoT)
Increasing speed of business and social innovation and change	Evolution from Mediocristan to Extremestan	Increasing concentration risk through globalization/consolidation

Our Cognitive Biases

Gambler's Fallacy
Belief that past events influence present risk

Anchoring Bias
Fixation on past risks instead of evolving risks

Normalcy Bias
Discounting risks not directly experienced

Bias Blind Spot
Lack of acceptance of one's own bias in decision-making

Choice-Supportive Bias
Belief that one's on choices were better than they were

Texas Sharpshooter
Misapplying result to prove preconceived theory

Availability Bias
Over-estimation of low but emotionally impacting risk

Confirmation Bias
Focus on confirming rather than disproving hypotheses

Base Rate Bias
Focusing on edge data not base data when estimating risk

Zero-Risk Bias
Preference to eliminate one risk vs larger overall reduction

Controls and Practices to Mitigate Against Unforeseeable Risks

Move past "a bad thing" to "some bad thing" happening	Assume Yes and plan accordingly	Move from Reactive to Proactive to Preemptive
Balance Predicting (Risk Mgt) and Preventing (High Availability. Redundancy) with Responding (Business Continuity, Crisis Mgt, Disaster Recovery)	Incorporate independent perspective and external practices into risk identification, management and exercising	Manage Supply Chain Risk holistically with assessment, investigative due diligence, review and joint planning and exercising
Train and exercise, focusing on desired behaviors and outcomes not scenario details	Counterbalance your Blind Spots with diversity of viewpoints, questioning assumptions and lateral thinking	Move from Scenario-Based to All-Hazard/Business Impact Planning

Experts-Group-Event Safety

Experts-Group
Event-Safety

People have been gathering together since the beginning of mankind. The current events we face today have behind them a long history with a variety of cultural origins. But in the end, people come together for special reasons - wether attending a concert, a political speech, a play at the theatre, or an exhibition: One of the core expectations in this form of human behaviour is to stay safe and not get (seriously) harmed at any type of event. This expectation should be the simple goal of any organiser and producer of public or private gatherings all over the world, regardless of the political system of the societal structure of that particular country or continent.

The German Task Force Event Security (Arbeitsgruppe Veranstaltungssicherheit AGVS) was founded by event managers and stage managers Christian A. Buschoff and Harald Scherer in May 2010, together with the Cologne University of Applied Science, with the aforementioned ideas and intrinsic motivations in mind. Shortly after the first meeting a serious accident at the Loveparade, a techno music open-air festival in Germany‘s Ruhr region, resulted in the death of 21 people.

Like many fatal accidents in the 19th century (theatre fires with the enormous loss of lives) the Loveparade disaster brought about a paradigm shift: The work of the task force is now monitored by the event industry and the media due to the public awareness of the topic. Safety is everybody‘s concern and is on the agenda of every organisation, because it is closely connected with both the idea of human and cultural rights, as well as the freedom of the individual. This is decreed by the UN‘s Universal Declaration of Human Rights (1948).

In essence the task force focuses its concept for event safety on prevention and risk management. It is a guideline, a manifest, which consolidates the content of a variety of safety analyses and combines proper methodology with experiential knowledge from all parties involved in the planning and holding of events. There are no intentional specific links to national or local laws or rules and regulations: Nowadays almost every country has its own laws, be they written or unwritten. And even in the absence of such laws, the nearest neighbouring country may have their own approach to the topic. And, last but not least, there are technical standards that should be followed to achieve a proper result.

After more than five years in the field the experts-group‘s ideas are being used in many events all throughout Europe and have been discussed at international meetings worldwide, from Cincinnati to Moscow to Beijing and to Istanbul. This is the first English translation, which aims to give this manifest a broader audience and to open it up to international review.

During the discussion about content the considerations departed from the search for one method toward a preventative approach of observation. Due to the strict disconnection remains the individual areas to the right place, thereby a clear and recognisable framework for all parties involved is possible. The main focus for a world wide idea of visitors safety will be provention. The preventative observation of the event‘s security occurs as part of a constant process and a continuous processing of the following ten questions:

1. What are the objectives of the event?
2. Who bears the economic risk?
3. Are the responsibilities clarified?
4. Was the feasibility of the event assessed?
5. How can one influence the event?

6. What dangers and risks arise from the event?
7. What behaviour is to be expected at the event?
8. Who makes decisions concerning the event?
9. What information is available about the event?
10. How are the parties involved prepared for the event?

The objective of this processing to transfer the dangers and risks that cannot be resolved with preventative measures into a risk management process, where they can be addressed with various measures and methods. These may vary greatly and must be individually coordinated.

The free publishing of the instructions allows for the unification of the planning of events, in turn making it more transparent for all parties involved. You will find the free document download link here:

https://www.th-koeln.de/anlagen-energie-und-maschinensysteme/arbeitsgruppe-veranstaltungssicherheitagvs_24963.php

We would be very happy to receive your feedback on this document and if you would discuss it among your peers so that we can incorporate your experience in the future.

Berlin | Cologne, May 2016

Christian A. Buschhoff | Harald Scherer

Contact:

TH Köln (University of Applied Sciences)
Institute of Rescue Engineering and Civil Protection
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picture © by Harald Scherer

Flexmort – Flexible Mortuary Solutions

Flexmort is a UK company and provides turn-key systems for dealing with high numbers of deceased. Flexmort was awarded the Queen's Award for Innovation in 2015 (the UK's highest business accolade). Flexmort's portable mortuaries are used throughout the world and provide mortuary cooling facilities which can be deployed quickly during mass fatality situations or simply used when extra body storage is required (e.g. Hospitals).

Mortuary Managers, Police and DVI (Disaster Victim Identification) teams helped design Flexmort's temporary mobile mortuary systems; the AirCool12™ and the Mortuary Dome. Over 95% of British hospitals use Flexmort systems as well as the UK Police etc.

The AirCool12™ revolutionised mortuary storage as it could be used internally, was easy to set and could be transported easily. The system provides a 4°C mortuary for 12 deceased and is set up within 25 minutes. The AirCool12™ also benefits from features such as lightweight, high performance insulation and fully rollered pop-up racking to reduce manual handling issues as the deceased can easily be loaded into the system. Uniquely, the AirCool™ system has ignitability and flammability test data available under the standard BS5867 (part 2).

Flexmort is a trusted supplier to the Hamad Medical Group who operate as the principle public healthcare provider for the country of Qatar. The corporation is required to be at the forefront of any major incidents involving mass civilian casualties.

"The Flexmort system offers us high quality solutions and the versatility that we require to ensure our major incident preparedness is all-encompassing" - Paul Welford, Assistant Executive Director

Below: The AirCool12™ mobile forensic morgue

Dublin Civil Guard purchased a Mortuary Dome in 2015 which was deployed at the end of the year in the instance of a fire causing multiple civilian deaths. Cahir O'Byrne the Emergency Management Office in Dublin stated,

"The Mortuary Dome is simple to set up and easy to transport and undoubtedly improves our ability to respond to situations with potentially high numbers of fatalities"

Above: The Flexmort team outside a Mortuary Dome

Alongside these innovative mortuary storage systems, Flexmort provides mass fatality products such as high performance body bags, absorbent pads and CadSeal™ (repatriation foil) as well as flat packed coffins.

During the Ebola crisis in 2014, Flexmort™ provided equipment to the UK government and other international organisations such as UNICEF. Their technology aided those dealing with the crisis first hand and proved highly successful.

For further information please contact info@roftek.com, visit our website at www.flexmort.com or call +44 (0)8455 333561

Emergency Management Team – Or Is It a Group?

Paul G. Barker

CMG
Crisis Management Guides
DMT Global Limited

www.DMTglobal.net
Paul@DMTglobal.net

THROW AWAY THE CHECKLISTS!

TO BE A GOOD EMERGENCY MANAGEMENT TEAM YOU DON'T NEED TO KNOW ALL OF THE ANSWERS ….

YOU ONLY NEED TO KNOW THE QUESTIONS ….

DMT GLOBAL'S UNIQUE CRISIS MANAGEMENT PROCESS IS DESIGNED TO BE CREATED DURING "PEACE-TIME"

HERE IS HOW IT WORKS

1. **COMPILE A LIST OF *POTENTIAL* EMERGENCY SCENARIOS THAT COULD OCCUR**
2. **CONSIDER EACH SCENARIO**
   - ✓ **COMPILE A LIST OF POSSIBLE SITUATIONS THAT COULD ARISE WITH THIS SCENARIO**

Collect as much up-to-date information as possible

Consider ALL of the **KNOWN**, **ASSUMED** **&** **POTENTIAL** Risks

- ✓ The protection of **PEOPLE**
- ✓ The protection of the **ENVIRONMENT**
- ✓ The protection of your **ASSETS**
- ✓ The protection of your **REPUTATION**

3. **COMPILE A SUB-LIST OF POTENTIAL ESCALATIONS OF EACH SITUATION**

4. **CONDUCT A RISK ASSESSMENT ON EACH OF THE POTENTIAL ESCALATIONS**
   - **ASK - WILL IT HAPPEN?**
     - Assess the Likelihood of the worst-case situation **Occurring** ***(LO)***
     - **AWARD A SCORE FROM 0 TO 10**
   - **ASK - WILL IT HURT?**
     - Assess the Likelihood of the **Severity** of the worst-case situation ***(LS)***
     - **AWARD A SCORE FROM 0 TO 10**
5. **NOW MULTIPLY THE LO SCORE BY LS SCORE**
   - **THIS IS YOUR *RISK VALUE***
6. **NOW IDENTIFY THE HIGHEST RISK VALUE**
7. **START TO WORK OUT HOW YOU REDUCE THE LO & LS SCORES**
   - **THIS IS YOUR ACTION PLAN**
     - Consider the outcome of the Risk Assessment
     - Specify & assign the ***objective*** of each action
     - Specify how to measure if actions are effective and will be achieved on time
     - Plan "B" - What to do if the situation changes significantly
   - **MONITOR & REVIEW**

DMT Global provide a unique Web-Based Training Program & Crisis Management Guide Application

DMT Global Limited

"When the time to respond is upon you, the time to train and plan has already past"

Web-Based Training for your Emergency Management Team

Bespoke Training Courses can be provided at your location

Web-Based Assessment

Download interactive CMG Templates from the on-line library

Design & Save your own Web-Based interactive CMG's

Share your CMG's with other users in the on-line library

Multiple User Log-On and CMG completion process

Compile Actions Plans & Assign Tasks On-Line

Users can access the on-line CMG meeting from anywhere, anytime

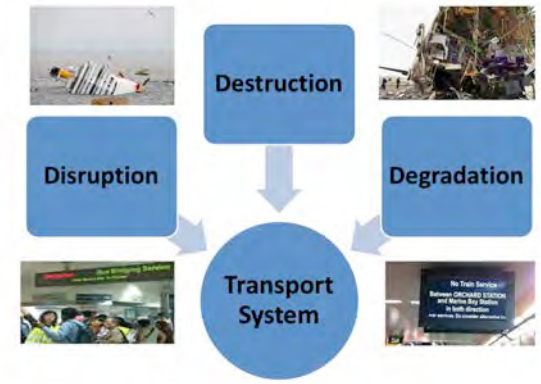
Emergency Management in the Transport Sector– Get it right or your reputation and public confidence is at risk!

Chew Weng Lee, Deputy Director (Emergency Preparedness), Ministry of Transport (Singapore)

Presentation at the Asia Emergency Management Conference 2016 (Macau)

What is Transport Emergency?

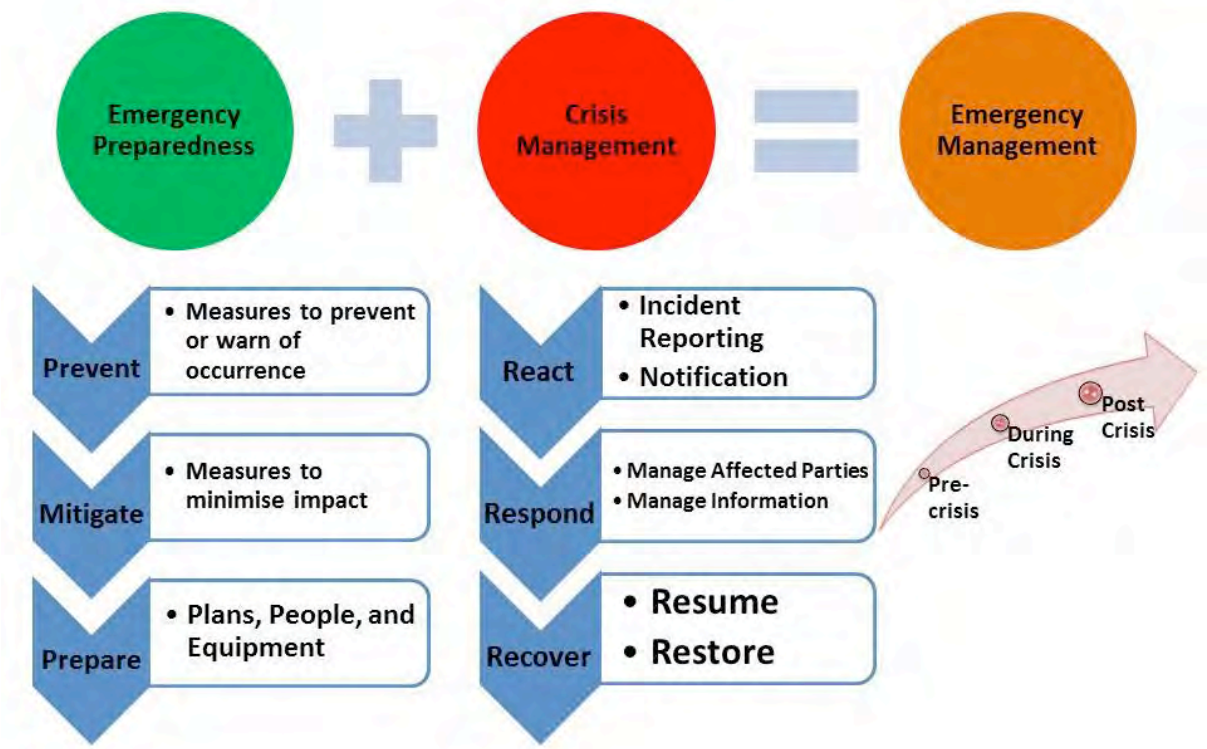
A Transport Emergency need not be a crisis or disaster to be of concern for the transport service provider, the transport regulator or the transport ministry. The social and economic impact resulting from a transport emergency has great implications to the country and the organisations. It impacts their image, reputation and public confidence, both domestically and internationally.



Transport Emergency could result from the **disruption** (e.g. breakdown) or **degradation** (e.g. stoppages, delay) of the transport system, affecting the movement of people, goods and services. In the worst case, the transport system can be subjected to **destruction** by a terrorist act or the act of god. The cause of a transport emergency can be due to a natural disaster, safety or security incident.

What is Emergency Management?

Emergency Management is about knowing what can possibly happen and knowing what to do. Emergency Management is about the activities that are carried out before a crisis, during a crisis and after a crisis. There are two components: the Emergency Preparedness component and the Crisis Management component in Emergency Management. Each component has three phases.



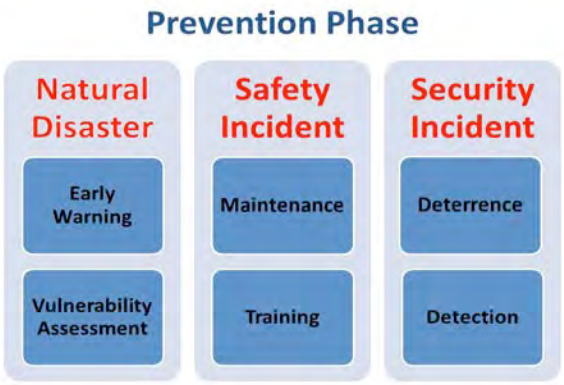
Emergency Preparedness Phases

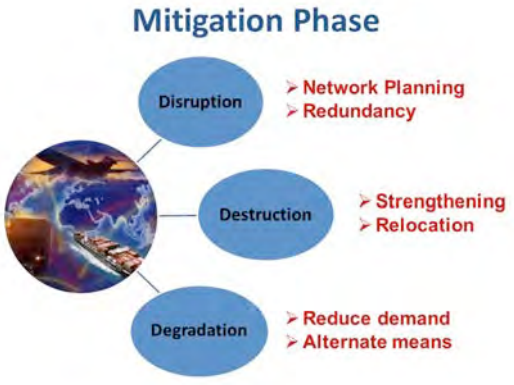
Prevention Phase

While a natural disaster is not preventable, an early warning system can be put in place to provide alert and critical transport assets (identified from the conduct of vulnerability assessment) moved to a safe location or protected.

Safety related incident in the transport system can be prevented by having in place a timely maintenance regime and replacement of assets, and staff well-trained to carry out the job. The maintenance regime should include schedule for inspection and repair, and ensuring the threshold limit for the replacement of critical transportation system and infrastructure.

The preventive measures for security related incident in the transport system will include putting in place deterrent and detection measures at transport nodes, interchanges, systems and infrastructures.





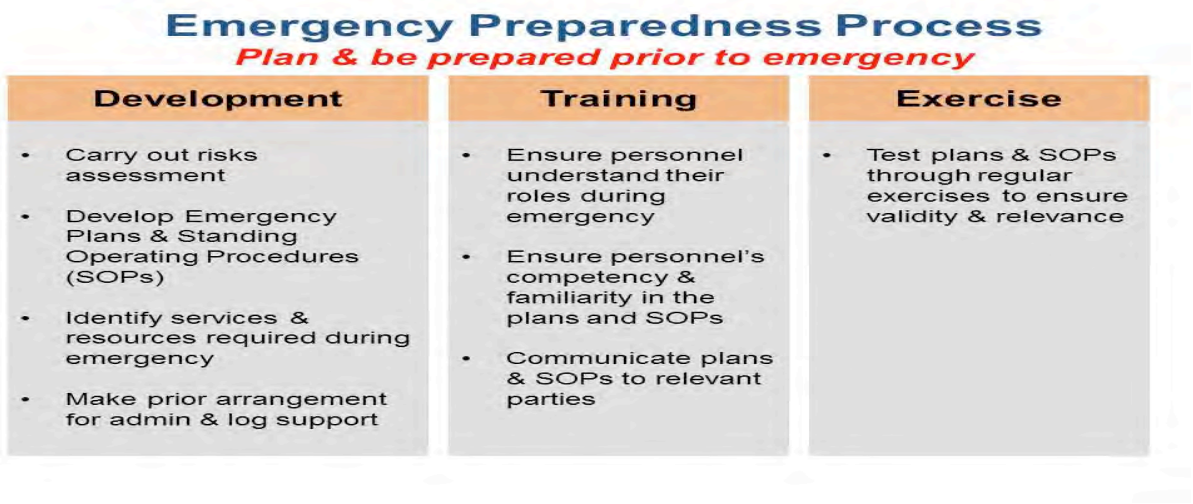
Mitigation Phase

Mitigation measures that can help to minimise the impact and damage to transport system and infrastructure include the following:

- planning for redundancy in the network to mitigate disruption;
- reducing demand and providing alternate means to manage degradation of transport services;
- relocating and strengthening critical transport assets to minimise damage caused by act of destruction to the transport system.

Preparedness Phase

The Emergency Preparedness Process called for the planning and preparation to be carried out well before an emergency. It includes the development of contingency and actions plans; conduct of training to familiarise staff with the plans; to the conduct of exercises to validate and ensure the relevancy of the plans and procedures.



Emergency Preparedness Framework

An Emergency Preparedness Framework should comprise of four components: Resources, Instrument, Mechanism and Responsibilities.

Emergency Preparedness Resources refer to the **P**lans, **P**eople and **E**quipment required for the crisis management of the transport emergency. It involves the formulation of plans and processes for all-hazards affecting the transport systems; checking the relevancy and validity of the plans and ensuring that it is up-to-date. It involves ensuring that the people responding to the emergency are operationally ready, current with their plans and procedures and are well-trained. It involves ensuring that the equipment and resources meant for the management of the emergency are appropriate, serviceable and available when needed.

Emergency Preparedness Instrument refers to the means and tools used to gauge and validate one's emergency preparedness and operational readiness. The two instruments are exercises and evaluation.

An exercise promotes familiarity with the plans, procedures and equipment. It develops skills, working relationships and build mutual trust.

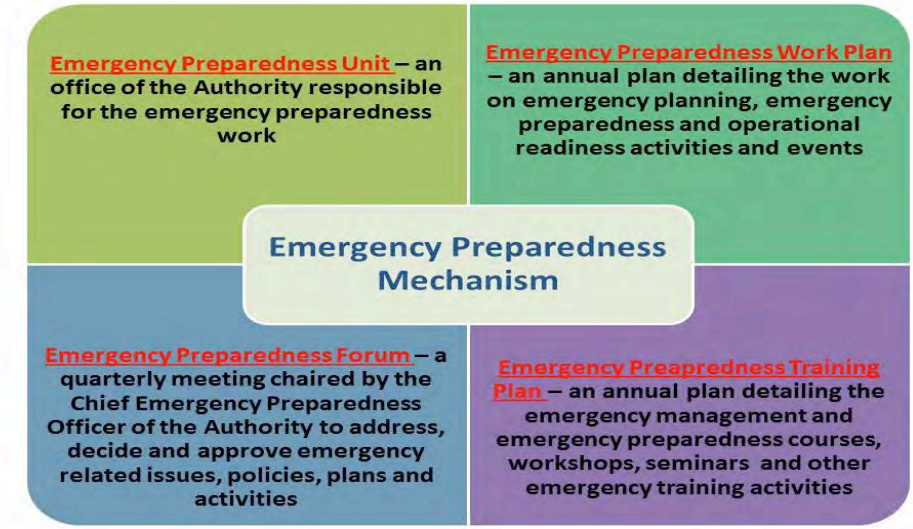
The two evaluation tools are the quantitative assessment tool and the qualitative assessment tool.

- The Quantitative Assessment Tool measures the Readiness Conditions (REDCON) of three readiness factors: manpower, logistics and training. It account for the number of essential personnel, critical equipment and trained staff.

- The Qualitative Assessment Tool measures four Readiness Factors: Organisation and Staffing; Operations; Resources and Training. It comprises of a set of checklists to assess each focus area in each Readiness Factor. The transport agencies can use this tool to self-assess their emergency preparedness and operational readiness.

These evaluation tools are a useful performance indicator that transport agencies can use to ascertain their emergency preparedness and operational readiness.

Emergency Preparedness Mechanism refers to the means for facilitating the build-up, execution and maintenance of emergency preparedness work, knowledge and capabilities. It comprises of the Emergency Preparedness Unit; Emergency Preparedness Forum; Emergency Preparedness Training Plan and Emergency Preparedness Work Plan.



Emergency Preparedness Responsibilities refers to the roles defined for the transport ministry (government), transport regulator and transport service provider in preparing the transport sector for a transport emergency.

Crisis Management Phases

The **Crisis Management Responsibilities** of the transport ministry, transport regulator and transport service provider in managing a transport emergency can be defined as follow:

- The Transport Ministry, representing the Government, is the Lead Agency for all major transport incidents and is responsible to lead a multi-agency committee to coordinate the crisis response and recovery effort. It includes the provision of policy and strategic directions, and coordinating the allocation of strategic resources.

- The Transport Regulator, also a government agency, is the Crisis Manager for all transport incidents and is responsible for impact management. It includes the provision of operational directions, managing the wider consequences of the incident such as preventing an incident from escalating and the allocations of scarce resources.

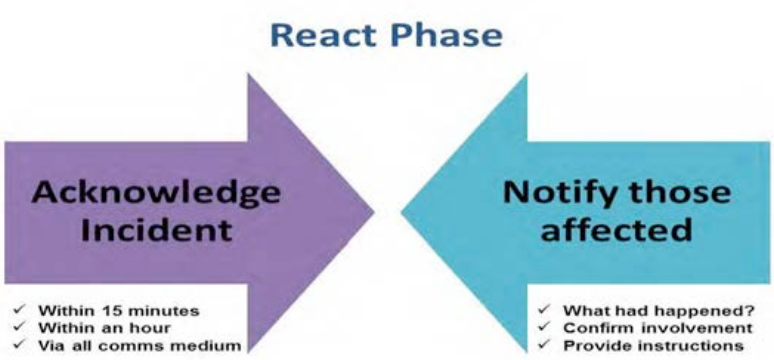
- The Transport Service Provider, is the Incident Manager for all transport incidents and is responsible for the on-site consequence management. It includes the execution of immediate measures to manage the on-scene and off-scene activities that have a direct impact on the incident.

