

GNSS User Requirements in Emergency Management

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Agenda

- Acknowledgements
- MAGES Overview
- Requirements Capture Process
- User Groups Outline
- Applications
- Example of Requirements of Fire Brigades
- Specific Delta Requirements for Other User Groups
- Benefits to EM from E-GNSS
- Conclusions

Acknowledgements & Disclaimer

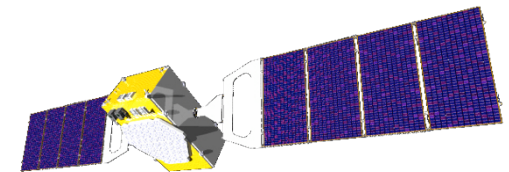
- European GNSS Supervisory Authority (GSA) provided financial support to the MAGES project
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- Thanks to partners in project MAGES for contributions and helpful discussions. This work draws from MAGES work packages 2400, 2500 & 2600. The contribution of the authors and participants in those work packages and their respective companies is gratefully acknowledged.
- However, the views and opinions expressed throughout are those of the author, and as such do not necessarily represent those of GSA, nor the views of the companies participating in project MAGES

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MAGES Overview (1)

- Mature Applications of Galileo for Emergency Scenarios
- The use of GNSS for emergency services promises significant improvements to the effectiveness and response time in disaster management and alerting
 - Positioning
 - Position reporting
 - Disaster alert broadcasting (not part of this talk)
- Emergency users will gain particular benefit from added functionalities of European Galileo & EGNOS Systems
 - Higher accuracy, integrity, security, certifiable services, ...
- Applicable to all emergency user domains
 - Disaster relief, search & rescue, fire brigades & ambulances, police forces, others



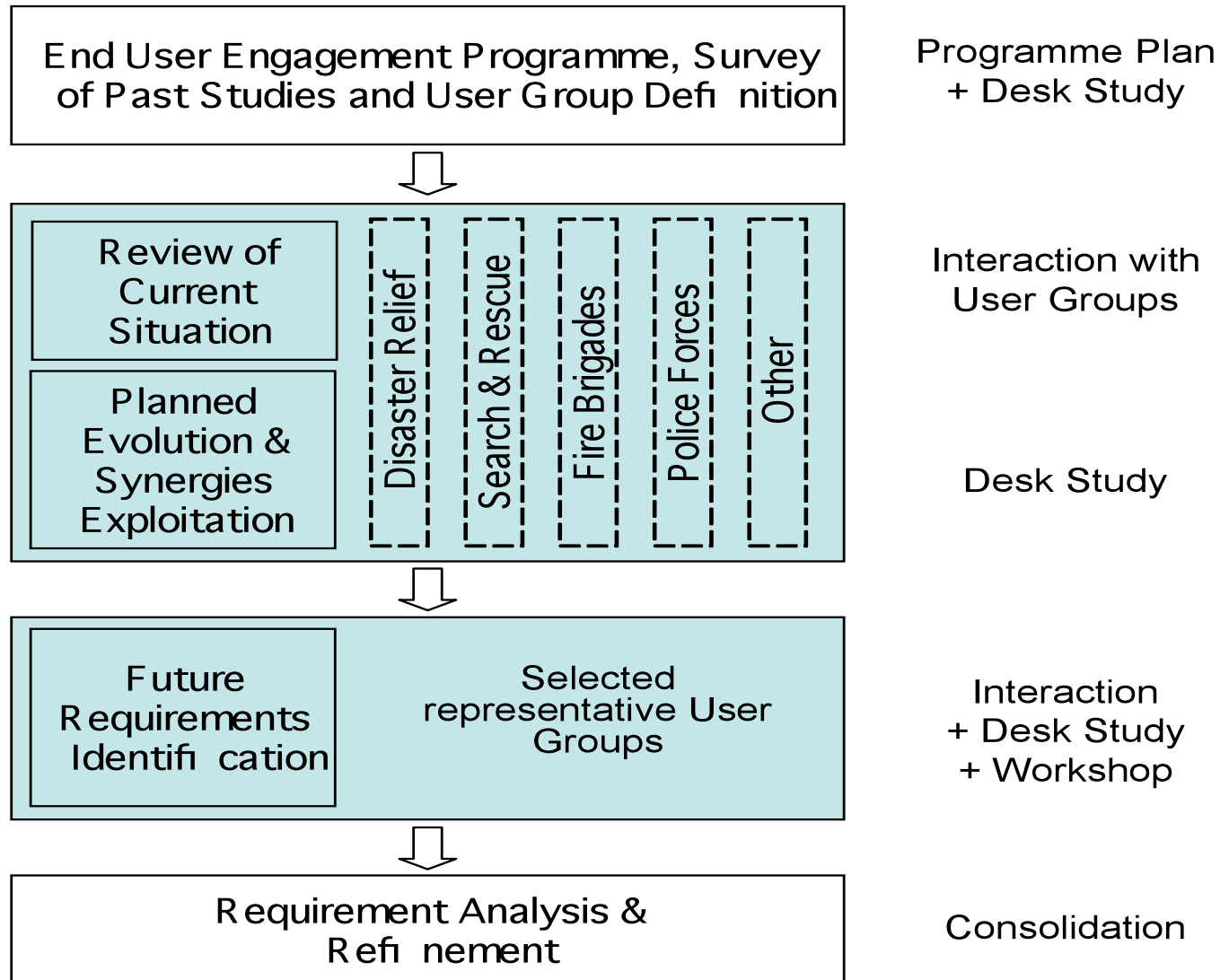
MAGES Overview (2)

