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ASSIST

Alpine Safety, Security & Informational Services and Technologies

Specific Targeted Research or Innovation Project (STReP)

Sixth Framework Programme

Aeronautics and Space Priority

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Publishable Final Activity Report

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List of Abbreviations

AED	ASSIST End Device
AMN	ASSIST Mobile Node
ASN	ASSIST Service Node
ASSIST	Alpine Safety and Security Information Systems and Technologies
CAP	Common Alerting Protocol
CSW	Catalogue Service for Web
DMZ	De-Militarized Zone
EO	Earth Observation
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
MCB	Multi-Communication Box
OGC	OpenGIS Consortium
PAN	Personal Area Network – Bluetooth Profile
PDA	Personal Digital Assistant
SAR	Synthetic Aperture Radar
UML	Unified Modelling Language

1 Project Execution

1.1 Background

Natural disasters are problems that occur regularly in alpine regions, posing a major threat to the safety of settlements, tourists and traffic infrastructures. An increasing numbers of rock falls, mud slides, avalanches, floods and windfalls in recent years have shown that natural disasters may even strike areas that have generally been considered as safe.

These developments make it necessary to implement and improve safety measures, such as prevention activities and early warning / event driven systems, to enhance the communications infrastructure for rescue actions in case of a crisis. Simple, safe and fast communications routes and emergency-oriented information structures facilitate the deployment of mountain rescue, fire fighters, civil defence forces and other rescue organisations. In addition, decision support for space-related integral risk management must be provided in order to safeguard an adequate, sustainable use in Alpine regions. Hazard mapping and monitoring and risk classification provide essential decision support for adequate rescue operations in this context.

The vision for the future is that space technology-based methods such as EO Data can provide a significant contribution to solve these problems. Web based information systems including 2D and 3D visualisation technologies and mobile systems including Global Navigation Satellite Systems (GNSS), for example, assist rescue teams to determine their position and navigate in difficult and unfamiliar terrain even under bad weather conditions and support co-ordination with an emergency centre. Satellite communications systems can provide an important contribution to efficient and safe communication between the rescue teams in the field and the management centre especially in areas with no / limited / damaged communication infrastructure.

Remote sensing methods can be used to assess the conditions and development of alpine regions (deforestation, calamities, erosion damage, path construction, assessment and monitoring of surface deformations, mass movements, etc.). Geographic Information Systems (GIS) in combination with remote sensing data and other spatial information such as geological maps or digital elevation models are powerful tools to assess the hazard potential and vulnerability of a region.

1.2 Objectives

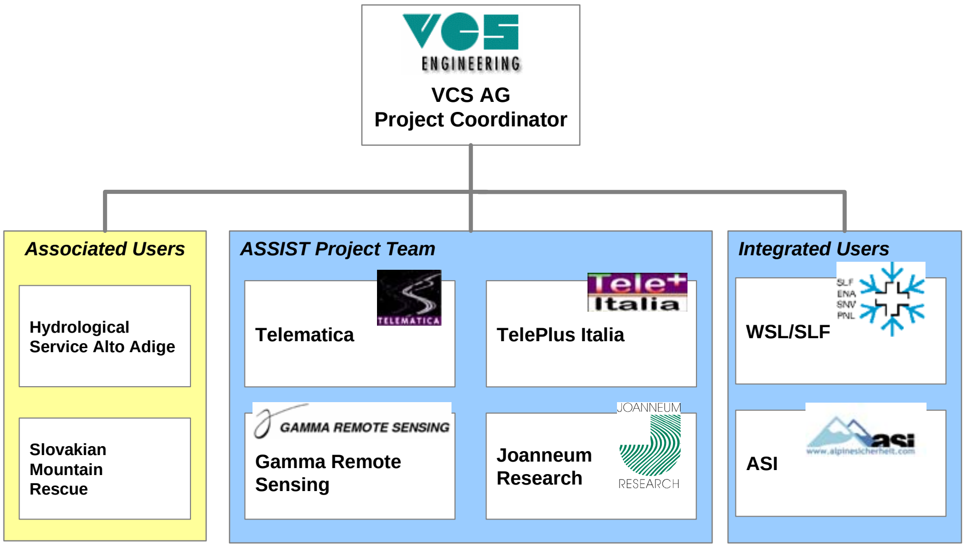
The ASSIST project is driven by the following overall objectives

- to assess and demonstrate, in how far state-of-the-art technologies like high-resolution earth observation techniques or Global Navigation Satellite Systems (GNSS) can be used to improve natural disaster management in mountainous regions
- to involve users operating pre-cursor services in the context of mountainous risk management in the requirements definition and results assessment of the project
- to open the way to (pre-) operational risk management services benefiting from the additional information available through the technologies assessed and demonstrated within the project
- to adapt to –where existing- available standards in order to ease the information exchange across different organisations involved in crisis management. In cases, where no standards exist, to support in the scope of the project the standardisation process.