The table below show a list of crisis management activities that the transport ministry, transport regulator and transport service provider will be responsible for, depending on the type of transport emergency and casualty's situation (with or without casualties).

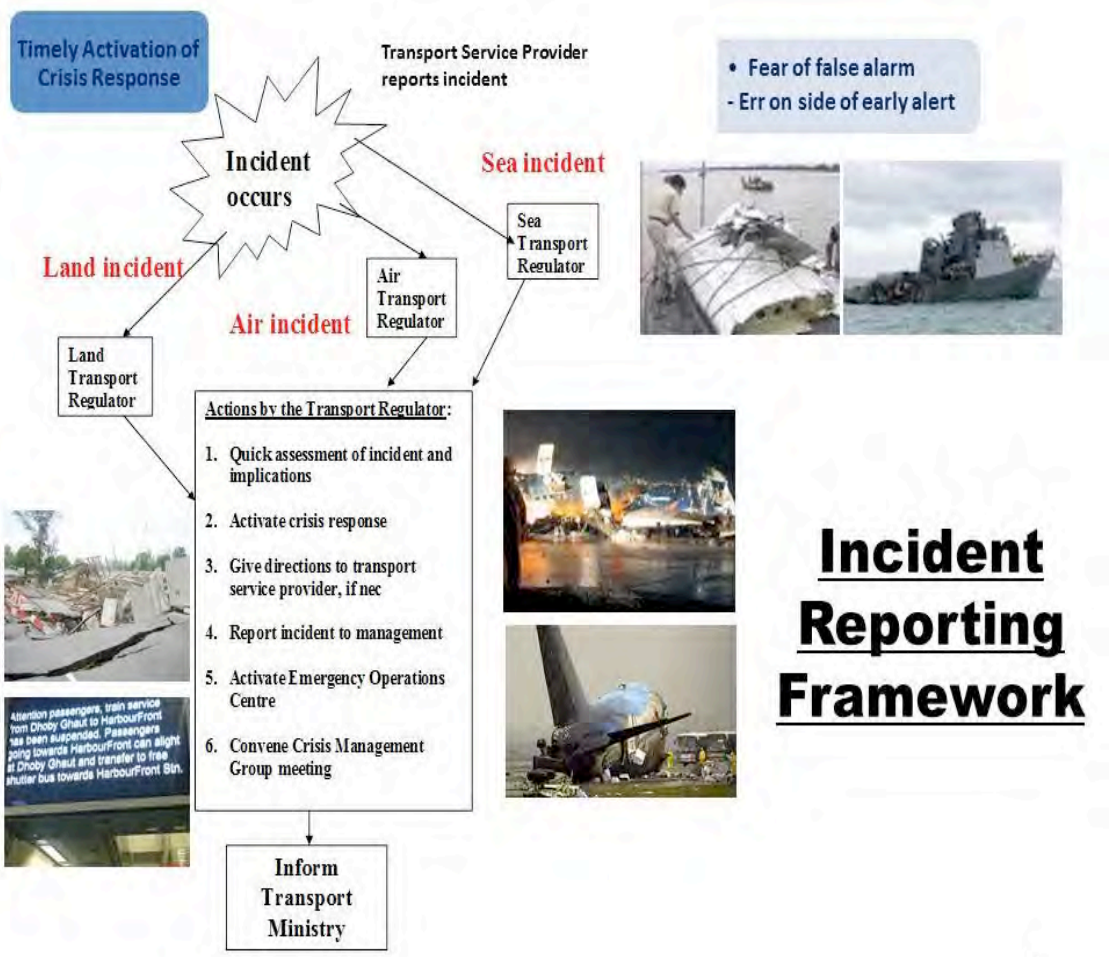
Crisis Management Objectives	Transport Ministry	Transport Regulator	Transport Service Provider
• Save lives • Protect property • Care for victims and their family • Business continuity • Restore normalcy • Restore confidence	• Lead government agency • Accident investigation / inquiry • Crisis communications strategy • International relations • Strategic planning • Resource management	• Crisis Manager • Search and Rescue operations • Next-of-Kins management • CARE (Caring Actions in Response to an Emergency) management • Operational and Contingency planning • Resource coordination • Crisis communications coordination • Casualty information management and coordination • Coordinate the overall mitigation and recovery effort • Wreckage recovery • Debris clearance	• Incident Manager • Victims and family assistance: notification, victims accounting, access to resources and information, personal effects • Execute mitigation plan • Implement business continuity plan • Resume operations • Provide transport service information

React Phase

When an incident occurs, the immediate reaction is to kick start the crisis response and report the incident. At the same time, it is important to acknowledge that an incident has occurred (within 15 minutes) and to notify those affected immediately. Next is to follow up, preferably within an hour, with more details of what had happened.

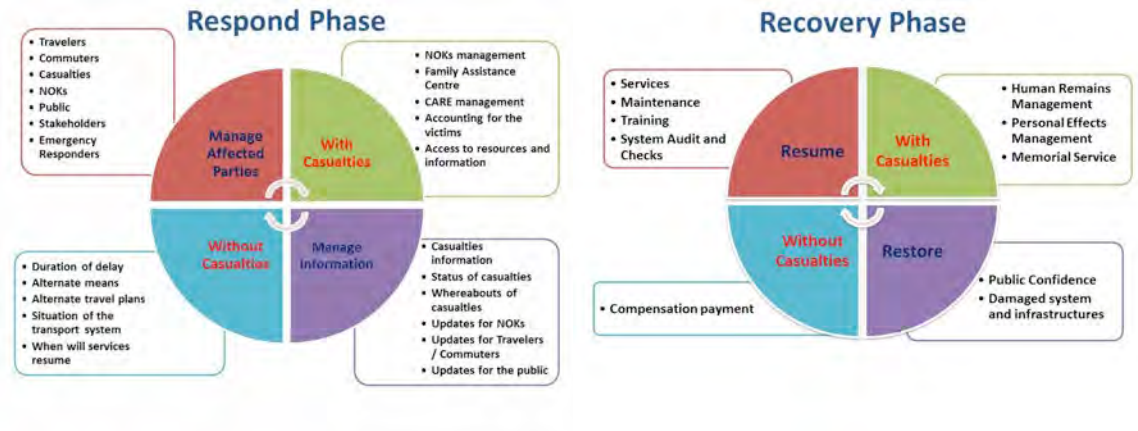


A typical incident reporting framework involving the transport ministry, transport regulator and transport service provider is as shown in the diagram below:



Respond Phase

In the respond phase, while the emergency services are busy with saving lives and properties, the transport agencies should be focused on business continuity, managing information and reassuring the public to restore public confidence. Clear and consistent messages that are timely and accurate on the transport situation should be provided to the public. The public would want to know what to do and what not to do in a transport emergency. The diagram provides details on the parties affected in a transport emergency and the actions and information that are expected by them.



Recovery Phase

In the recovery phase, the transport agencies should be focused on the restoration and resumption of transport operations, removal of debris and emergency repair. Being able to restore normalcy quickly is an important step to regain public confidence and trusts.

In summary, in an emergency, it is necessary to act fast, stay focused and be flexible. Having an emergency preparedness framework in place will help ensure that you are ready!

Responding to Modern Terrorism Threats
Key Issues in Crisis Response

By: Peter R. Morgan, P.D.S.M.

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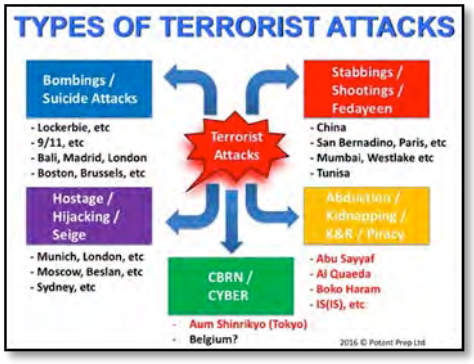
Introduction

The ever evolving face of terrorism makes it very difficult for law enforcement to keep up with the rapidly changing threats posed by terrorist groups: from the hijacking and hostage-taking incidents of the 1970s – 1990s to the multiple and frequent bombings, shootings and Fedayeen style attacks since 2001. As the graphic below shows, numerous tactics have been used by terrorist groups over the years; making it all the more important that authorities are ready and able to respond to an extremely wide range of incident and scenarios.



With the emergence of Islamic State (IS) in the last few years and the increase of so-called "lone-wolf" individuals or groups supporting IS, the threat has increased significantly and it has become harder for law enforcement to anticipate and interdict their activities, particularly as many of the perpetrators are now home-grown radicalized IS sympathizers.

The Global Terrorism Index Report for 2015 prepared by the Institute of Economics and Peace notes that "lone-wolf" terrorist attacks account for 70% of all terrorist-related deaths in the west since 2006. The prevalence of attacks on civilian targets has also made it very difficult for authorities to respond without unduly affecting the rights and freedoms of the general population.

It has therefore become more important than ever for authorities to have an effective and

comprehensive approach to maintaining public safety and security. By adopting the "2-Ps and 2-Rs" (Prevention, Preparation, Response and Recovery), authorities can develop and implement a systematic approach that will help them better prepare and respond to the escalating terrorist threat around the world.

This article will therefore consider how the authorities can better enhance their prevention, preparation, response and recovery measures needed both from a public as well as private sector perspective.

PREVENTION

Legal Frameworks

It is essential that Governments and organizations have the necessary legal instruments in place to effectively prevent and respond to a terrorist incident. Without these, it will be very difficult for law enforcement to proactively intercept and interdict as well as investigate terrorist acts and their perpetrators. Some key questions to consider include:

- *Does law enforcement have the necessary legal powers to undertake their duties?*
- *Are there legal provisions for the mobilization of the military if required?*
- *Are there international declarations related to terrorism that need to be adhered to?*
- *Can the terrorist's financial assets be frozen, investigated and seized?*

Border Controls

One of the key opportunities for preventing and interdicting possible terrorist activities is to have effective screening or monitoring at borders. Without such checking and screening processes, it is very difficult for authorities to flag any potential Person(s)-of-Interest (POI) or to monitor their movements. Whilst it may not be possible to interdict them at this stage if no crimes have yet been committed, it is at least then possible to track their subsequent movements if they are later found to be involved in any criminal or terrorist activities. It also makes it easier to determine whether they may have left the country or not. More effective border controls would also make it more meaningful when intelligence is shared between countries as there is then greater justification for POIs being given a greater level of scrutiny when passing through border checkpoints.

Threat Assessments

Whilst many countries now issue terrorism threat levels, not enough is being done to conduct thorough threat assessments of vulnerable locations, events or persons. It is essential that all areas of vulnerability are carefully assessed to determine if they provide opportunities for terrorist acts that might be prevented with a few security enhancements. Of course, with so many soft targets available, the threat assessments must adopt a careful balance between enhanced security and public convenience.

Target Hardening

Locations or persons identified as particularly vulnerable during the threat assessments should be carefully addressed. A high profile dignitary or business person, for example, may wish to consider arranging for enhanced personal security. High profile, high importance or symbolic targets, such as critical infrastructures, airports, transport facilities, high public traffic areas, etc, need to have enhanced CCTV coverage, security, and interface with response services.

High Visibility

Target hardening can also be achieved through an increased law enforcement or security presence, which can often act as an effective deterrent. However, bear in mind that they themselves may also become the targets of specific or secondary attacks, as was recently seen in Turkey.

Proactive Investigations & Interdiction

One of the most effective prevention tools available is proactive intelligence gathering and investigation by the authorities. This would be more effective if there was greater sharing of information between agencies. More importantly, any actionable intelligence must be promptly followed up: failure to do so may provide the necessary window or impetus for terrorists to proceed with their intended acts, as seems to have been the case in the recent Brussels attacks. This will then leave the authorities open to significant public and media censure if it later transpires that they were in a position to interdict the event and, for whatever reason, chose not to.

PREPAREDNESS

Strategic Intelligence

When it comes to being properly prepared, it's important that law enforcement authorities are closely monitoring the current and emerging trends so that they can take the necessary precautionary steps well in advance. Analysis of trends and terrorist groups, however, must be forward thinking as history has shown that the terrorists are often a few steps ahead of the authorities as they are not constrained by legal issues or political considerations. All too often, terrorist groups and their capabilities have been gravely underestimated with disastrous consequences.

Awareness

When strategic intelligence does suggest there may well be a potential threat, it is essential that law enforcement, as well as the general public, are made properly aware of this threat and what they can do to heighten their sense of alertness throughout the community. Cross-sector briefings can be very effective to ensure that everyone is on the same page and aware of each other's roles, responsibilities and capabilities.

Training, Exercises and Drills

Responding to a terrorist incident or aftermath is a very difficult and complicated matter and it is essential that those required to respond, particularly the decision-makers, fully understand what is required of them and how to maximize the effectiveness of the response. This can only be done through regular and thorough training and exercises which, whilst time consuming and disruptive, ensures that everyone is better prepared to respond to any eventuality that might arise.

Community Engagement

Whilst training and exercises focus primarily on the response by the authorities, it is still important that the public are kept up to date with the threat (if any) so that they can take their own precautionary measures and that they are confident that the authorities are able to respond effectively to an incident and, more importantly, protect the public at large. The public can, and should, from time to time be involved in training exercises and can even assist the authorities to stress-test their plans with evacuation simulations, etc, that also involve the public.

Threat Levels

Currently, many countries are issuing threat levels for the information of the public but as some of these threat levels can remain in force for over a year, their value soon begins to fade as complacency sets in. Without specific intelligence to support a heightened threat level (anything at "Severe" or above), these should be used very sparingly and only for short durations. More effective would be a Readiness Level Alert that would put authorities on a heightened readiness level to ensure a prompt and effecient response whenever the need arises.

RESPONSE

Response Strategy

The first step in having an effective response strategy is to have in place all the necessary prevention and preparatory measures and resources required to respond quickly, efficiently and professionally. Some of these key elements will be discussed in greater detail below.

Operational Priorities

It is important to have a clear understanding and agreement on the key operational priorities throughout the response. First and foremost, of course, should be the saving of life, whether it's during the course of an ongoing hostage incident or the aftermath of a bombing or shooting incident. Secondly, it is also essential that the wider public are also kept safe either from the incident itself or from further incidents that might take place. Thirdly, the authorities should be looking to bring the perpetrators and their accomplices to justice in order to preempt further incidents taking place.

Command & Control

Any response to a terrorist incident requires a well tested and robust command and control mechanism. Terrorist incidents, by their nature, will be extremely complicated incidents to deal with, particularly if there are multiple incidents, significant casualties or massive disruption to routine activities. Without an effective and comprehensive command and control capability, the authorities will not be able to quickly address the many issues that they will need to deal with and manage.

Tactical Intelligence

Tactical intelligence will also be key if tactical teams are deployed. They will want to know as much as possible about the threat posed, the environment in which they are working and the capabilities of the terrorist(s) involved. Whilst most tactical teams train to an extremely high level for these sort of events, they will always want to know as much as possible in order to increase their chances of success.

Tactical Response

A tactical response should always be ready and available but should also be used with extreme caution. As was seen in the recent Lindt Café Siege in Sydney, even extremely well trained tactical operators may not be able to secure the safe release of all the hostages and tactical failures can often lead to much soul searching and subsequent censure if it later transpires that more could have been done to ensure the safety of the hostages involved.

Negotiation Response

Which is why authorities must also continue to maintain a highly trained and capable negotiation response. A negotiated resolution to the incident is always preferable but even if that is not always possible, it helps to buy time for other options and solutions to be put in place.

Media Management

Any terrorist incident is naturally going to attract massive international media interest and one of the tasks of the crisis response is to carefully manage the media to ensure that they do not interfere with the running of the event or put at risk those involved by compromising the response measures. Frequent press briefings and updates will go a long way towards ensuring media cooperation and assistance, particularly as the media may well be able to obtain key information that might be relevant to the authorities during the response or during the later investigations.

Public Management

During a terrorist incident, the public are of course going to be extremely concerned and will want as much information as possible, particularly if they believe that their loved ones might be affected. The media may be able to help with this but it is important that the authorities reassure the public that they are properly dealing with the incident and provide advice on what the public can do to safeguard themselves. The assistance of the public

should also be sought, as was the case following the Boston bombing, as they may be able to provide potentially vital information and intelligence to the responding authorities.

Social Media

Whilst the authorities can often develop a good working relationship with the media, this is not always the case with social media, which has to be carefully monitored so that quick follow-up actions can be taken to address any issues that might arise. In the recent hijacking of Egypt Air MS181, which later turned out not to be a terrorist incident, one of the so-called hostages actually took a selfie with the 'hijacker'.

Transnational Cooperation

One thing that has become very evident following the Paris and Brussels attacks, terrorists and terrorism are not confined by borders and authorities must continue to establish good working relations with their international counterparts in order to respond effectively and decisively. Transnational cooperation is essential if the authorities wish to work together against terrorist groups in order to interdict their activities.

Sustainability

Whilst many authorities do train and prepare for the possibility of a terrorist incident in their jurisdiction, exercises do not always test the full scale and complexity of such incidents and more effort needs to be put in to ensuring a higher level of capability and capacity building for a prolonged and complex incident. The terrorist attacks in Mumbai, for example, demonstrated the difficulty authorities will have in dealing with multiple incidents, in multiple locations, over an extended period, with determined and well armed terrorists.

RECOVERY

Investigations

Of course, once the incident has been dealt with, the authorities still need to pursue with the utmost rigour the investigation of the incident, the group involved and their support network. This is essential in order to bring the criminals involved to justice and also to interdict other groups from carrying our similar atrocities.

Emotional Issues

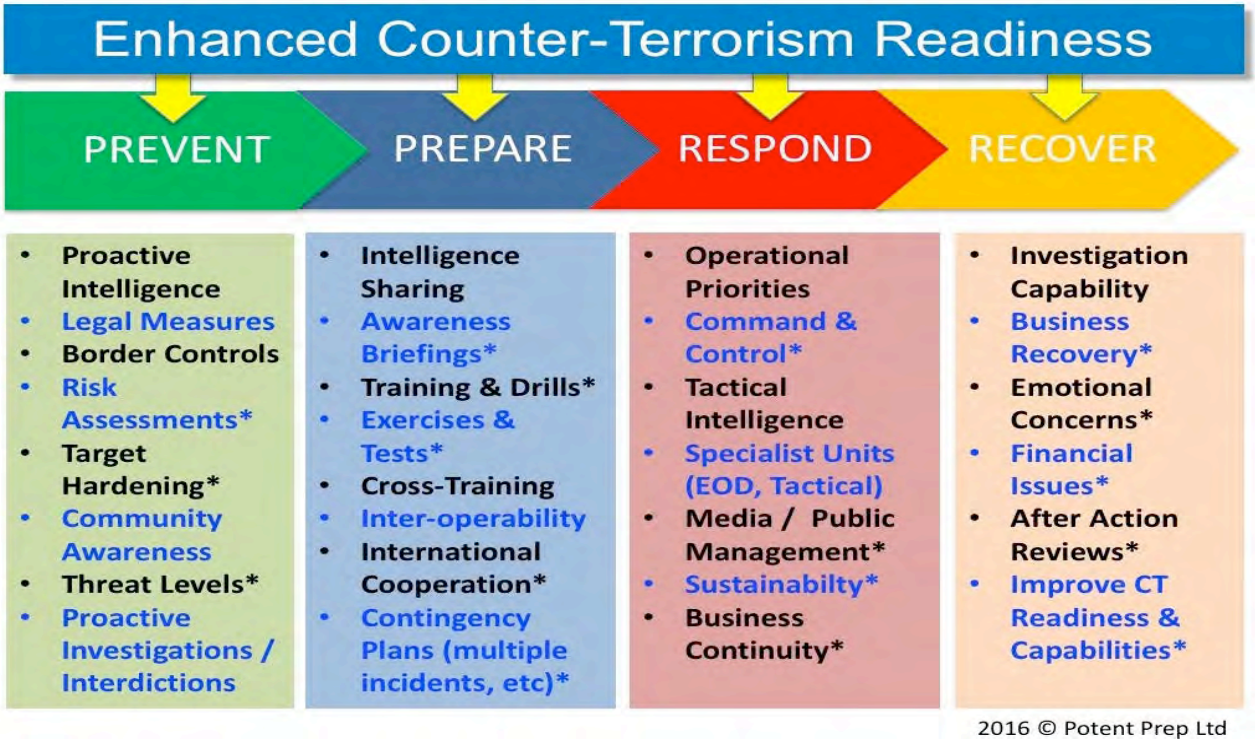
Responders, victims and the public at large are always deeply affected by such events and the need for emotional support should be a critical element in the recovery process to ensure that everyone can start to move forward. This may require the assistance of Medical Health Practitioners to provide necessary counselling and support to all those affected.

Business Continuity

Both the public and private sector will also need to put in place necessary business continuity measures in order to get everything back to normal as soon as possible. Following the Brussels attacks, for example, the primary airport was out of action for a number of months. Fortunately, the authorities had necessary contingency measures in place and were able to use an alternative airport. However, business losses can often be significant and it may be necessary for financial injections to help support those affected by the incident and to help bring about an earlier return to normalcy.

Conclusion

It is clear from the preceding that there are many measures that can be taken to better prevent, prepare, respond and recover from a terrorist incident and it remains incumbent on the authorities to ensure that these are all effectively in place and well tested so that in the tragic event of a terrorist incident taking place, they will be that much more ready to respond.

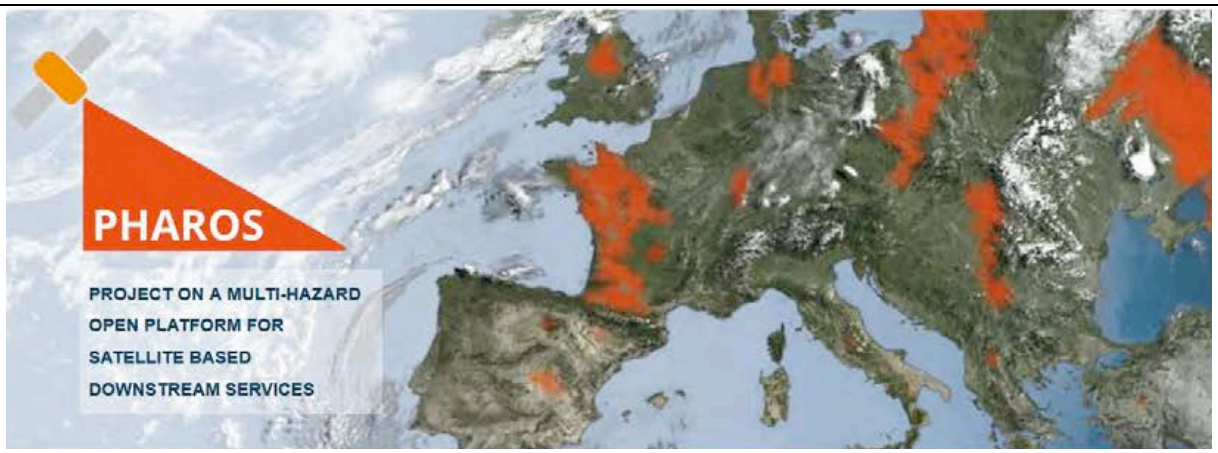


Lastly, how ready are you right now?

(Peter R. Morgan is the Director of Potent Prep Ltd and spent over 33 years in law enforcement. He was closely involved in CT-response as Commander of the Police Crisis Negotiation Unit for 12 years, responsible for counter-terrorist incidents, public order negotiations, serious criminal and domestic crisis incidents as well as suicide intervention and barricaded situations. He is also the author of "Critical Issues in Crisis Negotiations", available on Amazon. This article is adapted from the presentation given at the Asia Emergency Management Conference on 12 May 2016. For more information, please contact Peter at prmorgan@potentprep.com).