- A pan-European project involving ~20 organisations and companies with interests in the domain
- Co-funded by GSA under FP6 3rd Call,
- Led by EADS Astrium (Portsmouth UK)
- Companies involved in MAGES are (from North to South by State):
 - Denmark: Terma;
 - The Netherlands: Logica CMG and TNO;
 - Belgium: Septentrio;
 - United Kingdom: EADS Astrium, Helios Technology, LogicaCMG; 425 Company;
 - Germany: EADS Astrium, Eurocopter, Funkwerk Avionics, EADS Defence & Security;
 - France: EADS Astrium, EADS Astrium Services, CNES;
 - Italy: IAI and Tele+Italia;
 - Portugal: Critical Software and Skysoft;
 - Spain: GMV and GMV Sistemas;

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MAGES User Requirements Capture Process



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Emergency Management User Groups Outline

- **Mainly public institutions & authorities**
 - (Health Ministry, Ministry of Interior, Ministry of Defence, Search and Rescue)
 - Represent the dominant players in the segment.
 - These are also involved in the regulation, definition, purchasing and the use of positioning systems and navigation equipment.
- **Also many private disaster relief organisations & service providers**
- **Several levels of organisations with distinct roles:**
 - Policy level organisations
 - Risk assessment level organisations
 - and Operational level organisations.
- **Operational Level is primary focus of project MAGES**
 - Directly applicable to GNSS applications and respective User Requirements.

EM User Groups Definition (1)

■ Fire Brigades

- Address various types of emergency (Fires, Road Accidents, etc.) & operate across various environments (including deep indoor, urban and rural scenarios)
- Key priorities are Fast response time & Safety of fire personnel within the hazardous environment in which they operate

■ Health Services

- Services very fragmented & decentralized in most states
- Intervention time delay generally most significant element driving requirements. Time delay reduction methods include:
 - a) decentralized service;
 - b) modernize service, increasing intervention efficiency through application of fleet management concepts

EM User Groups Definition (2)

■ Police Forces

- Factor driving requirements are need for improved operational efficiency and effectiveness of deploying resources
- Major concern is safety of staff, including security of information about staff and operations.

■ Helicopter Search and Rescue

- Main requirements drivers are to be able to safely conduct operations in challenging metrological conditions and environments

■ Disaster Relief

- Main additional priority is to promote close cooperation between services and agencies (complex interrelationships between international, regional or national institutions and NGOs)
- Requirements drivers include facilitation of communications and standardisation of equipment or interfaces

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Emergency Navigation Applications (1)

■ Route Guidance and Optimisation

- presentation on personnel and vehicle platforms of navigation guidance

■ Fencing Areas at Risk

- establishment of specific geographic areas where an alert is provided to the resource upon approaching or entering

■ Situational Awareness

- providing awareness to individual resources of the surrounding resources, features and hazards.
 - This application essentially presents to individual platforms information typically only available today at central command facilities.

■ Resource Management

- coordination and management of resources both in preparation for, and during EM scenarios
- Necessary role of central command facility to perform the management functions of resources under its remit

Emergency Navigation Applications (2)

■ Alarm Call

- Alarm Call consists of alarms (emergency calls) tagged with location information to assist in response to emergency situations
 - Alarm triggered by EM personnel (e.g. police officer). Location provided to C&C centre (or other resources) which determine and action appropriate response (*Focus of this work*)
 - Emergency calls (E112) made by public. Location of call provided by mobile network operator to Public Safety Answering Point (PSAP) which relays information to appropriate services – (*Not the focus of this work*)

■ Feature Mapping

- Feature Mapping concerns active mapping of features, risks or targets by EM resources in order to assist in operational coordination and planning during incidents

■ Helicopter Operation and Guidance

- concerns the utilisation of GNSS for helicopter navigation in performing EM operations
- only applicable to helicopter platforms - places distinct demands on requirements

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Navigation Requirements of Fire Brigades (1)



	Accuracy	Integrity		Availability / Continuity	Applications
		Alarm Limit	Time to Alarm		
Vehicle Urban	15 - 20m	25m	20s	99.5%	Route Guidance and Optimisation & Fencing Areas at Risk
Handheld Urban	10 - 20m	20m	20s	99.5%	
Handheld Indoor	5m	5m	6s	99.5%	

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Navigation Requirements of Fire Brigades (2)