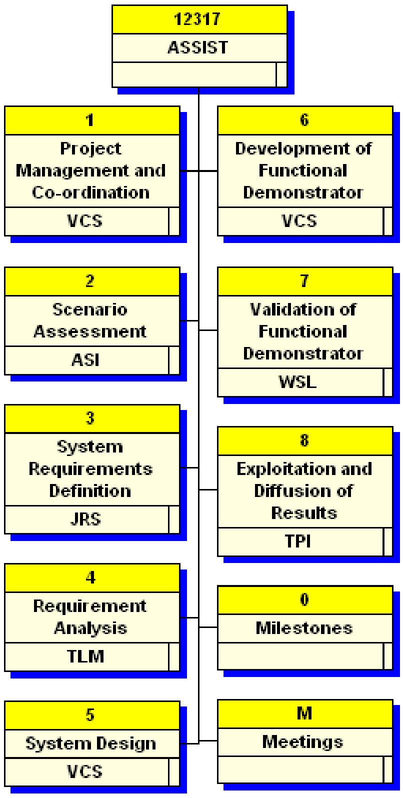
The final vision behind the ASSIST concept is the operation of different autonomous services, with a maximum feasible extent of automation for routine tasks, providing their users with the necessary data and exchanging, where needed in a seamless way data with other services.

1.3 Project Consortium

To benefit from the experience of organisations involved in risk management, the ASSIST consortium comprises of technology partners and “Integrated Users” providing input to the scenario and requirements definition. Further “Associated Users” were invited to participate to internal project reviews and to provide feedback and input to the documentation generated in the course of the project. The selection of both Integrated Users and Associated Users was performed with the goal to maximize the geographical coverage. With the set of users involved, now the countries Austria, Switzerland, Italy and Slovakia are covered. The following figure shows the organisations participating in the ASSIST project.



1.4 Approach



The overall project is split into eight top-level work packages. The work packages 1 (Project Management & Co-Ordination) and 8 (Exploitation and Diffusion of Results) span along the whole project duration, while the other work packages follow a waterfall lifecycle. The cost considerations performed in work package 4 were the basis for the go-ahead decision for the further development.

As methodology for the complete system design UML was used, starting from use case definitions, and further employing component decomposition, class models and deployment diagrams.

The main driver for the design was the compliance to existing standards, were available, because a lack of standardisation was perceived as a major barrier for seamless, when the project started.

Development was performed using standard up-to-date programming languages (C++, JAVA, scripting languages) and standard tools.

1.5 Activities Performed

Within work package 2, the Integrated Users have identified risks and scenarios, which are possible candidates for processes to be supported by the expected enhanced technologies. From the overall set of scenarios identified the most promising subset has been selected on an internal project review. For this subset of scenarios the Integrated Users have established user requirements. Further, the regulatory constraints, the Integrated Users have to consider, have been documented as input to the further specification process and a test area for the later demonstrator has been defined, as shown in the following figures.

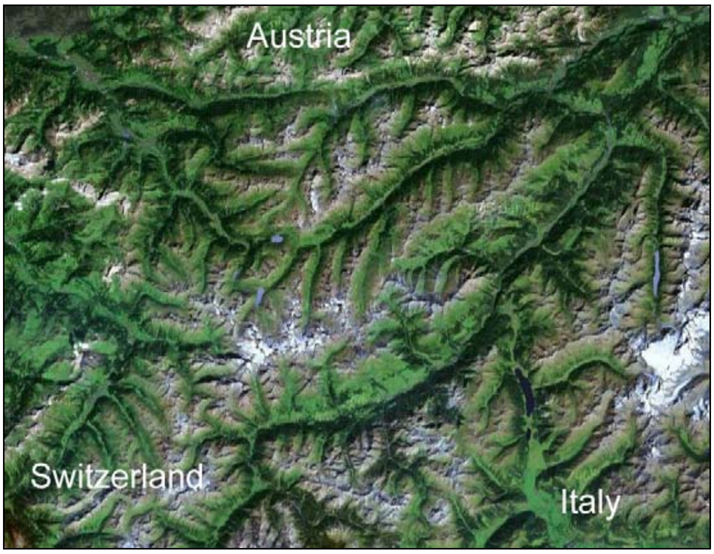


Figure 1: ASSIST Test Area around the border triangle of Austria, Italy and Switzerland