Catalonia in Flames: PHAROS – A Multi-Hazard Platform Demonstrates its Power in Crisis Management

By Benjamin Barth, Maria Antonietta Marchitti, Javier Mulero Chaves (German Aerospace Center, DLR)



Abstract

The Earth trembles, rivers burst their banks and tsunamis destroy coastal regions. There is a high concentration and impact of natural and man-made disasters, like floods, forest fires, nuclear accidents and earthquakes [1], [2], [3]. Different types of hazards and disasters may present similar core dynamics, but present nevertheless particularities in each case. Current emergency and disaster management systems have the drawback that they cannot be flexibly adapted since they often focus on single hazards and specific situations. Similarities between the hazards and disasters are generally not considered. During PHAROS (Project on a Multi-Hazard Open Platform for Satellite Based Downstream Services) a system which grants this flexibility has been developed, furthermore exploiting the similarities among the different hazards.

PHAROS supports crisis managers, operations managers and relief workers in every phase of the emergency management cycle, namely, preparedness, mitigation, response and recovery. The system is built as an open service platform and can be flexibly adapted to the circumstances at hand. A modular architecture enables the provision of different services, such as monitoring of the situation and early detection, simulation, situation assessment, decision support and communication with first responders and towards the citizens.

PHAROS was evaluated in a real operational scenario: a prescribed burn in Solsona, Spain, in March 2016 [1]. For optimal support the system was adapted and equipped with tools specific for fire management.

The PHAROS Idea

Just recently, extreme weather conditions substantially damaged infrastructure and caused deaths and injured persons in large parts of Europe [5]. Mostly Germany and France were affected, where heavy rain and storm turned into deadly floods, landslides and even tornados. On the other hand,

the south of Europe is continuously threatened by forest fires and droughts. All in all, the increasing amount of natural and man-made disasters makes it necessary to provide emergency management agencies with advanced tools to minimise the impact of crisis, both in terms of damages and human lives. The current crisis and disaster management tools generally focus on a particular aspect of crisis management, thus, not allowing practitioners to keep an overall view of the situation. In many cases they only support single-hazard management. PHAROS, on the other hand, provides an innovative multi-hazard service platform which integrates space-based observation, satellite communications and navigation assets to provide sustainable pre-operational services for a wide variety of users in multi-application domains (**Error! Reference source not found.**). Potential users are disaster managers and authorities, as well as researchers and private companies. Terrestrial infrastructure, like in-situ sensors and terrestrial communication networks, can also be integrated. The system has a modular structure which proposes a flexible and scalable solution and exploits the synergies existing between different tools. PHAROS can be easily extended with new tools and services to adapt to different hazards and situations.

The project has targeted a pre-operational development level for the provided system, i.e. the services designed and implemented during the project are mature enough from the technical point of view to allow a real operational deployment in a short period of time, in case it is requested.

The project has been developed by partners from six different European countries, joint forces to achieve the project goals: the German Aerospace Center (DLR), Tecnosylva, Avanti Communications, Space Hellas, IQ Wireless, Stichting Platform Mobile Messaging (SPMM), Eutelsat and the Pau Costa Foundation. The project thereby was coordinated by the German Aerospace Center (DLR). The development of the system and the pilot demonstration has been supported by the Catalan Fire Brigades (Bombers de la Generalitat de Catalunya) and the Forest Sciences Centre of Catalonia (CTFC).

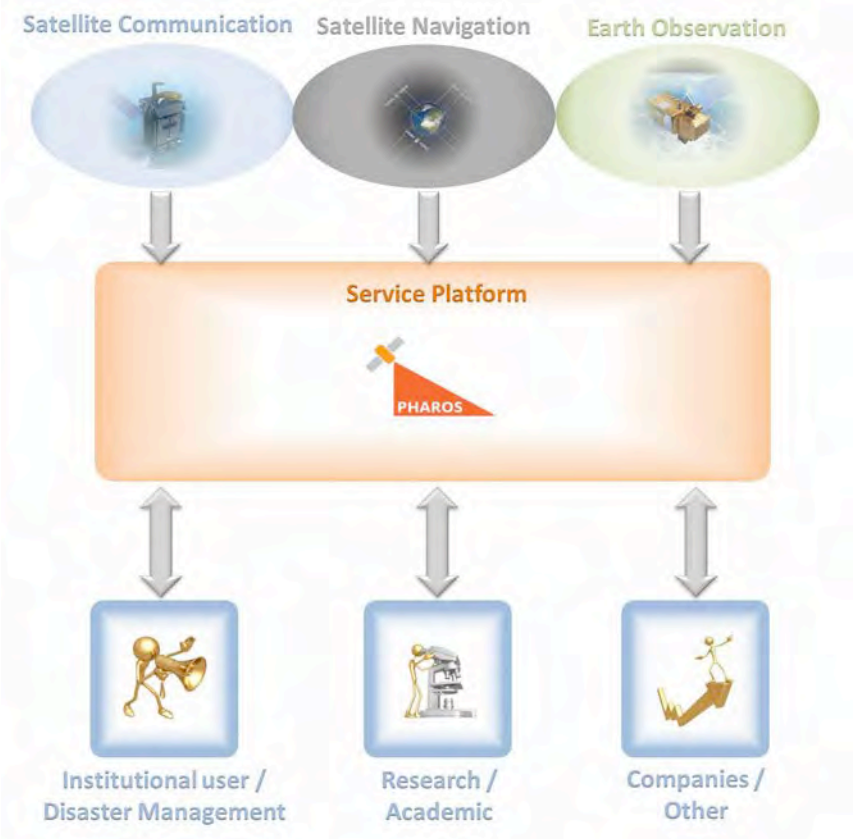


Figure 2-1: Concept of the PHAROS system

During the project lifetime, PHAROS has selected forest fire as exemplary scenario. In this context, the PHAROS Pilot Demonstration was held in the area of Solsona (Catalonia) between the 2nd and the 4th of March. The main objectives of the pilot demonstration are to evaluate the system performance in a real scenario and to gather feedback from the end users. Therefore, end users were provided with the PHAROS system during a real fire case in the context of a prescribed burning. A liaison with the DLR project VABENE++ allowed the acquisition of images of the situation on the field out of a helicopter. This completed the common operational picture, improving the situation awareness and the supporting decision processes.

Support in Every Step of Emergency Management

By keeping a close interaction with the end user community (civil protection agencies and fire brigades in different European countries), the PHAROS project has been able to identify the main requirements from the end user perspective when it comes to the provision of risk and emergency management services. First, the need of providing services which can be used during the whole emergency management cycle (see **Error! Reference source not found.**) has been emphasized. Therefore, PHAROS offers services tackling the following application scenario [6]:

- **Risk assessment** scenarios correspond to services associated with the assessment, via observation and simulation procedures, of a hazard or a risk linked to a specific hazard. This assessment may take place during any phase of the emergency management cycle, either before and/or during an active incident.

- **Risk and disaster detection and monitoring** scenarios correspond to services associated with the detection of a possible risk or hazardous event (e.g. wildfire) and monitoring of its evolution.

- **Emergency/Disaster management** scenarios correspond to services which facilitate and support the proper management of the active event, including decision support.

- **Communication** scenarios correspond to services which facilitate and support the efficient and effective communication among the PHAROS actors, also covering the different phases of the emergency management cycle.

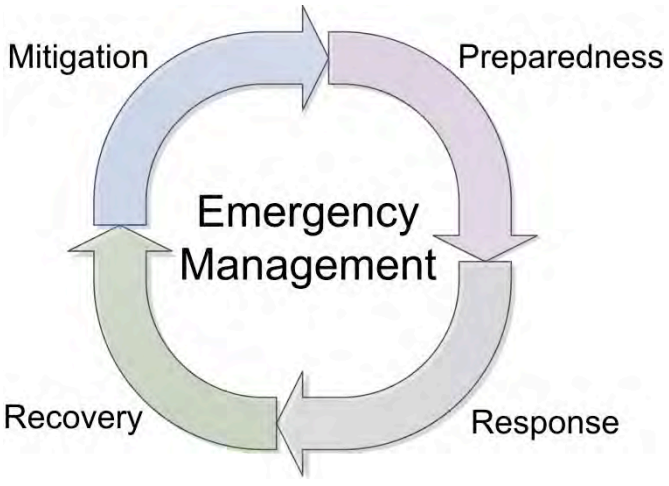


Figure 3-1: Emergency management cycle

The second requirement identified is the support of interoperability with already existing systems as well as the possibility to export information to other systems, since they have been highlighted as aspects which could increase the acceptance of the proposed solutions. PHAROS meets these needs by its modular structure. Already operational tools in use can easily be added to the PHAROS platform and supplement the system, e.g. during the project, Google Earth was incorporated as a tool in use. Furthermore, the modular structure also offers flexibility and scalability to adapt the system to different organisational levels, like for instance local, regional, national and international.

The PHAROS Service Concept

In the following we introduce a classification for the potential users of the PHAROS system and present the PHAROS service concept, identifying the portfolio of products and services provided by the system and their added value. The service concept has been derived from the outcome of the different workshops carried out, firstly among the members of the consortium, and secondly, together with the invited end users.

Two different types of actors have been identified: the (i) users of the system, who will use or consume its services and (ii) the system stakeholders which may be any entity that provides data/services to the PHAROS system with a certain purpose. Besides, according to the aim of use of the system, users have been classified in three different categories:

- Primary users: any responsible authority (i.e. entity which is formally assumed to directly confront a particular situation and/or incident) uses the system for institutional purposes.
- Secondary users: any third-party entity, for instance, research institution**s** or private companies that exploit a service of the system, for instance, to increase awareness about a particular situation and/or incident, not acting on behalf of any responsible authority.
- Recipients: The individuals (i.e. citizens) that are provided with information that is sent/made available through the PHAROS system.

PHAROS offers two different types of products and services: the provision of gathered data products to the users and the provision of advanced products and services based on the processing of data (see **Error! Reference source not found.**). The flexible approach used by PHAROS allows using a wide variety of information sources, which can be added to or removed from the system according to the situation and their availability. The information sources are classified as:

- Earth observation (EO) Data: data provided mostly by satellite earth observation systems or aircrafts, high altitude platforms (HAPs), low altitude platforms (LAPs).
- Sensor data: data provided by different sensor networks deployed in the corresponding areas. Sensors can cover a wide range of data to be provided, such as temperature, humidity, moisture, pressure or smoke.
- Human data: data provided mostly by first responders on the field, which can be considered as a kind of human sensor network. In future, communication received from citizens could be also considered.

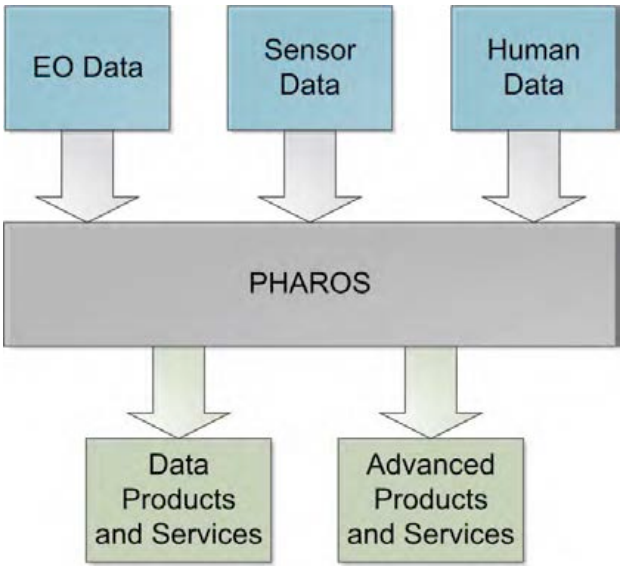


Figure 4-1 PHAROS high level input and output

The products and services provided by the PHAROS system are affected by several factors that influence the way they are used. These factors are (i) the type of hazard, (ii) the emergency management phase and (iii) the operational domain. In the following section the advanced products and services are presented.

Advanced Products and Services

The PHAROS system makes use of data processing and fusion techniques applied to the input data in order to offer advanced services and products (**Error! Reference source not found.**). Advanced services are mainly conceived for primary users in order to provide them with tools to be used during the whole emergency management cycle. Nevertheless, several products which are the outcome of using the advanced services can also be made available to secondary users. Almost all services are intended to be used or triggered in real time. Additionally, historical data and the outcome of the different services are also available in the system in order to allow the analysis of the different emergency management strategies and identify room for improvement and lessons learned.

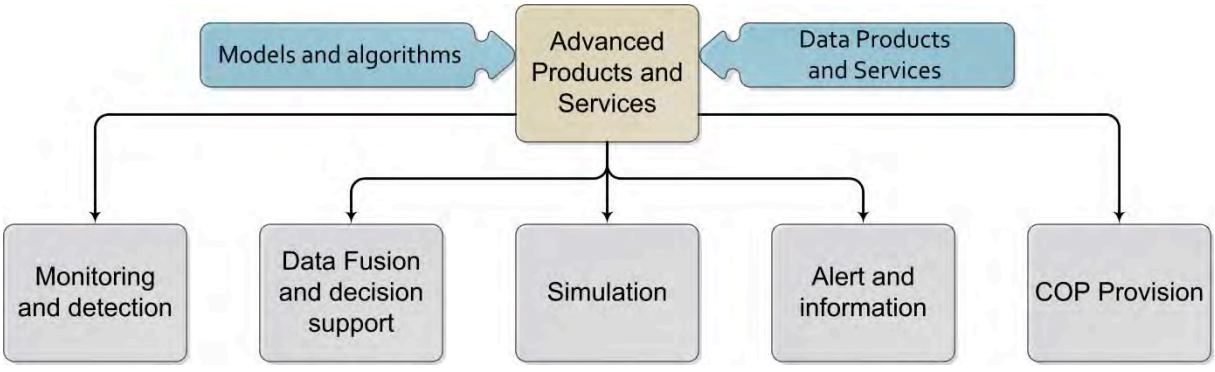


Figure 4-2 PHAROS advanced products and services

Another important aspect to be remarked is the fact that advanced services are intended to interact with each other, meaning that the outcome of a service, if available, can be used as input by another service. This increases the added value of the complete service chain by integrating the different services. In the following section we present the different advanced services which are offered by the PHAROS system:

- Monitoring and Detection Services

  Taking into account that the PHAROS system is able to gather data from the different available data sources it allows the possibility to set up conditions or sets of conditions that trigger an internal alarm or other actions. In the general case, the services can be used for emergency detection, triggering the response phase. Once a relevant event has been detected, a critical functionality provided is the efficient monitoring of the active event and its evolution.

- Data Fusion and Decision Support Services

  These services gather all data relevant to a particular situation and assist the user during the decision processes. To do this, the system fuses and analyses the relevant data and present the user with several response options that are suitable for the case under consideration.

- Simulation Services

  Simulation services offer the possibility to analyse different scenarios in order to accomplish two different objectives: (1) assess the risk related to critical infrastructures for a particular area and hazard; (2) obtain a forecast of the hazard evolution and risk for a particular area.

- Alert and Information

  Alerting and informing the population before, during and after a crisis is another of the important assets provided by the PHAROS system. In this context, the system allows primary users to create, compose and dispatch messages to the population and to first responders on the field using different communication channels and targeting different receiver devices. Regarding the reception of messages, citizens are able to receive the PHAROS messages using standard commercial devices, such as smartphones.

- Common Operational Picture

  The PHAROS common operational picture (COP) is a dataset of information, gathered and processed to be shared among the users, providing a common overview of the whole situation and improving the situation awareness in a consistent way.

System Architecture

Error! Reference source not found. shows the architecture and the different components of the PHAROS system deployed for the pilot demonstration. A so called service platform is the core module of PHAROS. It orchestrates the other modules and provides the necessary interfaces between them. For this, it makes use of a work-flow engine and different databases. A dedicated gateway is used to offer services to secondary users. As data sources, earth observation (satellite and air-borne), in situ sensor (namely, the FireWatch system) and information from first

responders is used. The data processors, decision support, simulation and modelling and alerting blocks provide the previous mentioned services. A detailed technical description can be found at [1] and in the deliverables available at [7].

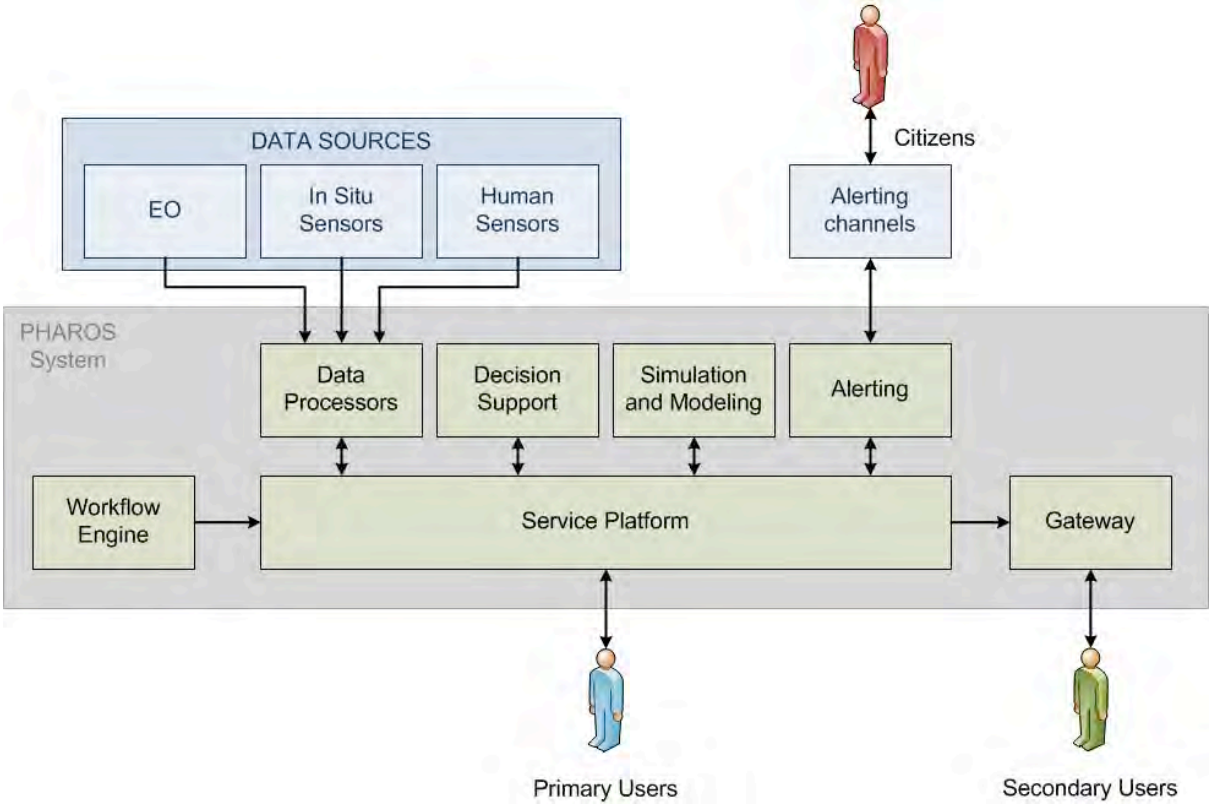


Figure 5-1: PHAROS system architecture

The Pilot Demonstration

The demonstration of the PHAROS system has been prepared and carried out with the main objective of illustrating the concept and evaluating the performance and viability of the integrated set of tools, services and products developed during the project. The second objective of the pilot demonstration has been to test, validate and gather feedback from key stakeholder groups, i.e., end users of the PHAROS platform on the pre-operational system, as well as members of the advisory board who followed the project throughout its course.

For these purposes, the pilot demonstration has been based on forest fire which has been chosen for several reasons: (i) it allows a typology of incident that can be easily reproduced, (ii) it is one of the most relevant hazard types at European level (especially in the southern region) both in terms of amount of events and associated impact, (iii) a forest fire might be large enough to be visible by different sources (e.g. aerial monitoring), and (iv) it is complex enough to require assistance in decision-making.

For the generation of the forest fire scenario, the Catalan Fire Brigades (Bombers de la Generalitat de Catalunya) performed a prescribed burning in the area of Solsona (Spain) from March 2nd to March 4th, 2016. Prescribed burns are controlled fires which are used in forest management to reduce the amount of fuels, i.e. the risk of uncontrollable forest fires is decreased. The fire fighters performed prescribed burnings during three days each with duration in between four to five hours.

Thereby, the open fire line was around 80-100 meters (**Error! Reference source not found.**). Twelve to twenty fire fighters formed the team that carried out the burn.

Figure 6-1: Image of the fire during the pilot demonstration Marcos López Martínez (c) Fraunhofer IOSB, 2016

Since the pilot demonstration was focused on a forest fire scenario, the stakeholders were mainly representatives of the Fire and Rescue Services (FRS), actively participating in forest fire management but with different profiles within their organisations. In order to have an extensive and satisfying evaluation a variety of the end users profiles was invited. This diversity allowed integrating a wide range of expertise in the fire emergency sector into consideration, further enhanced by the two different perspectives from which it could be received, i.e., end users working on the field during an emergency as well as end users working from a control room during an emergency. Around 110 participants with different expertise took part in the demonstration.

The Forest Science Centre of Catalonia (CTFC) supported the Consortium during the pilot demonstration. The CTFC's headquarter is located in Solsona and was used to set up a control room for the consortium. Different stations were set up in this control room guided by supporters familiar with the system. Forest fire specific exercises were performed with the end users for the evaluation of the system. Feedback was gathered during these exercises as can be seen in **Error! Reference source not found.**. The end users were also able to have a hands-on experience and try out the system autonomously. In particular, the control room was organized in different stations, each offering support for a different module of the system:

- General coordination and logistics area;
- Decision support and Cartography area;
- Simulation and technical supporters area;
- FireWatch control station;

- Citizens alert support area;
- Helicopter support area and data display;
- VABENE++ (acquisition of aerial images) support area.

Figure 6-2: Workstations in the control room

The services provided by the PHAROS system also helped the fire fighters to perform the prescribed burn. A picture taken during a briefing carried out before the burning can be seen in **Error! Reference source not found.**. The map in this picture was provided by PHAROS and was very useful for the planning of the burn which, among others, depended strongly on the weather conditions. Gladly, the weather conditions were good enough to allow catching fire at each of the three days of the demonstration. The fire was controlled during the sessions in which the Consortium had also the possibility to take photos and measurements of the temperatures.

Figure 6-3: Briefing of the prescribed burn

In cooperation with VABENE++ a helicopter (**Error! Reference source not found.**) flew over the area of the prescribed burn. It was equipped with thermal sensors and a 4K camera system. The images provided by the system helped to get a picture of the situation on the field and supported the response planning and monitoring.

Figure 6-4: Aerial images acquired through the VABENE++ system

The gathered feedback during the demo was very positive. End users valued the interoperability of the system as a very strong aspect. Especially, the possibility to adapt to different organisational and regional levels was emphasised as a valuable feature. Furthermore, the easy integration of

different information sources and system already in use was very welcomed. This makes PHAROS flexible and robust for future requirements and needs.

The maturity of the system was highlighted by the end users and they were impressed by the different features offered in one system. PHAROS was assessed to be very useful in every step of the disaster management cycle. This makes PHAROS an innovative system compared to the emergency management systems currently used in the emergency sector.

The possibility to communicate with the first responders on the field as well as to send warning and alert messages to the affected citizens was a special highlight. During the project an App for smartphones was developed. This App receives alerts dispatched by the PHAROS system and includes special features for first responders, e.g. the ability to exchange position and ignition information. The App was acknowledged as user-friendly and its potential in emergency management was valued promising.

Additional Material on PHAROS Website

In the following chapters different services of the system are explained in more detail. In case more information is required please check the project website [7] where the documentation and a video describing the system can be found.

Acknowledgment

The research leading to these results has received funding from the European Community's Seventh Framework Programme ([FP7/2007-2013]) under grant agreement n° [606982].

References

[1] J. Leaning and D. Guha-Sapir, "Natural Disasters, Armed Conflict, and Public Health", New England Journal of Medicine, 2013, available at: http://www.nejm.org/doi/full/10.1056/NEJMra1109877?query=featured_home&, [Last accessed on June 2016].