	Accuracy	Integrity		Availability / Continuity	Applications
		Alarm Limit	Time to Alarm		
Vehicle Urban	10 - 15m	10m - 15m	12 - 20s (60s) ¹	99% (95%) ¹	Situational Awareness & Resource Management & Alarm Call & Feature Mapping
Handheld Urban	5 - 10m	5m – 10m	12s (60s) ¹	99% (95%) ¹	
Handheld Indoor	5m	5m	6 - 12s	99%	

¹ for Feature Mapping Application

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Specific Delta Requirements for Other User Groups – Navigation (1)

	HELICOPTER	(LAND) VEHICLE	HANDHELD
Different Requirements	Accuracy: 20m(H) 20m(V) Alarm limit: 30m TTFF: <60 s	Accuracy: 10m(H) 10m(V) Alarm limit: 10m TTFF: <20 s	Accuracy: 5m(H) 5m(V) Alarm limit: 5m TTFF: <20 s
Common Requirements	Integrity (TTA) : SoL (< 12 s) Continuity: High Availability: > 99 %		

Specific Delta Requirements for Other User Groups – Navigation (2)

- Differences requirements of both Emergency Alarm Call and for Fencing Risk Areas for different User Groups
 - Police and Fire Brigade requirements found to be rather stringent:
 - 5m positioning accuracy
 - All other EM groups had less demanding identified needs:
 - 20m positioning accuracy
- Assumed to be consequence of operationally different demands from different services – Police and Fire Services potentially more likely to encounter situations where the users' health or even life may be under immediate threat (criminal actions / evolution of fire emergency)

Specific Delta Requirements for Other User Groups – Security (1)

- The Police services identified more demanding security requirements than other EM services
- Security needs for Information Management
 - “Very High” for Police services, whereas “Medium” for other services
 - Concerned with factors such as ensuring that only authorised personnel get access to information about (active) police operations
 - Need to block criminal access to this info
 - Impacts primarily the comms mechanisms used - e.g. encrypted radio channels
 - Related need: manage communications devices so that
 - (a) they don’t fall into criminal hands, and
 - (b) if they do then can be removed from the service group

Specific Delta Requirements for Other User Groups – Security (2)

- Vulnerability to jamming and/or spoofing of navigation signals
 - identified as important for Police services
 - not considered such by other groups addressed
- May be reflection of:
 - Greater awareness of system vulnerabilities by Police
 - Police likely to have to deal with emergency situations where criminals may seek to deliberately disable their navigation capabilities in order to weaken their operational effectiveness.
- Converse situation:
 - Can be occasions when Police forces wish to disable the navigation capabilities of criminals whilst retaining their own navigation service

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Benefits to Emergency Management that may derive from the introduction of European GNSS

- Today's baseline performance for navigation systems in emergency management provided by:
 - GPS
 - map-matching
 - dead-reckoning techniques
 - and low-end INS
- Facilitate, de-risk or otherwise aid a wide variety of applications in Emergency Management, and are user by all User Groups

Benefits to Emergency Management that may derive from the introduction of European GNSS

- Galileo & EGNOS will complement existing GPS-based Systems
- For some EM applications this will bring navigation system performance up to (or closer to) that desired by users, whilst in other cases the improvement is the facilitator for new applications
- Specific benefits include performance enhancement
 - Accuracy improved
 - Availability (& continuity) improved; dramatically so in Urban environments
 - System Integrity introduced
- And introduction of security features (Galileo PRS)
 - Added protection against spoofing
 - Robustness against interference and jamming
 - Enables more dependence to be placed on applications; facilitates use in more critical operations

Benefits to Emergency Management that may derive from the introduction of European GNSS

- But ... not all requirements can be met by GNSS services.
 - Notable problem environments: Indoor & deep urban
- Integration with existing and future alternative technologies will be required if applications are to be fully realised in these operational environments.
- “Ultimate benefits” obtained through the integration of navigation services with other systems and services
 - Many Applications call for increased Communications capacity (e.g. to relay imagery)
 - Updated Geographic Information Systems needed at central facilities (& relayed to mobiles)
 - System integration: updates required in many cases to introduce new applications
 - Hybrid positioning: needed to cost-effectively & reliably navigate indoors



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Conclusions

- This talk presented navigation requirements applicable for Emergency Management
 - Some requirements common across many EM User Groups
 - Other requirements are specific to particular User Groups or very different for one Group than for others
- Improved GNSS will bring benefits to users that can facilitate certain new operations and enhance performance for others
- But improved GNSS alone will not be sufficient to derive full potential benefits for many identified applications.
- Changes in operational practice, culture and training probably needed to effectively introduce many new applications
- Introduction of certain services may require approval from external bodies (e.g. for airborne platforms) or from central government

A satellite with two large solar panel arrays is shown in space. The Earth is visible in the upper right corner, showing blue oceans and white clouds. The background is a dark field of stars.

Thank you for your attention Any Questions?

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