[2] Worldwatch Institute, "Natural Disasters Becoming More Frequent", available at: http://www.worldwatch.org/node/5825 , [Last accessed on June 2016].

[3] NASA Earth Observatory, "The Impact of Climate Change on Natural Disasters", available at: http://earthobservatory.nasa.gov/Features/RisingCost/rising_cost5.php , [Last accessed on June 2016].

[4] B. Barth et. al., "An Open Service Platform for Multi-Hazard in Action – the PHAROS Pilot Demonstration", Lecture Notes in Informatics (LNI), INFORMATIK 2016, 2016 (submitted and accepted for publication).

[5] Wikipedia article, "2016 European floods", available at: https://en.wikipedia.org/wiki/2016_European_floods , [Last accessed on June 2016].

[6] J. Mulero Chaves et. al., "PHAROS Deliverable 2.1: PHAROS Service Concept Specification", 2014.

[7] PHAROS project homepage, available at: http://www.pharos-fp7.eu/index.php/public-deliverables , [Last accessed on June 2016].

Advanced Incident and Risk Assessment: the PHAROS Simulation and Decision Support Services

By Miguel Mendes (Tecnosylva) and Ulrich Rappe (German Aerospace Center, DLR)

Introduction

The new Crisis Management System PHAROS brings together earth observation data, measurements from sensors in the field, simulation tools and communication technologies in a single platform (see also the other articles in this special issue). This platform is modular and based on a flexible software architecture so that it can be easily expanded to provide additional services. Currently the system is tailored to wildfire management, but it can also be configured for early warning, risk analysis, environmental monitoring, and managing other types of disasters. Besides situation assessment and risk analysis, PHAROS can also be used to alert the public via various communication channels.

Beyond the collection of sensor data and other information relevant for managing a wildfire incident, PHAROS offers advanced services to the disaster manager and wildfire expert to assess the situation, its projection and to provide support in taking the right decisions. This article describes two of these advanced components: the PHAROS risk modelling and simulation service (SM) and the Decision Support Services (DSS).

Advanced PHAROS Services

The PHAROS approach allows a disaster management system to be populated with the required data sources, such as earth observation data and data provided by in-situ sensors and to process and make these data available using different tools and assets, such as simulators, data processing algorithms and alerting services. Primary users, mainly the different authorities making use of the system, access the available features through the devised Graphical User Interface (GUI), while all modules are connected to a central Service Platform (SP) which provides central services and orchestration capabilities (see **Error! Reference source not found.**).

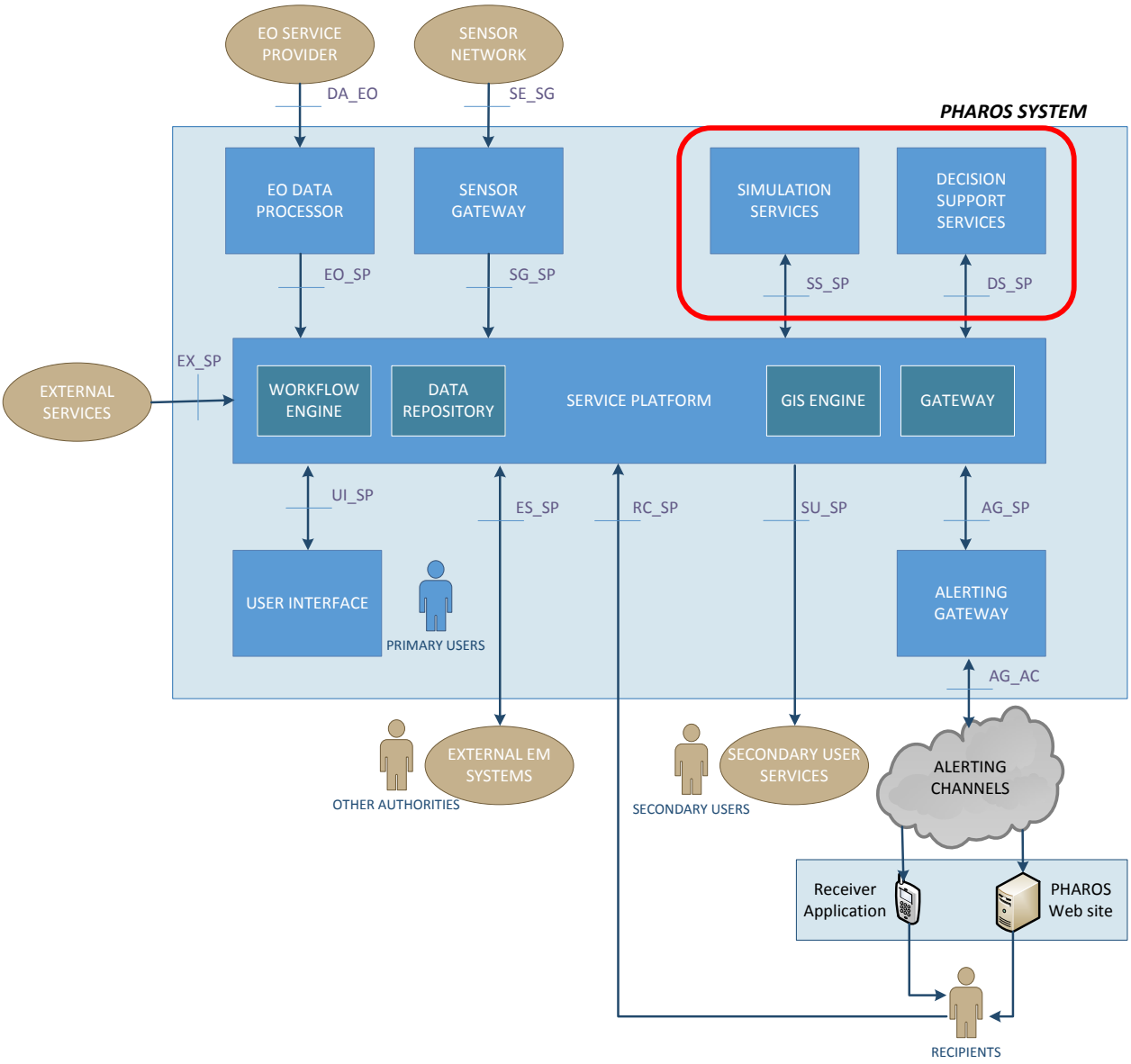


Figure 1: The PHAROS architecture [1]

The PHAROS Simulation Module (SM) is a wildfire simulator based on the widely known Wildfire Analyst™ simulator [9]. The SM is used to estimate promptly (1-2 minutes) the behaviour and progression of the fire in time on the terrain when a fire is detected as well as to carry out daily risk assessments related to wildfire. For this it takes into account all the necessary variables to calculate the progression and risk of fire, such as ignition points and secondary spots, terrain elevation, fuel models, fuel moisture, hydrographic networks, roads/paths, weather conditions, etc.

Hence, the PHAROS SM provides results for different phases of the emergency management cycle, namely for the preparedness and mitigation phases as well as for the response phase.

For the response phase the PHAROS SM includes two simulation modes, a fire spread mode that shows the estimated progression of the fire in time and an evacuation time mode that calculates

the time that a fire would take to arrive to certain point(s) defined by the user, such as critical assets, villages, etc.

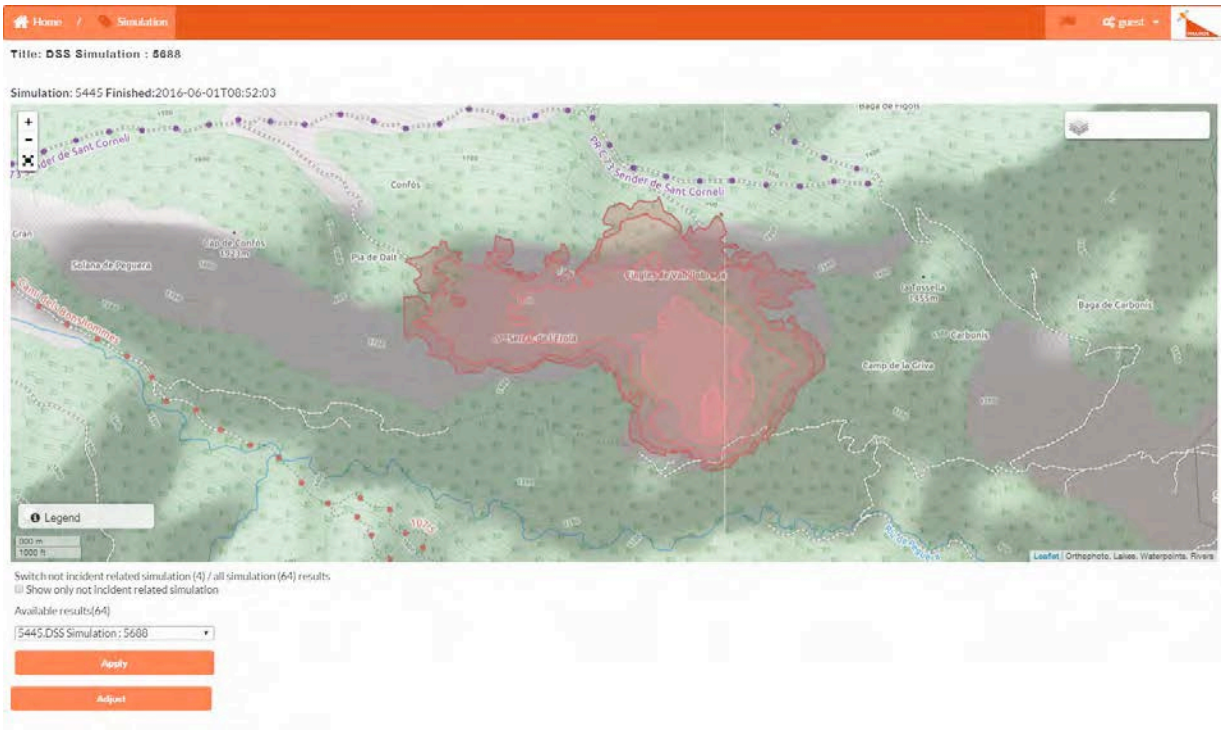


Figure 2: Fire spread simulation, the isochrones represent the time of arrival of the fire in hours

The fire spread simulations can be manually triggered by the user by setting the necessary parameters through the graphical user interface or automatically as part of the incident workflow (see next section).

With the aim of providing the most realistic results, the PHAROS SM includes an adjustment mode which allows adjusting fire spread simulations according to real observations of the fire on the field. By adding time control points to a simulation result the user can adjust the way the fire propagation model behaves in the existing fuels and it will launch a new simulation and show the updated result.

In addition, the SM provides daily wildfire risk assessment for planning and mitigation purposes, not only for first responders but also for other stakeholders such as electric supply and insurance companies. It provides a daily map of the wildfire structural hazard which represents the easiness that a fire has to spread in a given area according to the weather and fuel conditions (see **Error! Reference source not found.**). It also provides daily risk assessments related to power supply networks, it assesses the potential impact over a power line of a possible fire starting in the area near to this infrastructure and also the opposite situation, the potential growth of a fire starting at any component of the power line to the surrounding area (see **Error! Reference source not found.**).

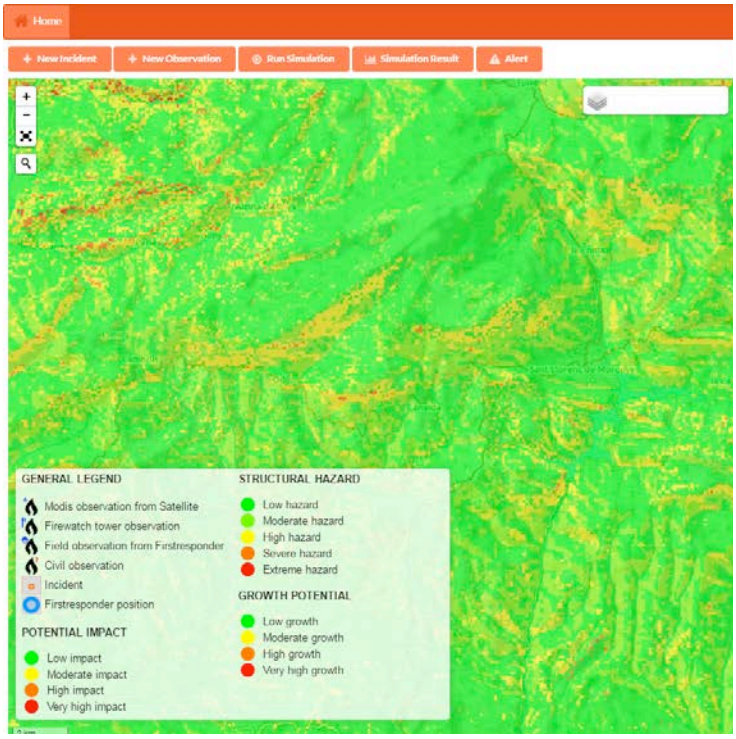


Figure 3: Structural hazard map

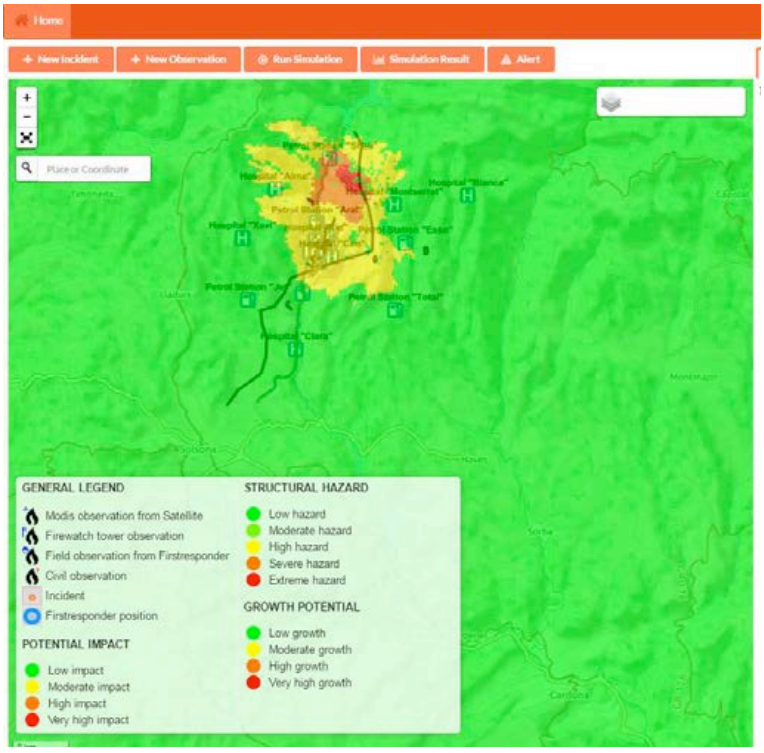


Figure 4: Wildfire growth potential of a power line

The PHAROS DSS consists of a set of services that helps the user to manage wildfire incidents (even in the case of multiple wildfires), to assess the situation, to trigger the simulation when the

situation has been updated (e.g. new sensor information is available), and to provide decision proposals to the user. The DSS services are further explained along a typical incident lifecycle in the next section.

Added Value for the complete Incident Lifecycle

PHAROS manages individual wildfires as so-called *incidents*. As soon as a (potential) wildfire is detected, a dedicated incident is created in which all information belonging to this wildfire – no matter if sensor measurement, field observation, earth observation based products, alerts sent, etc. – are grouped together.

PHAROS can manage any number of incidents at the same time (see **Error! Reference source not found.**). Incidents can be created automatically by the system (e.g. when a sensor measurement is received indicating a wildfire at a specific location) or manually by the user (e.g. in case of wildfire information received via phone call).

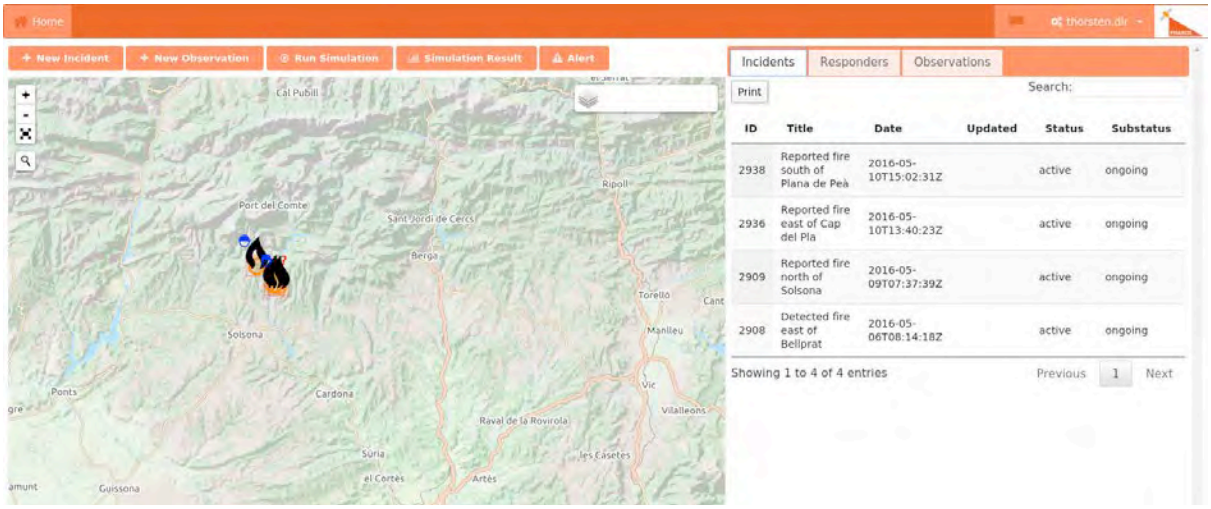


Figure 5: PHAROS GUI with map display and the list of currently active incidents

The management of incidents is provided by the incident management service of the PHAROS DSS, ranging over the complete incident lifecycle from incident creation, (de)-assignment of observations or other information to incidents, until the closure of incidents once the wildfire threat is over.

The following paragraphs describe a typical incident workflow, from the first information about a wildfire until the wildfire is extinguished.

Step 1: First information about a wildfire arrives

The PHAROS system can currently receive wildfire information either from the FireWatch sensor system, from the earth observation based hotspot service, or from other external, not integrated sources, resulting in a manual creation of a wildfire observation.

The PHAROS DSS then checks if the new observation belongs to an existing incident. In this case the new observation will be assigned to the respective existing incident by the DSS, e.g. if the observation describes a fire perimeter update, and a situation update for that incident will be

triggered. If the new observation does not belong to an existing incident, the DSS will create a new incident, associate the new observation to the new incident and will initiate a first situational assessment by triggering the Simulation Module.

Step 2: SM provides forecast

The PHAROS Simulation Module provides a wildfire spread forecast using the given observations and the current weather status and forecast, which can be shown on the PHAROS GUI (see **Error! Reference source not found.**).

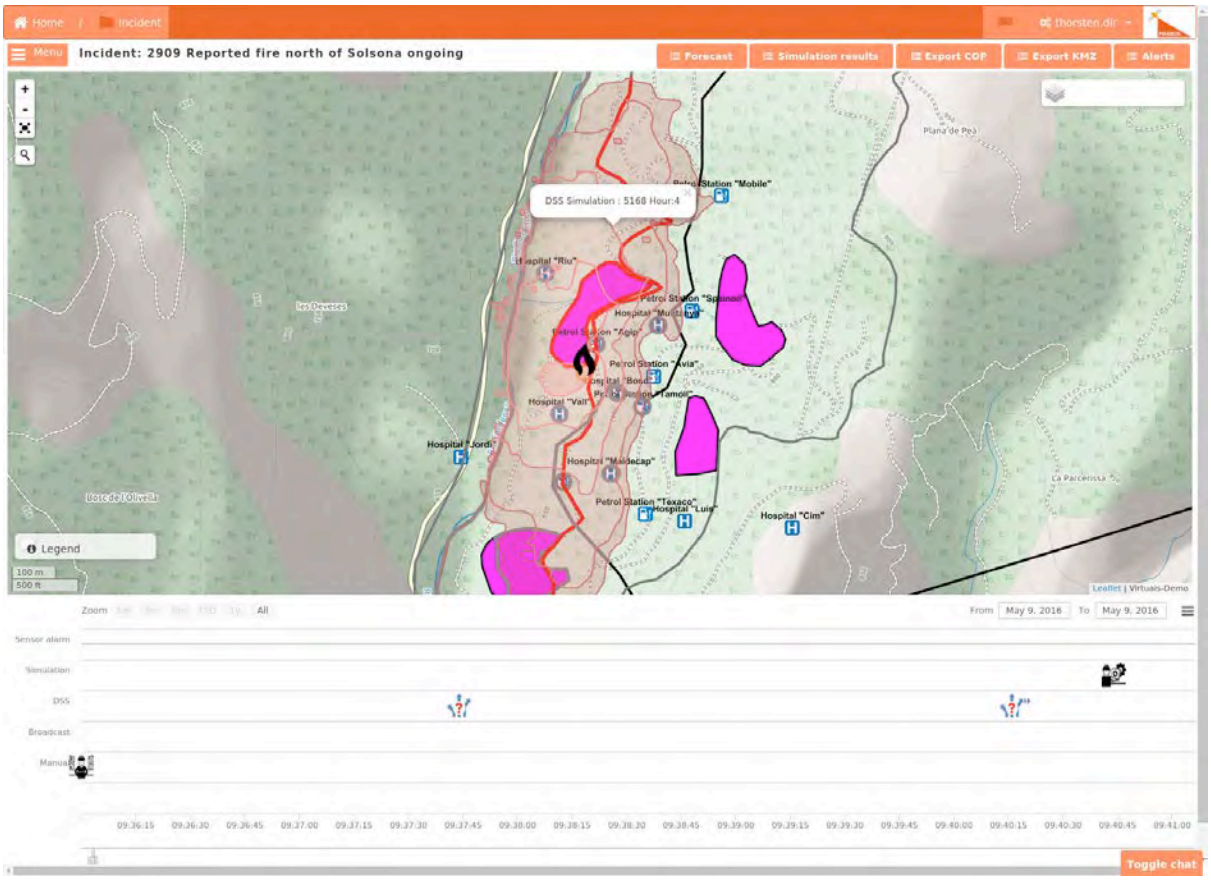


Figure 6: Simulated fire perimeter forecasts in the test region. The map shows also objects of importance for wildfire disaster management

Step 3: DSS provides situational analysis

Using all existing sensor and simulation information, the DSS then assesses the situation for the incident, taking into account important objects in the affected area. Among the objects known to the DSS are settlement areas, schools, hospitals, gas stations, streets and powerlines (additional object types can be configured, too).

For these objects the DSS generates a risk assessment which also includes a calculation of the estimated time of arrival of the wildfire. For the different object types and objects, specific warning, evacuation, or other requirements are known to the DSS. As an example, information can be provided at what time routes are expected to be blocked by the fire, making them unavailable

for normal street traffic, but also as evacuation route or inbound/outbound route for firefighting resources (see **Error! Reference source not found.**).

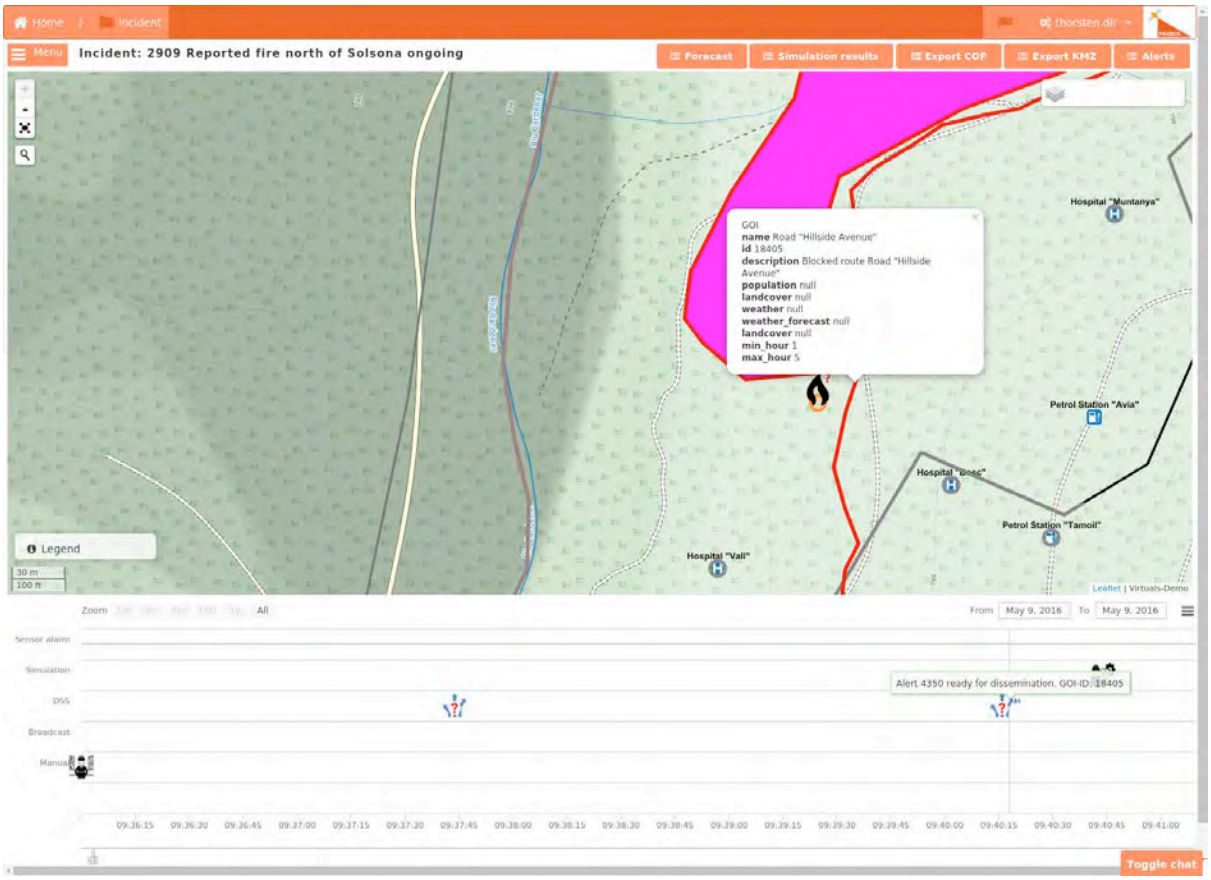


Figure 7: Individual attributes of an object inside the affected area, calculated as part of the situation assessment

Step 4: DSS provides decision support

Based on the situation analysis done in step 3 (see above), the DSS can determine if the conditions are met to inform the user about critical conditions or for specific actions to be taken. Based on the rules, thresholds and workflows configured in the DSS to this end, the DSS can generate *proposals* that are presented to the user via the PHAROS GUI (see **Error! Reference source not found.** for an example of an alerting proposal). Individual warning requirements are considered here (e.g. a hospital usually requires a longer evacuation time compared to standard buildings).

Such proposals can include e.g.:

- A notification to the user about a critical situation pattern detected
- A proposal to send an alert to the public, e.g. to evacuate an area

In case of an alerting proposal, the DSS in addition generates a draft alert message already pre-filled with relevant incident information.

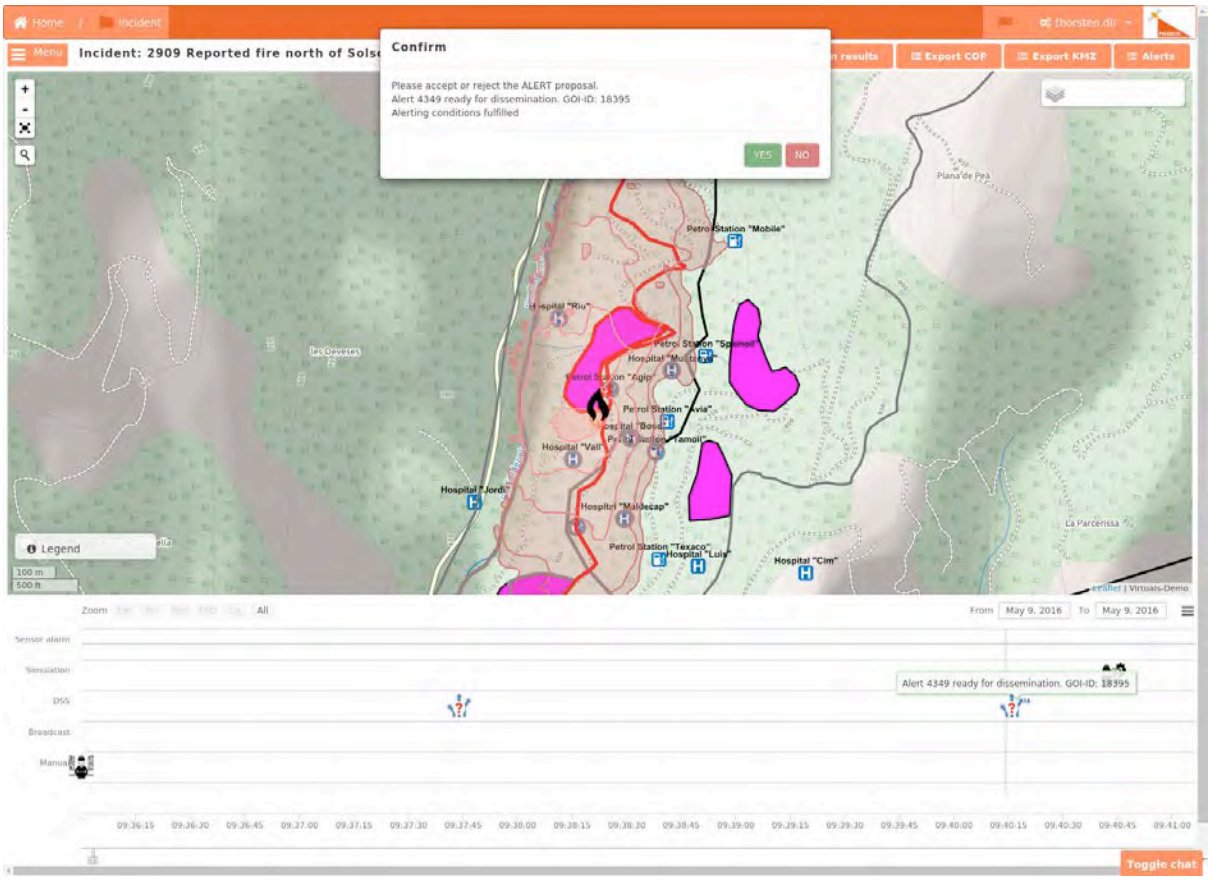


Figure 8: The DSS has generated an alerting proposal which is shown to the user on the PHAROS GUI

The user can then decide whether to accept or decline the proposal. In case that an alerting proposal is accepted, the user can edit the proposed alert message as required before dissemination.

The loop is continued when new information is received or existing information updated (step 1ff), or the user adds information triggering a new situation assessment (step 2ff). When the situation is under control and the fire is extinguished, the status of the incident is set accordingly. If the conditions for closing the incident are met, the DSS will propose to the user to close the incident.

Many more options and workflows exist in PHAROS. Nearly the complete behaviour, situational analysis and support provided by the PHAROS DSS is configurable and depends on domain knowledge, best practices and Standard Operating Procedures (SOP) provided by the user.

The PHAROS system, and with it the simulation and decision support services, has been successfully tested under real conditions (prescribed burnings) during a three-day wildfire exercise (see **Error! Reference source not found.**).

Figure 9: The PHAROS system used by firefighters and wildfire experts during the pilot demonstration in March 2016 in Solsona, Spain

Conclusion

As user feedback has shown, the integration of simulation and decision support capabilities into a wildfire management system provides important benefits to the user. One of the major benefits is the availability of rapid and advanced analysis of the effects of the hazard on the terrain which in turn will allow first responders saving precious time in taking decisions. This will permit an enhanced and quicker response allowing them to be better prepared in case of a crisis situation. In addition, the configurability of the analysis carried out by the DSS allows adapting the different analysis carried out and the proposals according to the specific needs of the first responders.

Furthermore the creation of daily advanced and novel risk assessment maps of critical infrastructures as well as the general risk of an area provides the risk planning and mitigation staff with the necessary tools to identify risks related to the hazards and take the appropriate measures to reduce or abolish their possible hazardous effects.

Acknowledgment

The research leading to these results has received funding from the European Community's Seventh Framework Programme ([FP7/2007-2013]) under grant agreement n° [606982].

References

[8] J. Mulero Chaves et al. "PHAROS Deliverable D2.9: PHAROS System Architecture - Final", December 2014.

[9] J. Ramírez et al. Wildfire Analyst: practical approach to operational wildfire simulation. 5th Wildfire Conference, Sun City, South Africa, 2011.

Effective Communication: The PHAROS Multi-Channel Approach

By Benjamin Barth (German Aerospace Center, DLR), Thomas Ladoire (Avanti Communications, AVA), Wim van Setten (Stichting Platform Mobile Messaging, SPMM)

Abstract

Modern communication means are an indispensable component in today's emergency and disaster management. They are the basis to enable coordinated actions and to develop complex strategies for response. Communication is essential for the interaction with first responders in order to save lives and avoid damage at infrastructure. Among the positive features provided by modern communications, alerting and warning the population is a very critical one. PHAROS combines all features of modern communication systems and provides it in a single platform. Means for informing, warning or alerting the population are offered in a standardized manner making the generated messages fast to create and easy to understand by the population at risk. Automatic translations in multiple languages increase the understandability in cross-border scenarios or help protecting foreigners and tourists. PHAROS uses a multi-channel approach which significantly increases the efficiency of alert messages and exploits complementarities [10].

The Essential Role of Communication in Emergency Management

No matter which hazard arises, communication means are essential in any phase of emergency management. The exchange of information is one of the main pillars to effectively detect and fight hazards. Furthermore, communication tools provide support during the relief and aftermath phase. In actual disasters, but also in training situations, communication systems are indispensable to update operation managers and enable them to plan and coordinate the next steps. They are necessary to make all participants aware of the situation and strategy, regardless of their location.

During disasters and emergencies, communication among different authorities is a key factor, but also first responders in the field are grateful for any available information on the situation. It essentially helps to protect their lives and the lives of others. PHAROS includes modern communication tools which allow both remote access and dispatching means for information exchange. The gathered and processed data offered by the PHAROS services can be provided where it is required.

Furthermore, communication allows the interconnection of different system elements which may be installed in different physical locations. For instance, sensor networks can use the available communication networks to send the corresponding data to a remote management system, increasing their availability.

Another very important feature for authorities provided by communication systems is to reach citizens in case of emergency and inform, warn or alert them in order to avoid victims and minimize the risk for the public. Additionally, dedicated actions might be recommended to the public, e.g. requests to close the windows in case of toxic clouds or orders for evacuation. Thereby, dissemination of alert messages to the population over all available communication means can increase the effectiveness of the alert message [10]. This multi-channel usage becomes in particular interesting in case of disasters, when communication networks are prone to collapse,

suffer damage or are not available. Among different channels, satellite are a suitable mean to allow communication during the early phase after a disaster event due to their robustness against disasters, as well as their resilience [12], [13], [14], [15]. PHAROS follows this multi-channel approach for public alerting, having in mind that, since natural and man-made disasters do not stop at nation borders, a multi-language solution is necessary.

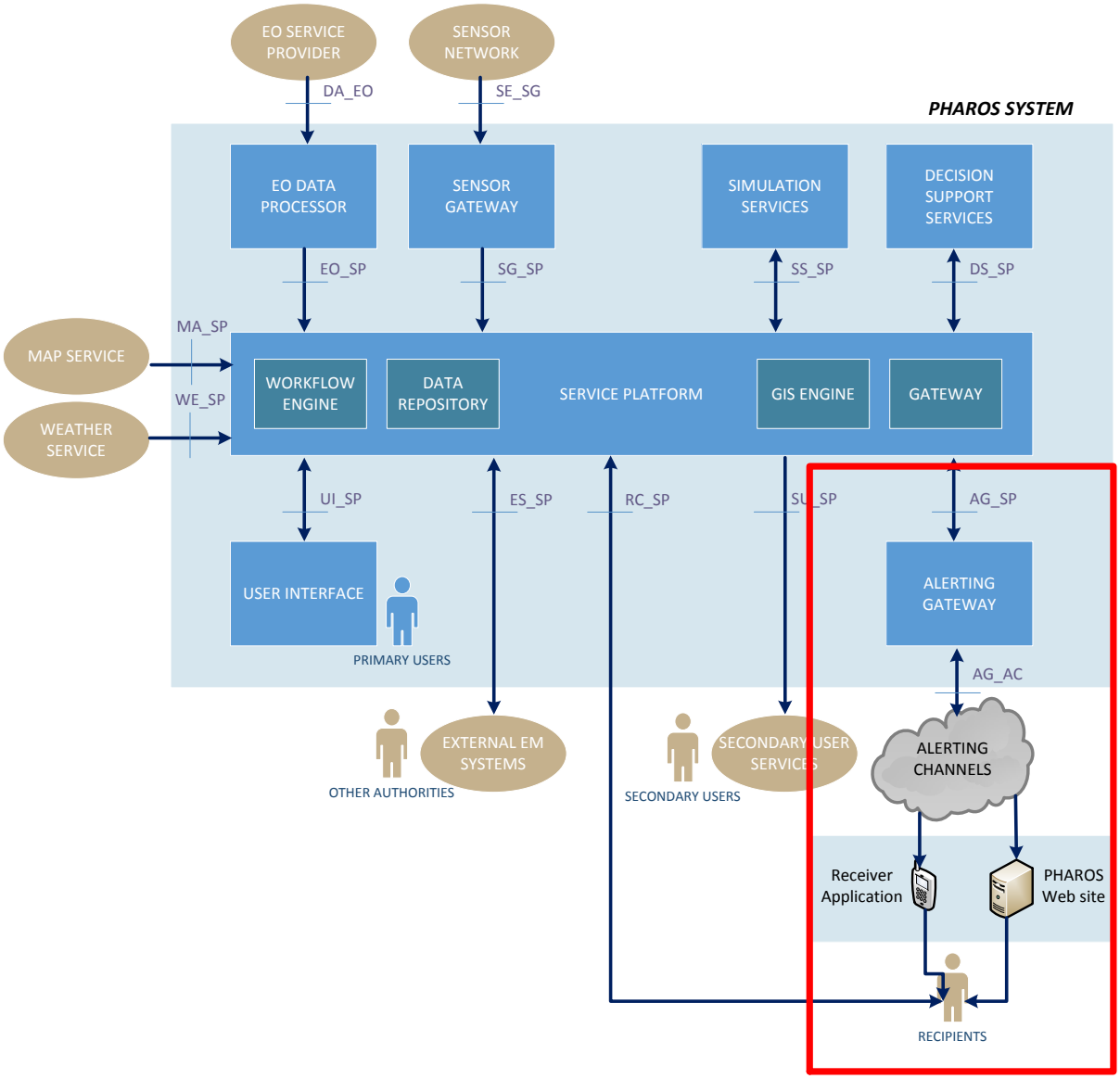


Figure 2-1: The PHAROS system architecture

Minimize the Risk. Use the PHAROS Alerting Tool

Alerting and informing the population before, during and after a crisis is one of the important assets provided by the PHAROS system. In this context, the system allows primary users to create, compose and dispatch messages to the population and to first responders on the field using different communication channels and targeting different receiver devices.

In **Error! Reference source not found.** the complete architecture of the PHAROS system is presented. The part used for communication with the first responders and the public is marked in

red. Thereby, the alerting module is fully integrated in the PHAROS system. In this way a single system can be used for detection, situation assessment, monitoring and alerting. Users do not have to switch among different tools and can control every action with a single user interface. For supporting public alerting and warning but also for enabling the communication with the first responders an alerting gateway (AG) is included in the PHAROS system. The alerting gateway creates in interaction with the PHAROS user interface alert, warning and information messages and distributes them over dedicated channels.

In order to trigger an alert the PHAROS system provides two options: (i) the user manually composes an alert message and (ii) the decision support system triggers a proposal for alert. In the first case, a wizard guides the user through the alert creation process. Different pre-selectable values are recommended and an alert message is automatically constructed. The pre-selectable values were a requirement by the end users since they ease, fasten and standardize the message creation. However, inserting free text is always possible so that the content of the message exactly declares what the user intends. **Error! Reference source not found.** shows the wizard of the PHAROS user interface. It is divided in topological tabs, each of them showing dedicated options. In the lower part of the wizard the draft of the automatically constructed message is presented and updated.

If the decision support system triggers an alert message, an already precompiled alert message is proposed. The user needs to check the message; if he likes it, he can modify it and confirm its dispatch. With this feature the system offers a complete automated chain from detection of the incident to the alert message generation and with this combines and exploits effectively synergies of the different services. This is a great benefit which can only be provided by an integrated platform. Pre-defined alerting plans can be stored in the system to be automatically applied according to the situation.

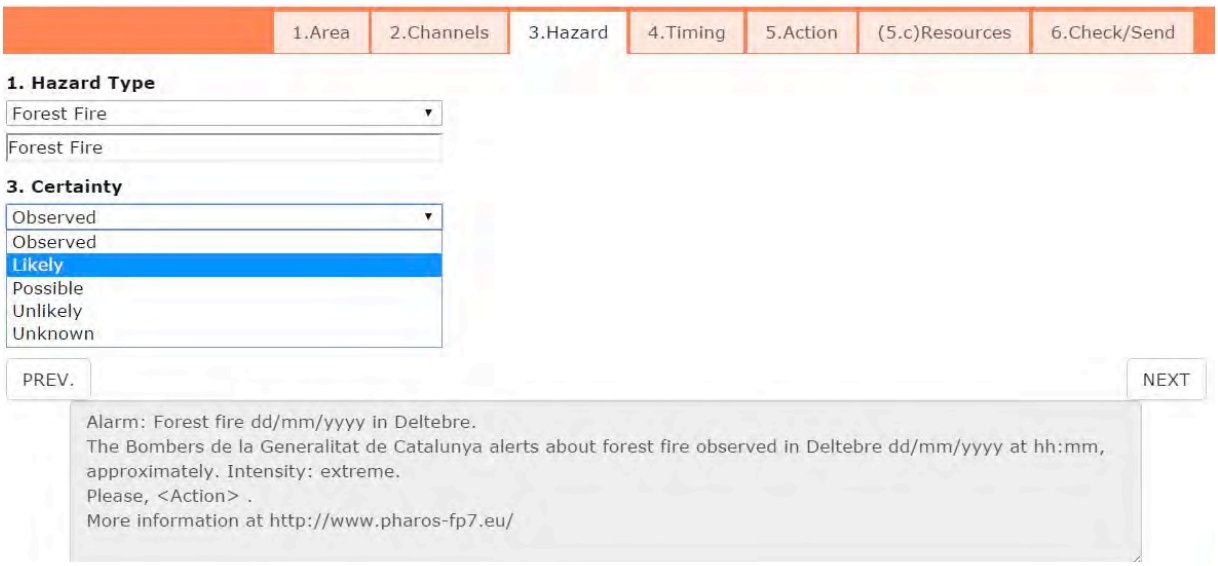


Figure 3-1: PHAROS alert creation wizard

The use of pre-selectable values has an additional benefit that is exploited by the system: standardized messages are created. These are automatically translatable since they follow dedicated rules. In contrast to commercial translator software it is guaranteed that the content is

exactly what it should be, leaving no room for misapprehension. This makes the system especially attractive for the use at nation borders; however, the feature also helps foreigners and tourists.

An important feature is the possibility to add attachments to messages. A picture is worth a thousand words and consequently maps and images of the current situation tremendously support first responders on the field. It should be mentioned that the definition of the affected area is a mandatory part of the alert message, by default.

Benefits of the Multi-Channel Approach

The consumer behaviour of media strongly changed over the last decades. While in times of radio and television a single device per household was usual, the arising of the internet and the consistently falling prices for modern media devices resulted in a change in society. There is no longer a single source of information gathering all people in a household; instead people use different media on different or multiple devices. Consequently, in order to maximize the efficiency of alert messages, i.e. the number of people reached, they must be disseminated over as many communication channels as possible. Some people may only watch TV; while others may not lose sight of their smartphone but do not even own a TV.

The more people are reached by the message the higher is the trust in the message itself. People usually discuss events like received alert messages and if other people confirm that they also received the alert or warning, it appears more important and is taken more serious.

Another benefit of the multi-channel approach is its robustness. In a disaster situation, wide parts of the infrastructure might be damaged and cannot longer be used for communication, alerting and warning. By using multiple channels there is a chance that not all channels are affected. If for instance big parts of the cell phone network are destroyed it does not necessarily indicate that others are also not available anymore. A very reliable link for disaster communication is provided by satellite systems. Satellites are not affected by disasters happening on Earth and still can provide coverage. In PHAROS we put the focus on global navigation satellite systems (GNSS) for the provision of this link. GNSS (like GPS, GALILEO) are commonly integrated in basically every smartphone and therefore are optimal to reach a lot of people.

In case multiple channels are available the multi-channel approach has another advantage: complementarities among the channels can be exploited, i.e. different attributes typical for some channels can be combined. Sirens for instance have a “wake up” effect: if they are started they attract a lot of attention, but their information content is very low. Unless there are different sirens for different hazard types, the only message of a siren is: alert. Other channels able to carry a lot of information like Newspaper, radio stations or TV lack this effect. A combination of channels can provide both, the “wake up” and the ability to provide information. In this case it is important that the message comes from a single source to keep it consistent.

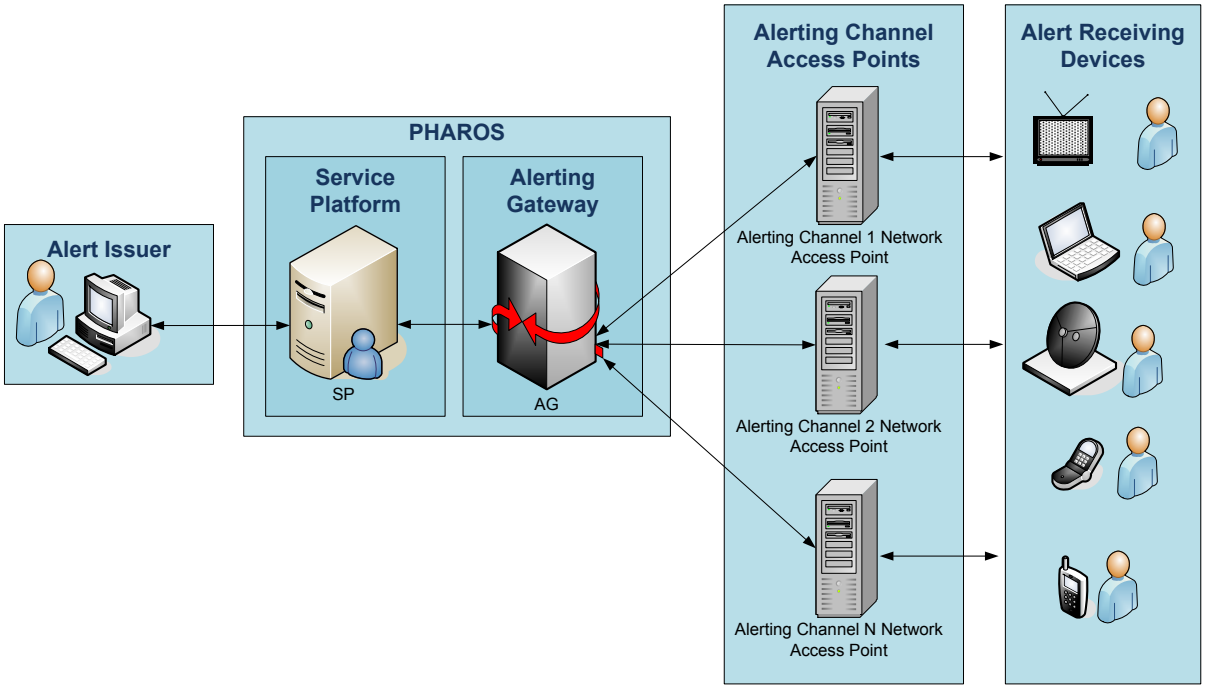


Figure 4-1: PHAROS multi-channel approach

All these are very good reasons for using multi-channels for alerting. In PHAROS we implemented this multi-channel approach in a flexible way supporting a wide range of communication channels which can be added or removed from the system. The basic network architecture can be seen in **Error! Reference source not found.**. In a predecessor project called Alert4All [16] some channels have been already investigated and the corresponding tools and interfaces have been developed: HbbTV, DVB-S/S2, DVB-T2, DVB-SH, interconnection to indoor fire detection systems (thanks to cooperation with Euralarm [17]) and interconnection to the German MoWaS system [18]. During PHAROS, cell broadcast, RSS-feeds and GNSS have been considered. Thereby, the system is compliant with the common alerting protocol (CAP) which is the de facto standard for alerting over different systems. However, the system is flexible and can be adapted for other protocols which are for instance necessary for GNSS connections where channel capacities do not allow messages with the size of CAP format. The A4A-protocol designed during the Alert4All project exactly matches the needs for the narrowband GNSS channel and was the perfect candidate to be used. In the following we give some detailed information on the alerting channels used during PHAROS.

To warn citizens, even when telecom channels are congested: Cell-Broadcast

Cell Broadcast (CB) messaging is a mobile technology feature defined by the ETSI's GSM committee and is part of the GSM standard [19]. It is also known as Short Message Service - Cell Broadcast (SMS-CB). Cell Broadcast is designed for simultaneous delivery of messages to multiple users in a specified area. Whereas the Short Message Service - Point to Point (SMS-PP) is a one-to-one service, Cell Broadcast is a one-to-many geographically focused messaging service. Cell Broadcast messaging is also supported by UMTS and LTE. CB messages are broadcast to defined geographical areas known as Cell Broadcast areas. These areas may comprise of one or more cells, or may even comprise the entire Public Land Mobile Network (PLMN) of an

Operator. Cell Broadcast is a technology that allows a text or binary message to be defined and distributed to, all mobile terminals (mobile telephones) connected to a set of cells. This means that one Cell Broadcast message can reach a huge number of mobile terminals at once, to warn Citizen, in case it really matters.

With Cell Broadcast it is possible to send a text message alert to: A large number of citizens - Including visitors from other countries - In near real time - With location specific information - In their desired language. It solves the problem of mass alarm delivery to all network describers, or to subscribers in a certain area and will reach citizen first as a media channel.

The major issue of Cell Broadcast is the impracticality for an Authority EU-Alert / CMAS developer and service provider – to allow working (incl. Training and Education) on this service, independently of a network operator. This is a critical limitation, which also explains the slow learning curve, using this technology. (Source: Cell Broadcast Forum). To additionally address this issue within the PHAROS project, a dedicated Cell Broadcast messaging service has been developed and used during the various PHAROS trials, based on Open BTS a Software Define Radio (SDR) and interfaced via the XML CAP standard.

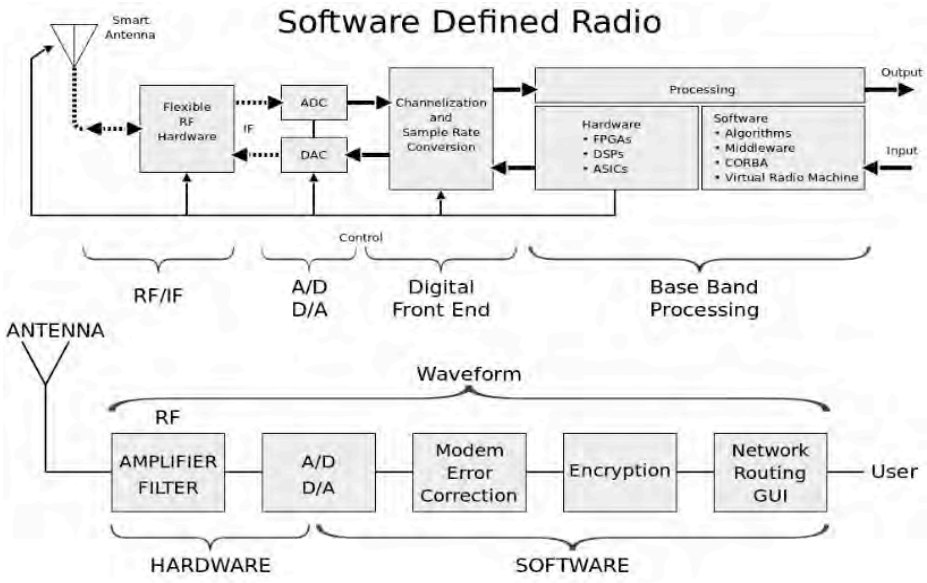


Figure 4-2: Typical block diagram of a Software Defined Radio (SDR)

To enhance the Cell Broadcast messaging setup even more the use of new satellite IP connections provided by Eutelsat has been studied.

Cell Broadcast Training and Education network for EU-Alerts.

As a tangible spin-off of the Pharos Cell Broadcast alert work being done, partners of the project are offering the PHAROS Cell Broadcast messaging services to qualified Authorities, in order to use the total Cell Broadcast setup as a **training, education and knowledge sharing network**, without disrupting citizen in any way.

This way it is possible to easily test various functions of the ETSI EMTEL defined EU-Alert (CMAS compliant) standards or experiment and learn addressing the real need to be presented to citizens affected in crises situations by possible alerts in a way that they can be readily understood and required actions can be taken, including people with specific requirements and elderly people with multiple impairments [20], experiment with Alerting libraries [21]. The method makes it also possible to experiment and use already the new MAMES protocol (MULTIPLE ALERT MESSAGE ENCAPSULATION OVER SATELLITE [22], [23], based on the work being done in the Alert4all project, specifically by DLR, as a possible general purpose narrowband communication protocol.

Available Everywhere, Anytime: GNSS

As already mentioned, GNSS is a good opportunity to still reach people at risk in case the terrestrial infrastructure has been destroyed, is overloaded or never existed. Embedded in navigation devices this channel also provides a "wake up" effect. During the project we put special focus on satellite-based augmentation systems (SBAS) [24] and Galileo as European solutions.

It turned out that Galileo's development has yet not reach a state were tools for alerting could be investigated and developed. However, there is still the opportunity to include alerting as standardized messages.

The European SBAS solution EGNOS has been tested in real set up using in space signals. Avanti Communications, partner of the PHAROS project, tested the sending of alert messages via their ARTEMIS satellite (**Error! Reference source not found.**) in collaboration with the project SBAS Africa. Alert messages using the A4A protocol have been sent via the SBAS payload of ARTEMIS and received successfully by a receiver in Cyprus which demonstrates that alert messages can be sent via a narrowband GNSS channels.

Figure 4-3: ARTEMIS satellite

RSS-feed for Web Applications

RSS-feeds are web based standards used to frequently update and publish information [25]. They can be basically embedded in any web-based service. In PHAROS, we used it to show the alerts in a web-site (**Error! Reference source not found.**). In a real setup, citizens could subscribe to the RSS-feed to receive information or go to the web-site to inform them actively.

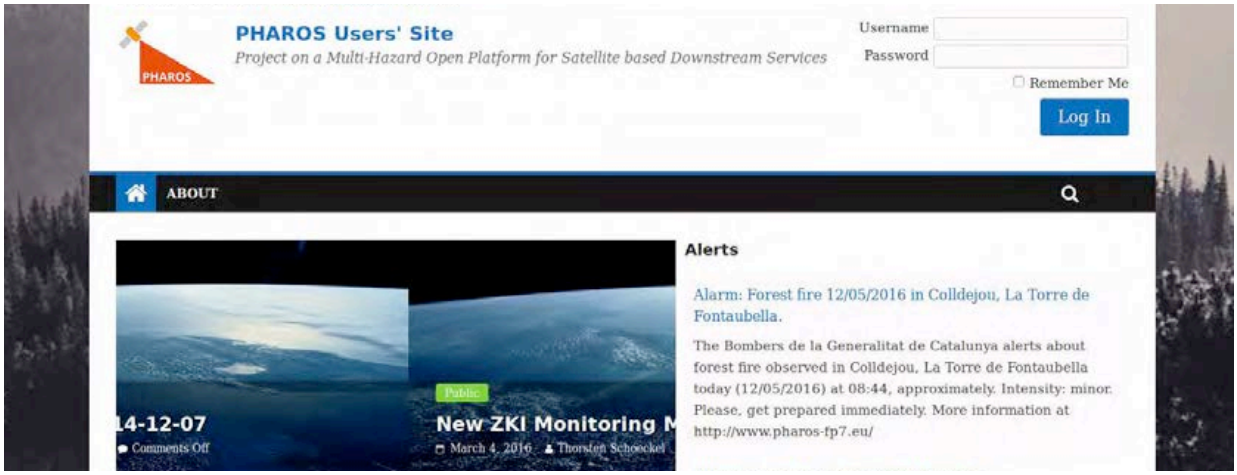


Figure 4-4: Pattern of the PHAROS website showing an alert message

Mobile Receiver Application

In Europe, smartphones are one of the most commonly used devices nowadays, making it obvious to design a receiver application for them in order to increase message penetration. There have been two PHAROS mobile applications designed and developed within the project framework: (i) the PHAROS mobile application for citizens that enables them to receive alert messages and (ii) the PHAROS mobile application for first responders that also enables them to receive alert messages but also adds further features.

Both applications can be used on any device (smartphones or tablets) running an up-to-date version of Android. These devices must have an Internet connection (GPRS/4G) available in order to receive the messages and allow communication to and from first responders. In the case of the mobile application for first responders, a GPS antenna is required in order to send the location of the device to the central platform.

When an alert message is sent to the population, the mobile application will receive the message either via cell broadcast or GNSS. The application will emit a beep, display the alert message and read the text using a text-to-speech engine (unless the user unselected this feature). The user can also pre-select the language in which the application should display/read the message. The PHAROS system makes use of pre-defined libraries installed at the receiver device which enable the mobile application to decode the received alert messages, compose and translate the messages automatically.

The message provides a short headline to quickly identify the hazard, a complete description including time and location, and a protective action to advise the citizens of how to protect themselves against the hazard.

Error! Reference source not found. shows the mobile application and the fact that it can display the list of previously received messages.

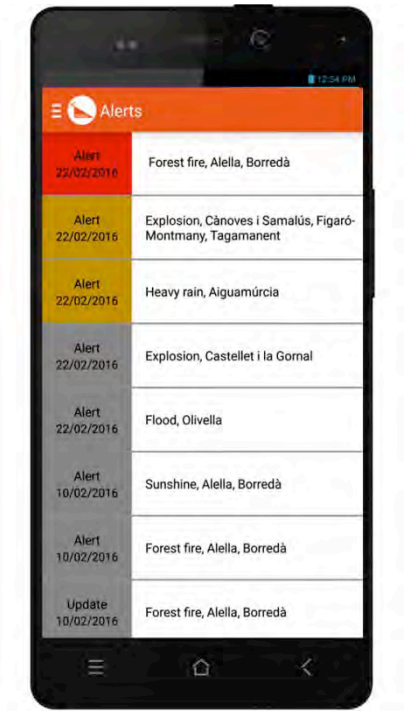


Figure 4-5: PHAROS mobile application

The mobile application for first responders offers additional features:

- Sending of the device location to the PHAROS platform
- Sending of pictures to the PHAROS platform that can ben visualised from the web portal
- A chat feature that enables first responders and authorities to communicate

Next Generation Alerting

In the future, additional channels will be made accessible to the system optimizing the multi-channel approach. Furthermore, channels investigated within PHAROS will be further enhanced and incorporated as much as possible to industrial standards. First steps are initiated to provide alert messages with EGNOS. EGNOS compliant commercial receivers then will enable alert message reception with navigation devices of cars and smartphones all over Europe.

In a long term PHAROS vision, social networks shall be taken into consideration. Further services dealing with the integration of data provided by the authorities with data provided by the citizens, for instance, by using the 112 services can be also considered.

References

[10] J. Mulero Chaves and C. Párraga Niebla, "Effectiveness Evaluation Model for Public Alert Systems", in *Disaster Advances*, 7 (8), Page 1-11. E-Journal Indore, Aug. 2014.

[11] T. de Cola and C. Párraga Niebla, "Design Aspects for Efficient Distribution of Alert Messages over GNSS", in *Proceedings of the IEEE Global Communications Conference 2013 (GLOBECOM 2013)*, Atlanta, USA, Dec. 2013.

[12] WISECOM, Wireless Infrastructure over Satellite for Emergency Communications, available at: http://www.wisecom-fp6.eu. [Last accessed on June 2016].

[13] J. Mulero Chaves, C. Párraga Niebla, I. Sivarajah, C. Garcia Monteiro, E. Barbosa, "Alert4All Deliverable D2.4: Analysis on information and communication technologies: state of the art report", Nov. 2011.

[14] J. Mulero Chaves and C. Párraga Niebla, "Effectiveness Evaluation Model for Public Alert Systems", Disaster Advances Journal, submitted for publication.

[15] Roßnagel, H., Zibuschka, J. and Junker, O. (2011), "On the Effectiveness of Mobile Service Notification for Passenger Egress During Large Public Events" in *Proceedings of the 8th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2011),* 8-11 May 2011, Lisbon, Portugal, available at: http://www.iscramlive.org/ISCRAM2011/proceedings/papers/112.pdf [Last accessed on June 2016].

[16] Alert4All project homepage, available at: http://www.alert4all.eu/ , [Last accessed on June 2016].

[17] Euralarm homepage, available at: https://www.euralarm.org/, [Last accessed on June 2016].

[18] German Federal Office of Civil Protection and Disaster Assistance (BBK), „Warnung für alle Fälle – das Modulare Warnsystem von Bund, Ländern und Kommunen", available at: http://www.bbk.bund.de/DE/TopThema/TT_2012/TT_PK_Kalkar_Udem.html , [Last accessed on June 2016].

[19] 3GPP TS 23.041, "Technical realization of Cell Broadcast Service (CBS)".

[20] ETSI EMTEL TR 103 335 "Emergency Communications (EMTEL); Guidelines for alert message content accessibility"

[21] ETSI EMTEL TR103 273, "Emergency Communications (EMTEL); Alerting libraries"

[22] ETSI EMTEL TR 103 338, "Satellite Earth Stations and Systems (SES); Satellite Emergency Communications (SatEC); Multiple Alert Message Encapsulation over Satellite (MAMES) deployment guidelines"

[23] ETSI EMTEL TS 103 337 "Satellite Earth Stations and Systems (SES); Satellite Emergency Communications; Multiple Alert Message Encapsulation over Satellite (MAMES)"

[24] EGNOS – "What is SBAS", available at: http://www.egnos-portal.eu/discover-egnos/about-egnos/what-sbas , [Last accessed on June 2016].

[25] Wikipedia article "RSS", available at https://en.wikipedia.org/wiki/RSS [Last accessed on June 2016].

Earth Observation – A Fundamental Input for Crisis Information Systems

By Christian Strobl, Ralph Kiefl, Patrick Aravena-Pelizari (German Aerospace Center, DLR/DFD)

Abstract

Space-borne and airborne earth observation (EO) is a highly valuable source of spatio-temporal information promoting the ability for a rapid up-to-date assessment and (near-) real-time monitoring of natural or and man-made hazards and disasters. Such information has become indispensable in present-day disaster management activities. Thereby, EO based technologies have a role to play in each of the four phases of the disaster management cycle (i.e. mitigation, preparedness, response and recovery) with applications grouped into three main stages:

- Pre-disaster (preparedness and mitigation): EO-based information extraction for assessing potential spatial distributions and severities of hazards as well as the vulnerability of a focus region for disaster risk evaluation and subsequent mitigation and preparedness activities.
- Event crisis (response): Assessment and monitoring of regional extent and severities of the characteristics and impacts of a disaster to assist rapid crisis management.
- Post-disaster (recovery): EO based information extraction to assist recovery activities.

Within the PHAROS system a wide range of data products are used, which are varying in temporal, spatial and spectral resolution and coverage. The used sensor platforms comprise space-borne satellites and airborne systems, i.e. aircrafts as well as unmanned aerial systems (UAS).

Monitoring the Earth with Satellite based Hotspot Detection Services

One of the main concerns of the EO part in the PHAROS system is to provide fire hot spots as an input for the Simulation Service. For this purpose two hot spot services are used, the MODIS hot spot service [1] and the MSG Seviri hot spot service [1]. Both satellite data are received at the two DLR (Deutsches Zentrum für Luft- und Raumfahrt, German Aerospace Center) ground stations. One is located in Oberpfaffenhofen (Bavaria) in southern Germany and the other one in Neustrelitz (Mecklenburg-West Pomerania) in Northern Germany.

The MODIS Hot Spot Service

The MODIS (Moderate-resolution Imaging Spectroradiometer) instrument is on board the Terra (EOS AM-1) and Aqua (EOS PM) satellite platforms as part of the NASA international Earth Observing System (EOS). Each MODIS sensor provides daily image coverage of almost the entire surface of the Earth in the mid to high latitudes, producing observations in 36 spectral bands at moderate spatial resolutions (250, 500, and 1000 m). Daily, the thermal information is collected with a spatial resolution of 1000 m, twice by each sensor, providing up to four thermal observations daily. The MODIS images used for fire detection are acquired from two direct

broadcast receiving stations from DLR located in Oberpfaffenhofen (Figure 0-1) and Neustrelitz (Figure 0-2) in Germany [2].

Figure 0-1: MODIS antenna on the roof of DFD's building in Oberpfaffenhofen

Figure 0-2: MODIS antenna on the roof of DFD's building in Neustrelitz

Subsequent to the data reception the MODIS data are processed in near real time (NRT). After the MODIS pre-processing is finished, the fire hot spots (thermal anomalies) are derived automatically from the MODIS data. For this detection of high temperature events (HTE) the MOD14 algorithm is used. The algorithm is based on the shift of the radiances/reflectance to shorter wavelengths (middle infrared) with an increasing surface temperature. MOD14 is well documented and tested in operational services and guarantees comparability and reproducibility as well as a standardized international acknowledged product [1].

The pre-processing of the MODIS data and also the derivation of the MOD14 hot spots is based on an OGC (Open Geospatial Consortium) compliant Web Processing Service (WPS). Also the interface for the MODIS products is OGC compliant:

- the MODIS hotspots are delivered as Web Feature Service (WFS)
- the MODIS scenes are provided for portrayal purposes as Web Mapping Service (WMS)

This assures the seamless integration of the MODIS processing results in the PHAROS system and furthermore in already existing applications of the potential end users.

The MSG SEVIRI Hot Spot Service

The MODIS hot spots are complemented by the MSG Seviri hot spot service. The SEVIRI Sensor (Spinning Enhanced Visible and Infrared Imager) is installed on top of MSG-1 and MSG-2 (Meteosat Second Generation satellite) platforms. These satellites are geostationary and cover Europe and northern Africa. For the normal mode a dataset is received every 15 minutes. The SEVIRI Sensor provides data in 12 different wavelengths within the visible to infra-red spectrum and with a pixel size of 1 km for the high resolution visible channels, and up to 3 km for the infrared channels. Accordingly to MODIS, the active fire detection uses the shift of the peak emission and the increased sensitivity to temperature changes to detect high

temperature events within a pixel [1]. The MSG data are received already preprocessed as part of the EUMETCAST payload.

Analog to the MODIS ones, the MSG SEVIRI hot spots are provided as OGC conformable web services.

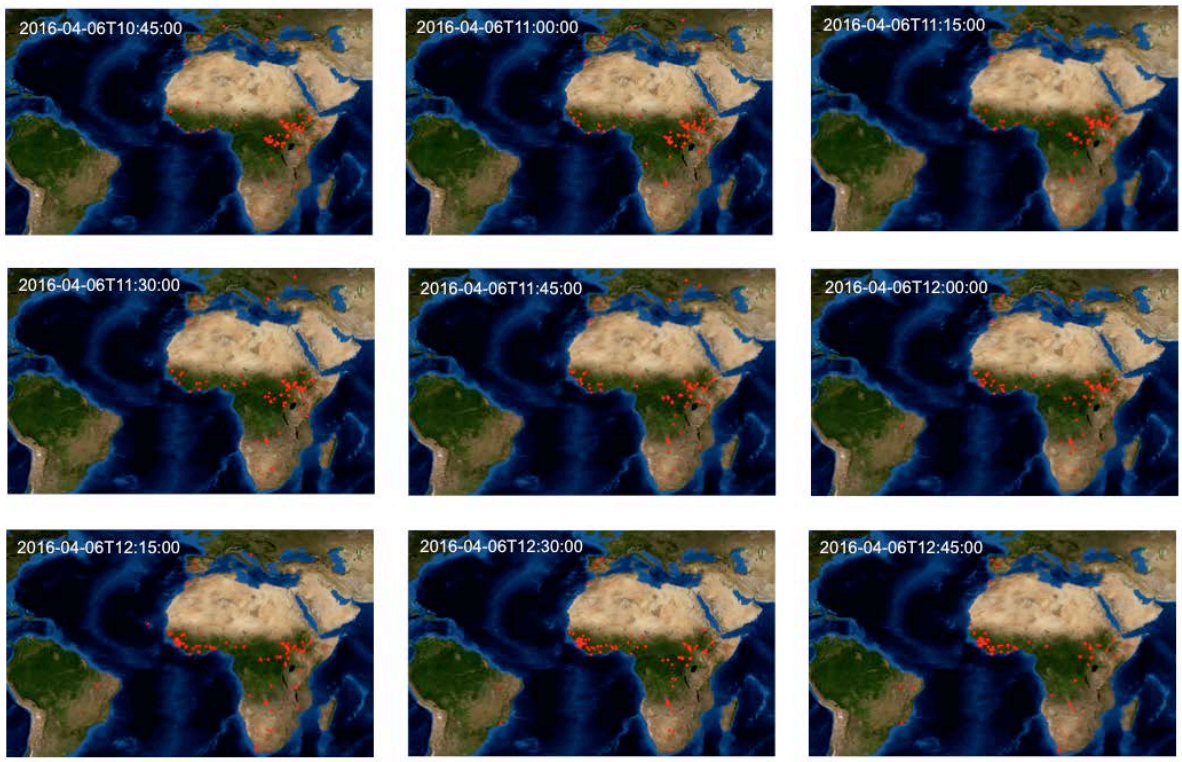


Figure 0-3: Example for MSG SEVIRI Hot Spots for an arbitrary day and a time period of 2 hours.

Getting a Real Immediate Response with the Usage of Airborne Earth Observation

The usefulness and added value of the provision of near-real-time (NRT) images for monitoring purposes is clearly proven. Especially for the response phase after a disaster event the rapid availability of EO-data has been often emphasized by end users during the project lifetime. NRT imagery can provide a timely and more accurate overview of the situation, allowing primary users to know the status of the available infrastructure (for instance, accessible roads or escape routes) as well as of their own resources (estimated location of vehicles and involved first responders). On the other hand, it has been pointed out by end users that the sensors and systems to be used in an operational scenario shall be mounted in the aerial resources (helicopters, aircrafts) owned by the corresponding authorities in charge of the situation.

For the image acquisition during the prescribed pilot demonstration, a helicopter (BO 115) has been provided and coordinated by DLR, which is certified to carry the used optical and thermal sensor systems.

The Optical 4k Sensor

The 4k system is a proprietary real-time optical sensor system of the German Aerospace Center (DLR) originally developed for a wide variety of applications, e.g. for automatic traffic data extraction and for rapid mapping applications (comp.[4], [5]) developed in the frame of the VABENE++ DLR internal project [6].

The sensor system is designed weight-optimized, small, and relatively low-cost, but equipped with a full real-time image processing chain including a high-capacity data downlink to the ground station. Figure 0-4 below shows the sensor system mounted on a DLR helicopter and the components of the 4k system with three non-metric off-the-shelf cameras, a microwave datalink system including two antennas, three processing units and a high-end GNSS/IMU system.

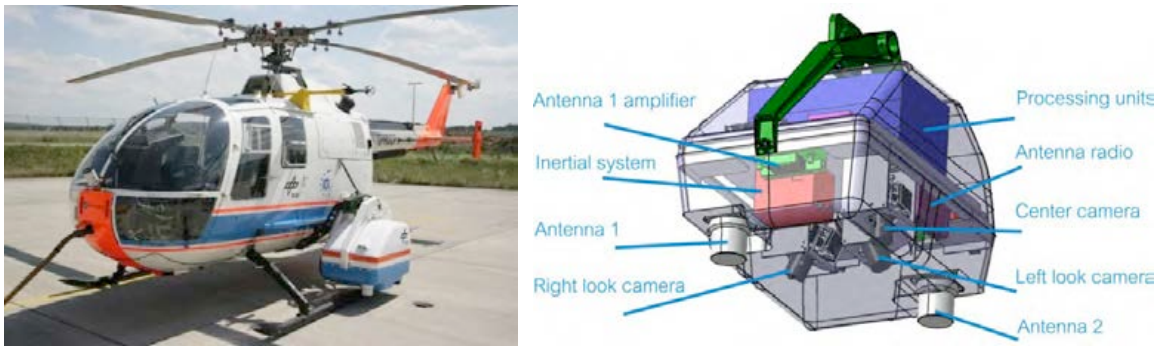


Figure 0-4: 4k system mounted on the helicopter BO-105 (left) and system components (right)

The system is connected to the 28V/35A power supply of the helicopter and to the GNSS antenna on top of the cabin. The system can be commanded from inside the helicopter via LAN or from the ground station via data link.

Three optical non-metric cameras are integrated in the sensor with different looking directions. The latest camera generation from Canon EOS, two 1D-X and one 1D-C, are installed on the platform. Each of them is capable of acquiring 17.9 MPix images with a frame rate of up to 14Hz. Additionally, the Canon EOS 1D-C is capable of acquiring 4k movies (Ultra-HD) with a resolution of 4096 x 2160 pixels at 25 fps and is installed in nadir direction.

For the data provision of 4k aerial imagery during the PHAROS pilot demonstration campaign a technical setup was applied, which consists of the helicopter based 4k camera and on-board processor on the one hand, and the ground station on the other hand. Images of the side looking cameras equipped with 50mm focal length were acquired with a frame rate of 0.5-1.0fps. The standard flight height during the demonstration was 1000m above ground level, which leads to a coverage of 1400m in across and 400m in flight direction. The ground sample distance was 13cm. During the orthorectification process, which was performed aboard, the images were projected on a surface model and then resampled to 10cm. After this preprocessing, the images with accompanying auxiliary files were sent to the ground station via a bidirectional microwave datalink (SRS) using 40MHz bandwidth in the C band.

The ground station contains several components (e.g. receiving antenna, several rack mounted workstations and a screen, if required), which are connected in a private network. The single

image files, which are assigned to one overpass, were optimized and processed to a virtual mosaic, which obtains a distinct time stamp. Finally the virtual mosaics were exposed as portrayal web services.

The visualisation of the aerial imagery was realised with a webmapping client, which was displayed on a distinct monitor screen in addition to the actual PHAROS system monitors. The chosen webmapping solution was based on ESRI's ArcGIS for Javascript API [7]. The following figure provides a screenshot of the client with a virtual 4k-image mosaic and additional reference layer.

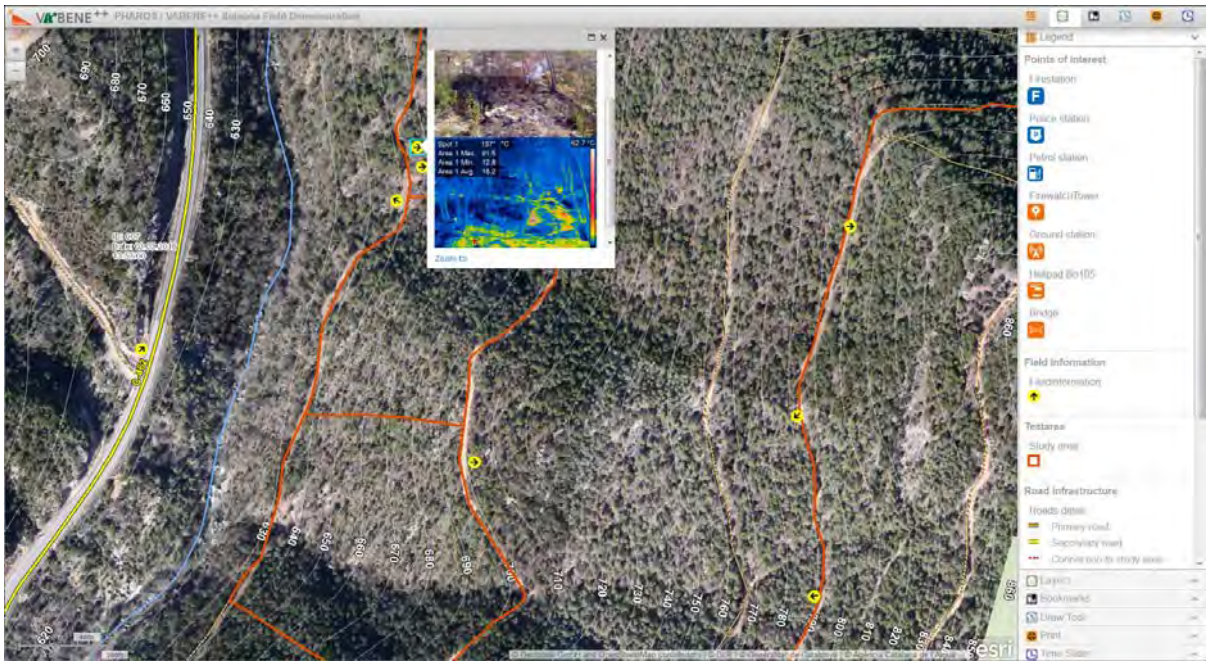


Figure 0-5: PHAROS / VABENE++ Aerial Imagery viewer

During the demonstration flights on March 02, 2016 and March 03, 2016 in total 523 images with file sizes between 15 MB and 250 MB (which adds up to 26.5 GB in total) were acquired and 30 virtual mosaics were processed. The time for data acquisition, downlink, processing, ingestion and service provision averages on 3:35 minutes per virtual mosaic / time step. The shortest response time between the start of the image acquisition and the data provision through the web service in the local network added up to 2 minutes. The following table provides an overview of the characteristics of the provided image mosaics.

Table 0-1: VABENE++ image mosaic specification

File format	GeoTIFF
Number of bands	3, RGB
Radiometric resolution	8 bit
Spatial resolution	0.1m

Temporal resolution	2 – 5 minutes, depending on flight conditions
Spatial reference system	UTM31, WGS1984
Number of columns / rows	7000 – 14000, depending on flight direction and conditions
Spatial accuracy	< 2m, depending on relief conditions

It is obvious that data with such a high spatial resolution provides very valuable information for the immediate response to small scale natural or technical disasters, especially in dynamic and fast changing scenarios. During the prescribed burning operation in the PHAROS demonstration campaign in Solsona, it could be demonstrated that not only the smoke plumes, but also the active fire front could partly be mapped, even under the very difficult conditions of a surface or ground fire. Additionally a detailed resource management could be supported.

Fire front, 2016-03-02, 10:46 UTC

Fire front, 2016-03-02, 10:54 UTC

Fire brigade, 2016-03-03, 13:40 UTC

Fire brigade, 2016-03-03, 11:00 UTC

Figure 0-6: Sample imagery of the fire front and fire brigade, acquired by the 4k-camera

While the timely and fully automatic analysis of data would be uttermost preferable, it is not yet feasible for every use case. Nevertheless, it could be demonstrated that in combination with mapping services, which are available at the national level in Germany with e.g. the

Center for Satellite based Crisis Information (ZKI) [9] or at European level with the Copernicus Emergency Management Service, a broader and quite timely - albeit of course not a near real time - analysis can be performed. During the Solsona campaign, the data exchange with the ZKI mapping unit was realised via FTP transfer. Transfer, analysis and product delivery could be carried out within 18 – 24 hours after image acquisition. Example map products you can find at Figure 0-7 and Figure 0-8.

The field information map in Figure 0-7 gives a detailed overview on the study site of the PHAROS pilot demonstration on March 02, 2016, the first day of the exercise. The map includes geolocated on-site optical and thermal photos. Thereby, the yellow points depict the location and the arrows the viewing direction of the photos. 4k aerial imagery (spatial resolution: 0.1m) acquired on March 02, 2016, 11:06 UTC is used as backdrop for the main map. A WorldView-2 image (0.5m spatial resolution) acquired on March 02, 2016, 11:17 UTC is used as backdrop for the zoom box on the lower left.

The monitoring map in Figure 0-10 shows the development of the fire hot spot and its corresponding smoke plume during the PHAROS forest fire exercise event on March 03, 2016 from 10:20 to 11:05 UTC by means of a 4k aerial imagery time series.

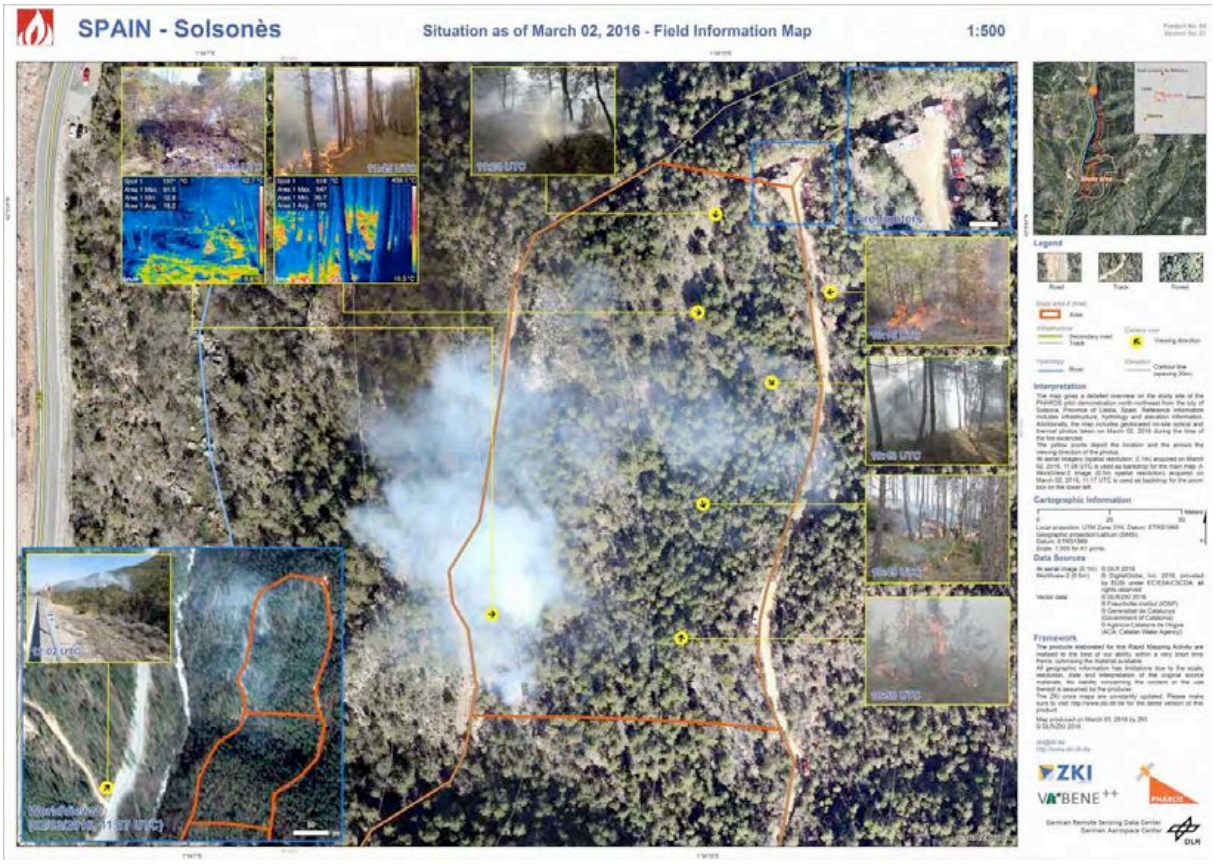


Figure 0-7: ZKI field information map, situation as of March 02, 2016

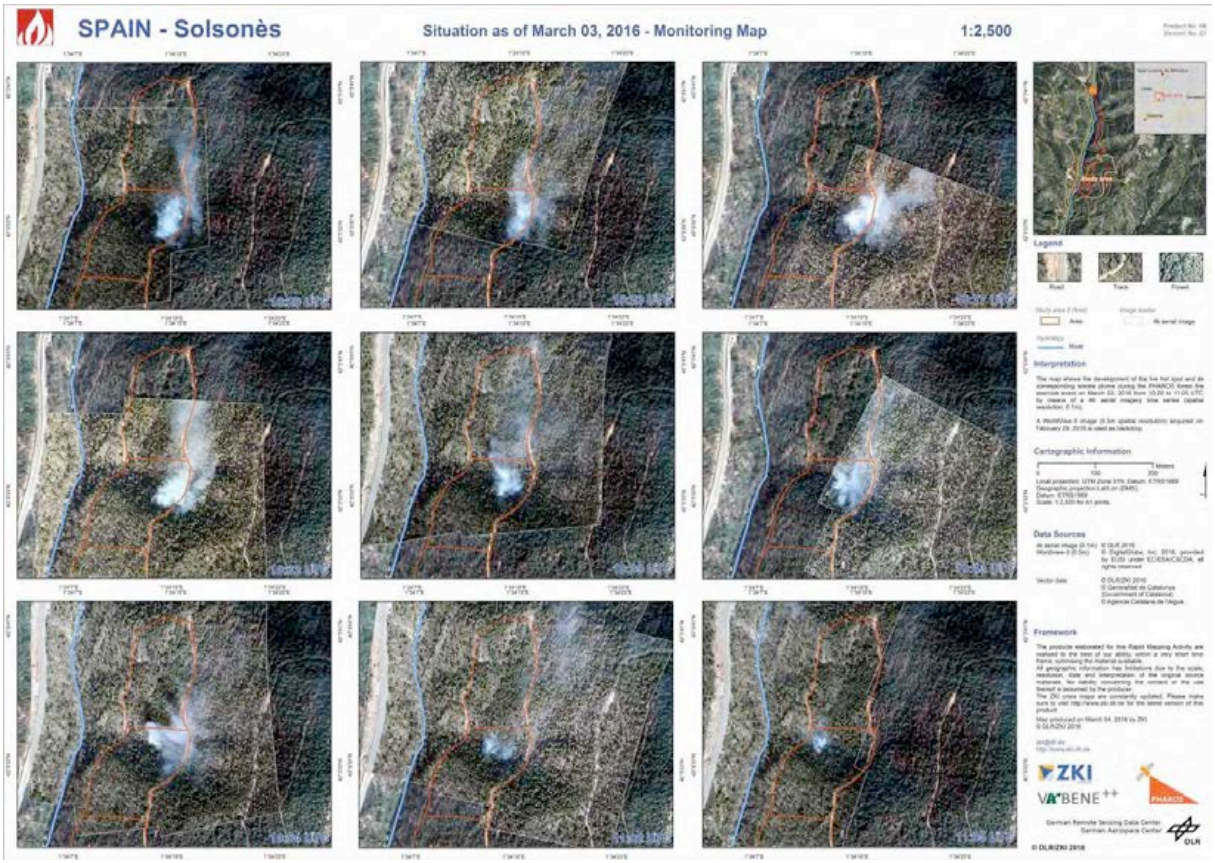


Figure 0-8: ZKI monitoring map, situation as of March 03, 2016

The Thermal AirSIG Sensor

Besides NRT information the view through smoke and tree canopy with infrared sensors is a crucial point for fire fighters. For the pilot demonstration in Solsona the AIR-Sig sensor from Fraunhofer IOSB was used. This sensor is often used for field investigations in the field of applied research tasks, especially for radiometry and image exploitation. It is often combined with aerial observation (compare Figure 0-9), because the target objects are not accessible via ground-based measurements [8]. This is also the case for the usage of the AIR-Sig in the PHAROS project.


Figure 0-9: AIR-Sig system mounted on the helicopter BO-105 (left) and AIR-Sig sensor (right)

The technical data of the AIR-Sig sensor [8] are:

Dual-Band IR Measurement System

- IRCAM Dual-Band FPA640 LM Aero "Clementine"
- IR Spectral Bands/FPA: midwave: CMT 3.5 – 5.1 mm longwave: QWIP, 7.5 – 9.2 mm
- Resolution 640 x 512 pixel, 50Hz, 14bit
- Field-of-View 8.8° x 7.0° (iFoV 0.2 mrad x 0.2 mrad)

With this infrared data the temporal-spatial progression of the fire front can be identified (compare Figure 0-10), which is of high value for the fire brigades and also for the scientists working in fire propagation.

Data Processing and Analysis of the thermal data includes the following steps:

- Pre-processing of the raw data (homogenization, non-uniformity compensation (NUC), bad pixel correction
- Radiometric calculation of the equivalent radiance and temperature distribution
- Higher Level Data processing (flight sequences based on estimated object temperatures (= effective temperatures) or apparent temperatures (= brightness temperatures) and single geocoded images)

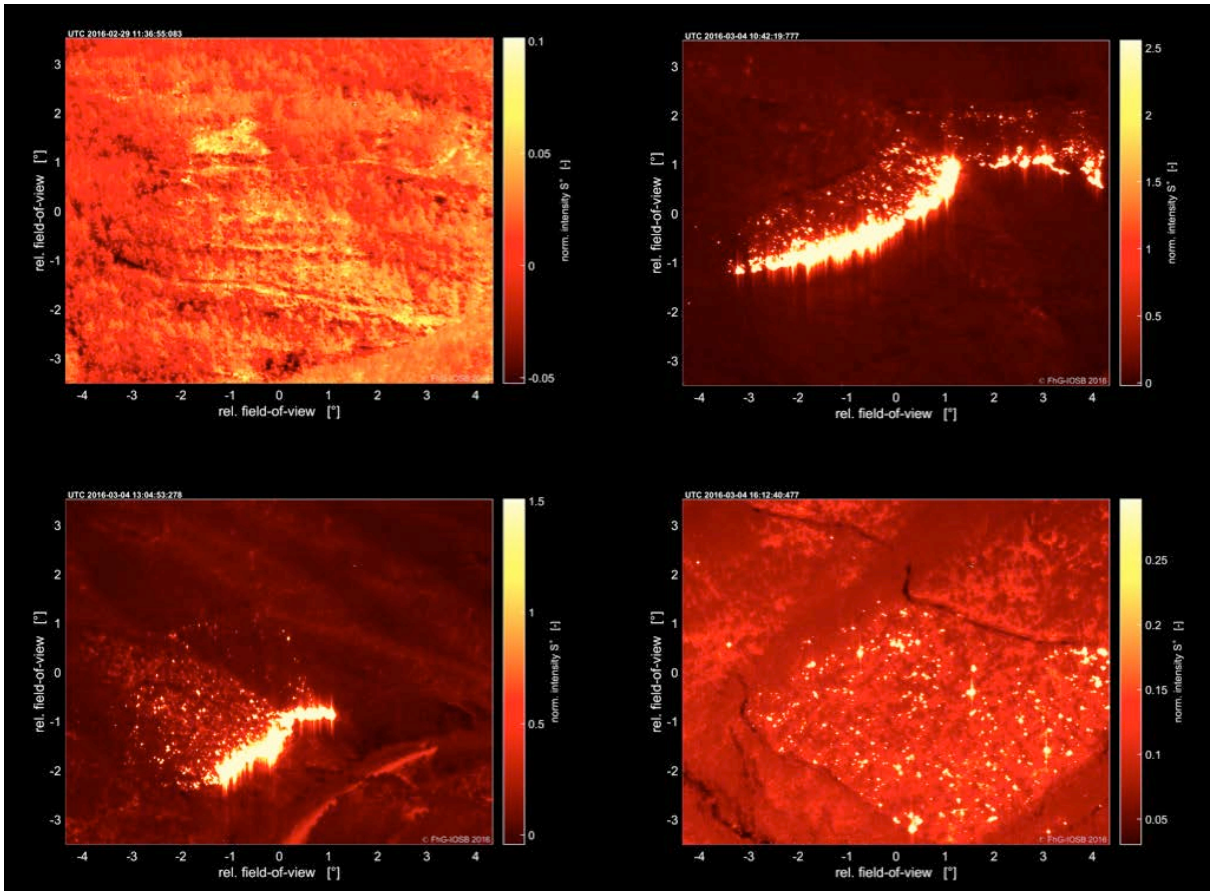


Figure 0-10: AIR-Sig Images showing the pre-fire situation (upper left), the fire front starting at ca. 10:30 (upper right), the fire front approaching the lower end of the fire exercise at 13:30 (lower left) and finally the situation 3 hours after the fire exercise was stopped (lower right).

Satellite based Earth Observation

Satellite-based Earth Observation (EO) can be applied to a variety of emergency responses for predicting, monitoring and/or managing natural or man-made disasters. It has been proven to be a valuable source of information for disaster management on local, regional and global scale, because of the following advantages [10]:

1. synoptic (i.e. large area) coverage,
2. frequent and repetitive data collection of the Earth's surface,
3. diverse spectral, spatial and potentially three dimensional information, and
4. relatively low cost for per unit coverage.

With regard to forest fires – the PHAROS implementation and test hazard – satellite based EO data features high potential to provide important information for the support of disaster management activities within all 4 phases of the disaster management cycle (Table 0-2). With regard to the PHAROS pilot demonstration a comprehensive set of satellite based Earth Observation (EO) pre- as well as post-event data has been tasked from the Copernicus data ware house via the Copernicus Space Component Data Access (CSCDA) system [11].

Table 0-2: Relevance of satellite data acquired for PHAROS within the different phases of the disaster management cycle with regard to the forest fire hazard

Sensor category: Spectral characteristics/ Resolution/	**Satellites**	**Contribution to disaster management: Forest fire**			
		Mitigation	**Preparedness**	**Response**	**Recovery**
Optical Multispectral / VHR1, VHR2, HR1, HR2	WorldView-2/3; Pléiades; RapidEye; Spot-5/6/7	Assessment of vegetation state, LULC, built environment and infrastructure, elevetation information (requires stereo imagery); planning of mitigation, e.g. the creation of wildfire defensible zones	Detailed and up-to-date reference and exposure information e.g. building footprints and (critical) infrastructure (requires VHR); LULC; monitoring of vegetation state; investigation of potentially affected areas; e.g. for evacuation planning	Localisation, quantification and monitoring of burnt area, smoke plumes, affected built environment, infrastructure and LULC	Monitoring and planning of recovery / reconstruction, e.g. recovery of LULC and reconstruction of infrastructure or resettlement
SAR/ VHR1, HR1	TerraSAR-X, Radarsat-2	Elevation information for mitigation planning e.g. extraction of digital terrain features	Reference and exposure information: LULC (requires polarimetric SAR data); elevation information (DEMs), e.g for slope information; localisation of waterbodies	Localisation, quantification and monitoring of burnt area	

The pre-event data ordered before the PHAROS pilot demonstration in standard acquisition mode [12] is listed in Table 0-3. In more detail

Table *0-4* shows the pre- and post-event acquisitions ordered in rush acquisition mode. Rush mode new acquisitions satellite imagery is delivered between 2 and 5 hours from sensing [12].

The data sets comprise optical as well as synthetic aperture radar (SAR) satellite imagery and cover the resolution classes Very High Resolution (VHR)1 (resolution <= 1m), VHR2 (1m <

resolution <= 4m), High Resolution (HR)1(4m < resolution <= 10m) and HR2 (10m < resolution <=30m) [12].

Table 0-3: Data sets acquired from Copernicus DWH in standard acquisition mode (via CSCDA Standard Data Request)

Acquisition date [dd/mm/yyyy]	Satellite / Sensor or beam	Data type	Archive / New acquisition
11/03/2012	RapidEye / Multispectral	Optical HR1	Archive
25/06/2012	RapidEye / Multispectral	Optical HR1	Archive
03/01/2012	RapidEye / Multispectral	Optical HR1	Archive
18/12/2012	Spot-5 / Multispectral	Optical HR1	Archive
06/05/2013	RapidEye / Multispectral	Optical HR1	Archive
31/07/2013	RapidEye / Multispectral	Optical HR1	Archive
16/09/2013	RapidEye / Multispectral	Optical HR1	Archive
05/05/2014	RapidEye / Multispectral	Optical HR1	Archive
23/07/2014	RapidEye / Multispectral	Optical HR1	Archive
11/09/2014	RapidEye / Multispectral	Optical HR1	Archive
07/12/2014	Spot-5 / Multispectral	Optical HR1	Archive
10/03/2015	RapidEye / Multispectral	Optical HR1	Archive
09/05/2015	RapidEye / Multispectral	Optical HR1	Archive
30/06/2015	RapidEye / Multispectral	Optical HR1	Archive
20/09/2015	RapidEye / Multispectral	Optical HR1	Archive
12/01/2016	RapidEye / Multispectral	Optical HR1	New acquisition
16/02/2016	RapidEye / Multispectral	Optical HR1	New acquisition
10/09/2014	Deimos-1 / Multispectral	Optical HR2	Archive
26/03/2015	Deimos-1 / Multispectral	Optical HR2	Archive
29/12/2015	WorldView-2 / Bundle	Optical VHR1	New acquisition
05/02/2016	WorldView-2 / Bundle	Optical VHR1	New acquisition
20/02/2016	Pléiades / Multispectral	Optical VHR1	New acquisition
09/05/2015	Spot-7 / Bundle	Optical VHR2	Archive

Acquisition date [dd/mm/yyyy]	Satellite / Sensor or beam	Data type	Archive / New acquisition
22/05/2015	Pléiades / Multispectral	Optical VHR2	Archive
17/09/2015	Pléiades / Multispectral	Optical VHR2	Archive
14/02/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
16/02/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
25/02/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
27/02/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
07/03/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
09/03/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
18/03/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
20/03/2016	TerraSAR-X / High Resolution Spotlight	SAR VHR1	New acquisition
05/02/2016	Radartsat-2 / Fine Quad-Pol	SAR HR1	New acquisition
06/02/2016	Radartsat-2 / Fine Quad-Pol	SAR HR1	New acquisition
29/02/2016	Radartsat-2 / Fine Quad-Pol	SAR HR1	New acquisition
01/03/2016	Radartsat-2 / Fine Quad-Pol	SAR HR1	New acquisition
24/03/2016	Radartsat-2 / Fine Quad-Pol	SAR HR1	New acquisition
25/03/2016	Radartsat-2 / Fine Quad-Pol	SAR HR1	New acquisition

Table 0-4: Data sets acquired from Copernicus DWH in rush acquisition mode (via CSCDA Service Project Emergency Request Form)

Acquisition time [dd/mm/yyyy hh:mm (UTC)]	Satellite / Sensor or beam	Data type	Archive / New acquisition
01/03/2016 11:40	RapidEye / Multispectral	Optical HR1	New acquisition
02/03/2016 11:15	RapidEye / Multispectral	Optical HR1	New acquisition

Acquisition time [dd/mm/yyyy hh:mm (UTC)]	Satellite / Sensor or beam	Data type	Archive / New acquisition
03/03/2016 11:18	RapidEye / Multispectral	Optical HR1	New acquisition
04/03/2016 11:21	RapidEye / Multispectral	Optical HR1	New acquisition
05/03/2016 11:24	RapidEye / Multispectral	Optical HR1	New acquisition
01/03/2016 10:40	SPOT-6 / Bundle	Optical VHR2	New acquisition
02/03/2016 10:32	SPOT-7 / Bundle	Optical VHR2	New acquisition
03/03/2016 10:25	SPOT-6 / Bundle	Optical VHR2	New acquisition
04/03/2016 10:17	SPOT-7 / Bundle	Optical VHR2	New acquisition
05/03/2016 10:10	SPOT-6 / Bundle	Optical VHR2	New acquisition
29/02/2016 11:19	WorldView-3 / Bundle	Optical VHR1	New acquisition
01/03/2016 10:16	WorldView-2 / Bundle	Optical VHR1	New acquisition
02/03/2016 11:17	WorldView-2 / Bundle	Optical VHR1	New acquisition
03/03/2016 10:42	WorldView-2 / Bundle	Optical VHR1	New acquisition
05/03/2016 11:06	WorldView-2 / Bundle	Optical VHR1	New acquisition
06/03/2016 10:45	WorldView-2 / Bundle	Optical VHR1	New acquisition
07/03/2016 10:45	WorldView-3 / Bundle	Optical VHR1	New acquisition
07/03/2016 17:47	RADARSAT-2 / Fine Quad Pol	SAR HR1	New acquisition
10/03/2016 17:59	RADARSAT-2 / Fine Quad Pol	SAR HR1	New acquisition
01/03/2016 06:12	TerraSAR-X / Staring Spotlight	SAR VHR1	New acquisition
02/03/2016 05:55	TerraSAR-X / Staring Spotlight	SAR VHR1	New acquisition
03/03/2016 17:51	TerraSAR-X / Staring Spotlight	SAR VHR1	New acquisition
04/03/2016 06:54	TerraSAR-X/ Staring Spotlight	SAR VHR1	New acquisition
05/03/2016 06:37	TerraSAR-X/ Staring Spotlight	SAR VHR1	New acquisition

The acquired satellite EO data was integrated into the PHAROS system providing very valuable thematic information on the PHAROS pilot demonstration study site in Solsonès, Catalonia. Furthermore, due the Copernicus DWH rush mode delivery times acquired data sets could be successfully integrated into the rapid mapping activities of the ZKI within relatively short time frames (Section 0). Pre-event data served for the collection of up-to-date reference data useful for pre-/post-event analyses as well as for the planning of the PHAROS pilot demonstration campaign.

The imagery sensed during the course of the exercise enabled a monitoring of fire hotspot locations and corresponding smoke plumes with a temporal resolution of 1 day. In addition VHR1 post-event imagery enabled the semi-automatic derivation of potentially fire affected areas.

DLR's Center for Satellite based crisis information (ZKI)

The Center for Satellite based Crisis Information (ZKI) of the German Aerospace Center (DLR) provides services for the rapid geospatial support of actors involved in the management of natural disasters, man-made emergency situations and humanitarian crises [9]. This includes the production of thematic information products derived by the use of satellite- and aerial remote sensing data analysis methods as well as the integration of ancillary data from further sources (e.g. population census information). Such products (e.g. thematic information layers) represent valuable input for (multi-) hazard management systems such as the PHAROS system. Within the PHAROS pilot demonstration several thematic information layers and maps were produced on the basis of the EO data sensed by the previously mentioned airborne (Section 0) and spaceborne (Section 0) EO sensors. Examples of ZKI mapping products and analyses are presented below (Figure 0-7 and Figure 0-8 and Figure 0-11 to Figure 0-15).

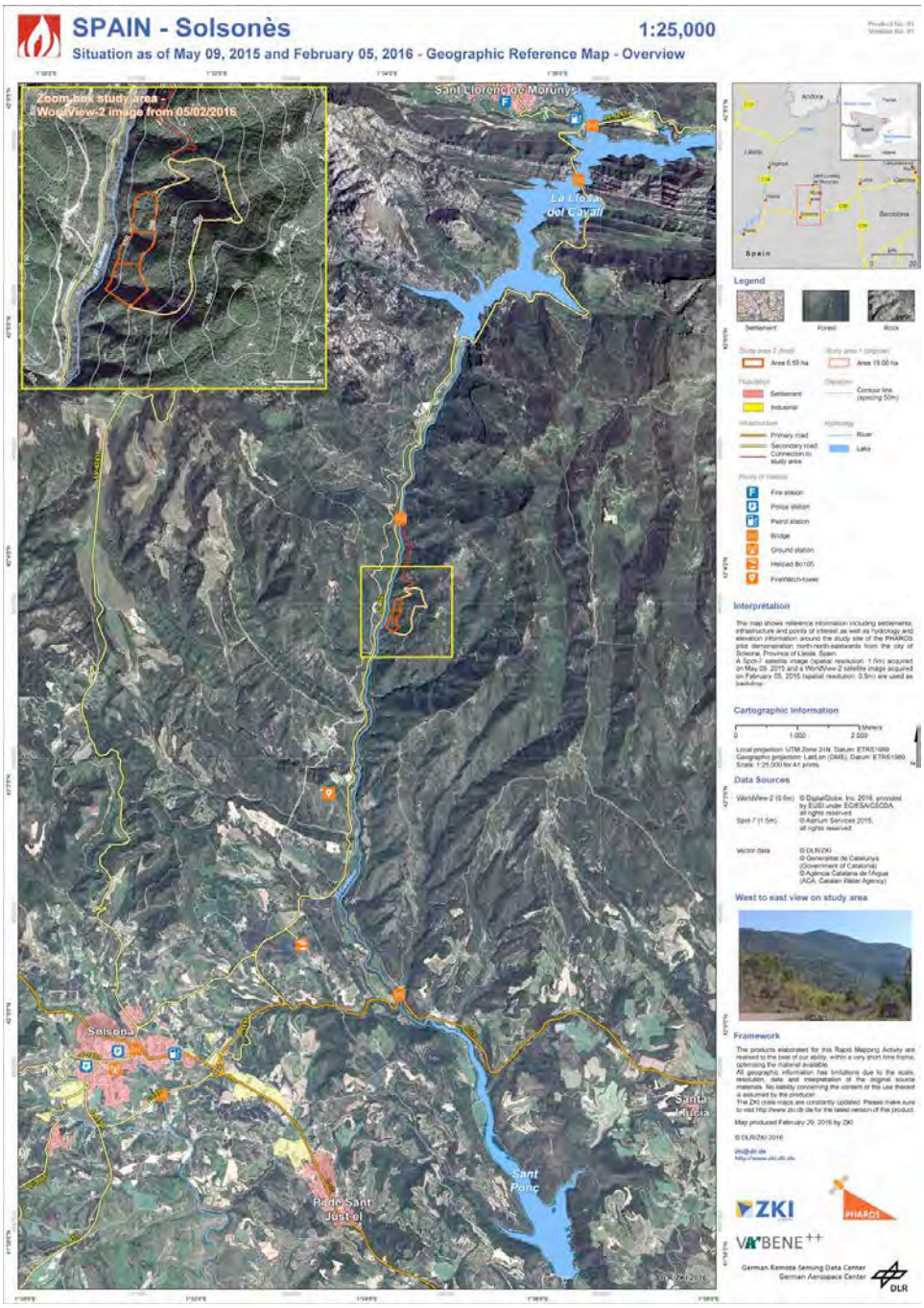


Figure 0-11: Geographic reference map of the region around the study site

Figure 0-11 shows a geographic reference map of the region around the study site of the PHAROS pilot demonstration in Solsonès, Catalonia. Within the map optical satellite imagery from the satellites SPOT-7 (VHR2; main map) and WorldView-2 (VHR1; zoom box) are used as backdrop and provide up-to-date large area information on the spatial distribution of settlements, infrastructure and hydrology.

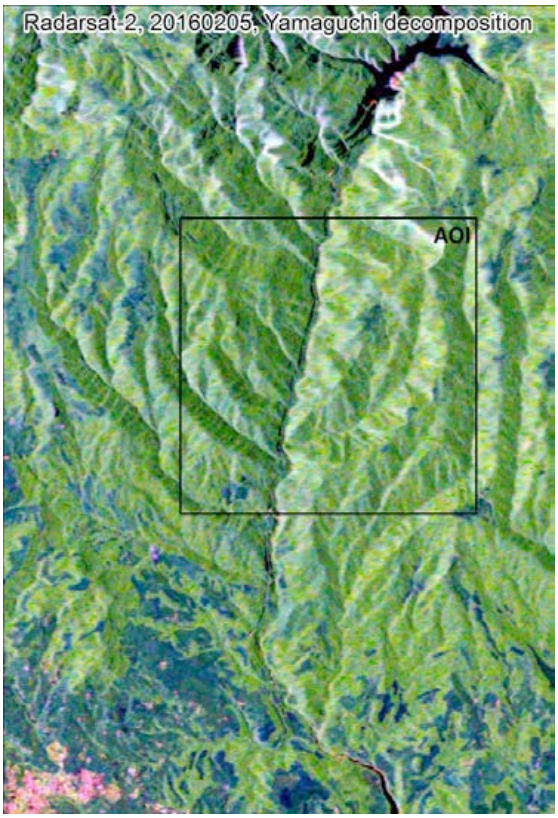


Figure 0-12: Radarsat-2 polarimetry based Yamaguchi decomposition for the region around pilot demonstration study site

Polarimetric SAR (PolSAR) data such as Radarsat-2 quadpol imagery can be additionally deployed in order to extract reference information (e.g. land cover). Figure 0-12 shows the result of a polarimetric decomposition for a Radarsat-2 scene of the pilot demonstration area. Herein the red coloured areas are indicating urban areas. Green colours indicate dense and high vegetation such as tree crowns. Dark green and blue colours indicate areas covered predominantly by low and sparse vegetation. Very dark areas indicate open water bodies.

The acquisition of satellite imagery within the demonstration week in rush acquisition mode enabled the capturing of the state of fire hot spots at acquisition time due to their corresponding smoke plumes. Figure 0-13 shows the state of fire hotspots/smoke plumes for each day of the pilot demonstration at about 10:30 UTC.

Post-disaster multispectral optical imagery serves for the extraction of areas potentially affected by the fire. **Error! Reference source not found.** shows a corresponding map highlighting potentially fire affected areas (depicted in red) which were extracted by means of semi-automatic image analysis.

Figure 0-13: Satellite imagery based monitoring map for the days of the pilot demonstration

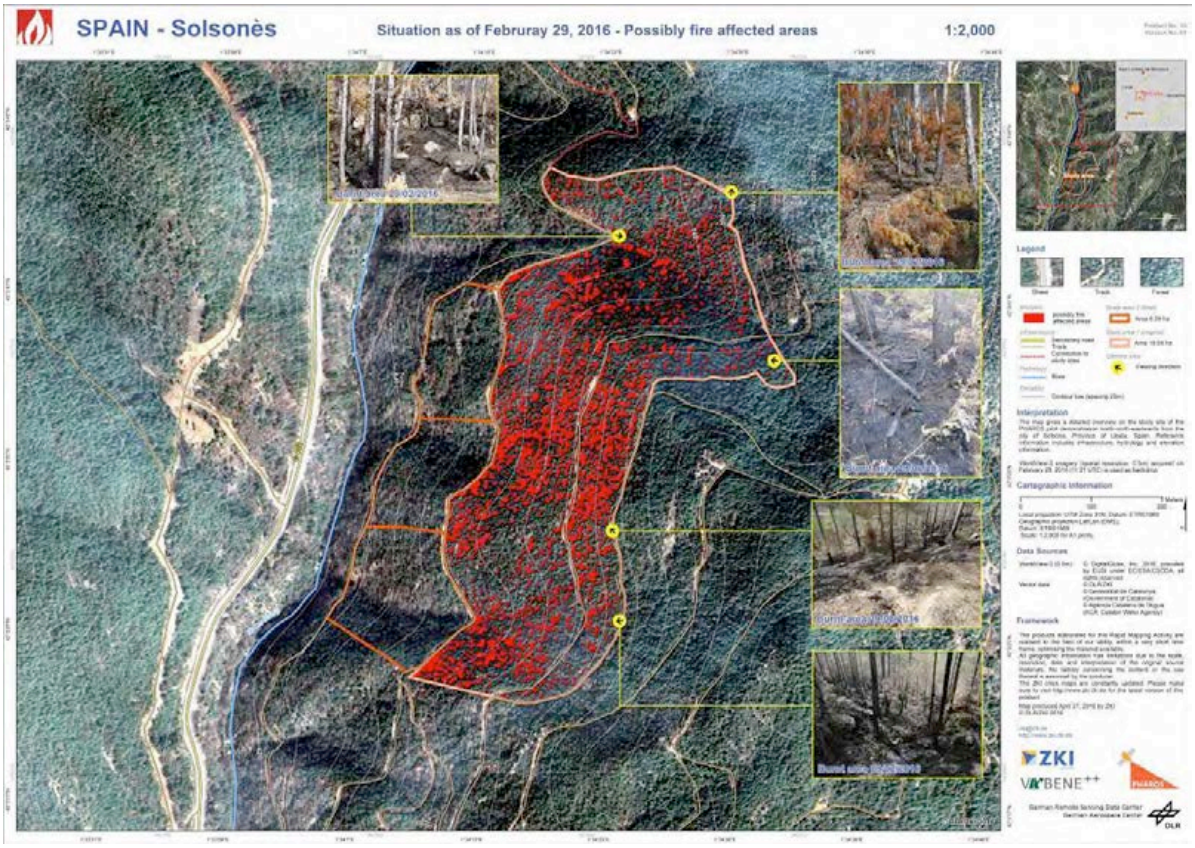


Figure 0-14: Map of possibly fire affected areas

The map in Figure 0-15 shows the surface temperature development within the study area during the PHAROS forest fire exercise event on March 04, 2016 by means of AIR-Sig imagery thermal imagery (Section 0) from 09:42 UTC, 12:06 UTC and 15:12 UTC. Additional information is given by geolocated on-site optical and thermal photos. A Pléiades image acquired on February 20, 2016 with 0.5m spatial resolution is used as backdrop.

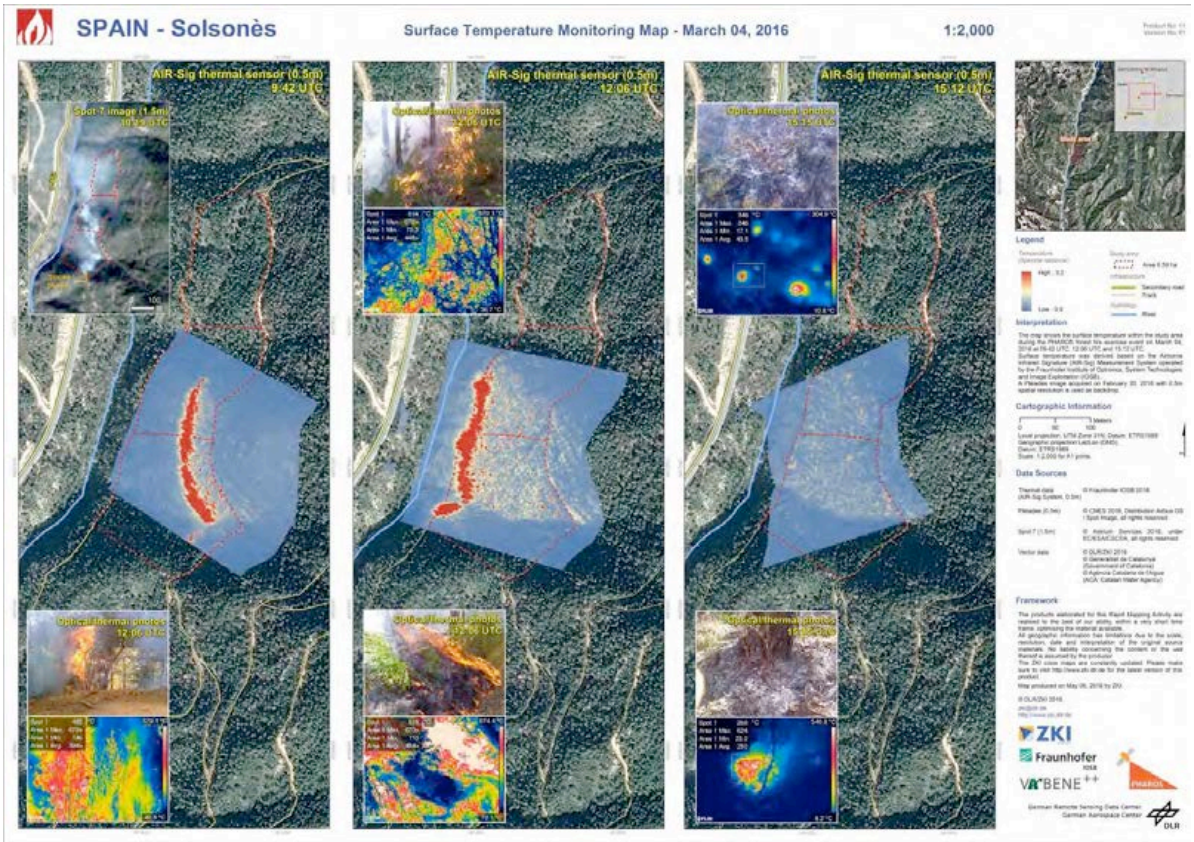


Figure 0-15: Surface Temperature monitoring map, situation as of March 04, 2016.

The map products provided by DLR-ZKI can be accessed and downloaded via https://www.zki.dlr.de/article/2773.

Conclusion and Outlook

In the context of the PHAROS Wildfire System Earth Observation was proven as a valuable part during the whole crisis cycle. For fire detection it is a cheap and effective alternative to in-situ sensors, which is most useful for areas with a small population density. To get near real time information from the on-going fire front airborne sensors are without alternative. To get more insight through smoke and tree canopy infrared information turned out to be of a great value to the relief units. In addition to all this information additional high and very high resolution satellites can be tasked within a few hours. Finally all this earth observation data is used to create crisis maps by the ZKI unit of the German Aerospace Center. These maps comprise valuable information, which is especially tailored to the needs of the fire brigades.

The PHAROS system contains already nearly all interfaces for the integration of Earth Observation data. Especially the future usage of services of the European Union, like the Copernicus Emergency Mapping Service (EMS), the Copernicus Space Component Data Access (CSCDA) and also

Sentinel 3 for hot spot detection are taken into account. In this respect the already pre-operational PHAROS system can be seen as the first step to a future Multi Hazard Crisis System.

References

[1] L. Giglio, "MODIS Collection 5 Active Fire product User's Guide, Version 2.4". Science Systems and Applications, Inc., University of Maryland, Department of Geography, 2010.

[2] EUMETSAT, Active Fire Monitoring with MSG; Algorithm Theoretical Basis Document, Doc.No. EUM/MET/REP/07/0170, v2, 2010.

[3] C. Strobl, E. Stein, P. Tungalagsaikhan, W. Ebke, E. Schwarz, T. Ruppert, P. Aravena Pelizari, and U. Raape, "The Integration of an Operational Fire Hot Spots Processing Chain in a Multi-Hazard Emergency Management Service Platform (PHAROS)," in Proceedings of the 1st Int. Electron. Conf. Remote Sens., 2015, vol. 1,2015,h002.

[4] Kurz, F., Rosenbaum, D., Leitloff, J., Meynberg, O., Reinartz, P., "Real time camera system for disaster and traffic monitoring", *Int'l Conf. Sens. Mod. Photogram. Rem. Sens.*, Teheran, 2011.

[5] Kurz, F., Rosenbaum, D., Meynberg, O., Mattyus, G., "Real-time mapping from a helicopter with a new optical sensor system", *Gemeinsame Tagung 2014 der DGfK, der DGPF, der GfGI und des GiN (DGPF 23/2014)*, Hamburg, Germany, 2014.

[6] DLR, "VABENE++ Traffic Management for Large Scale Events and Disasters", available at: http://www.dlr.de/vabene/en/. [Last accessed in June 2016].

[7] ESRI, "ArcGIS API for JavaScript", Redlands, CA 2015, available at: https://developers.arcgis.com/javascript. [Last accessed in April 2016].

[8] Carmer, Carl F. v., "AIR-Sig System – Airborne Infrared Signature Measurement System", Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB, Ettlingen, 2012.

[9] DLR, "Center for Satellite Based Crisis Information (ZKI)," 2015, available at: http://www.zki.dlr.de/ [Last accessed in November 2015].

[10] Y. Zhang, N. Kerle, "Satellite remote sensing for near-real time data collection," in: Zlatanova & Li (eds), Geospatial Information Technology for Emergency Response. Taylor & Francis, 2008.

[11] ESA, "Copernicus Space Component Data Access. Portal", ESA 2000-2016, available at: https://spacedata.copernicus.eu/. [Last accessed in April 2016].

[12] B. Hoersch, V. Amans, "Copernicus Space Component Data Access Portfolio: Data Warehouse 2014 – 2020," CSC data access, Issue Date 31/03/2015 Ref COPE-PMAN-EOPG-TN-15-0004, 2015. Available at: https://copernicusdata.esa.int/documents/12833/14545/DAP_Release_Phase_2_1.0_final[Last accessed in April 2016].

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