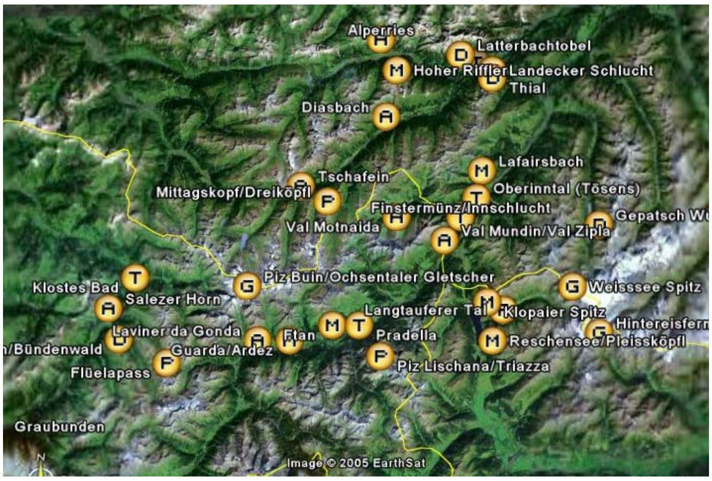


Figure 2: Natural hazard process areas (“hot spots”) in the test area

The marked “hot spots” identify the occurrence of natural risks as follows: G: Geological movements; P: Permafrost; D: Debris flows; T: Torrential floods; A: Avalanches; F: Forest fire. (Satellite imagery by Google Maps/Earth Sat)

Within work package 3, the technology partners within the consortium have translated the user requirements into a set of technical system requirements and a preliminary top-level architecture has been established. The establishment of system requirements has been performed along a set of 6 selected scenarios to be supported, namely:

- Scenario 1 – Support to Avalanche Position and Extend Determination
- Scenario 2 – Support to Snow Humidity Mapping
- Scenario 3 – Support to Landslide Forecast and Detection
- Scenario 4 – Support to Torrential Flood Warning
- Scenario 5 – Optimized Data Distribution for Crisis Management
- Scenario 6 – Inter-Node Information Exchange

Further, possible EO data sources as input to products, which may support alpine risk management, have been assessed for their usability in terms of availability, resolution and coverage. The results have been documented in a “System Requirements Document” (D3.1).

Concurrently, the integrated users have described their regulatory constraints, which may impact the design of a functional demonstrator, in terms of legislative obligations, data confidentiality, etc. These constraints are documented in the “Description of Regulatory Constraints” (D3.2).

The results of the preceding work packages has been used as input to the Requirements Analysis (WP4), where the established system requirements have been assessed in detail and split into requirements

- feasible to implement according to the actual possibilities and thus applicable to the development of the functional demonstrator and
- desirable/necessary for a later operational service, but not yet feasible to implement (e.g. due to lack of availability of data, or due to missing standardisation).

Further a cost benefit analysis has been performed in order to provide range estimations of cost necessary to run a future operational service. The results of this work package are documented in a “Cost Benefit Analysis” (D4.1) and a “Requirements Consolidation Document” (D4.2).

Based on this consolidated requirements baseline, the design and implementation of a functional demonstrator have been performed. The functional demonstrator comprises of three major components, namely:

- an ASSIST Service Node, being the central of data ingestion and exchange, providing data routing and archiving, as well as the interfaces to data suppliers, external data processors and other service nodes for data exchange within the ASSIST network
- ASSIST Mobile Nodes, supposed to support co-ordinating people in cases of event management
- ASSIST End-Devices, handhelds used by mobile in-situ staff both to provide information to this staff in crisis management situations, but also used to transfer in-situ observations from this staff in both crisis management and prevention situations.

The following figure shows the top-level context overview of the developed functional demonstrator.

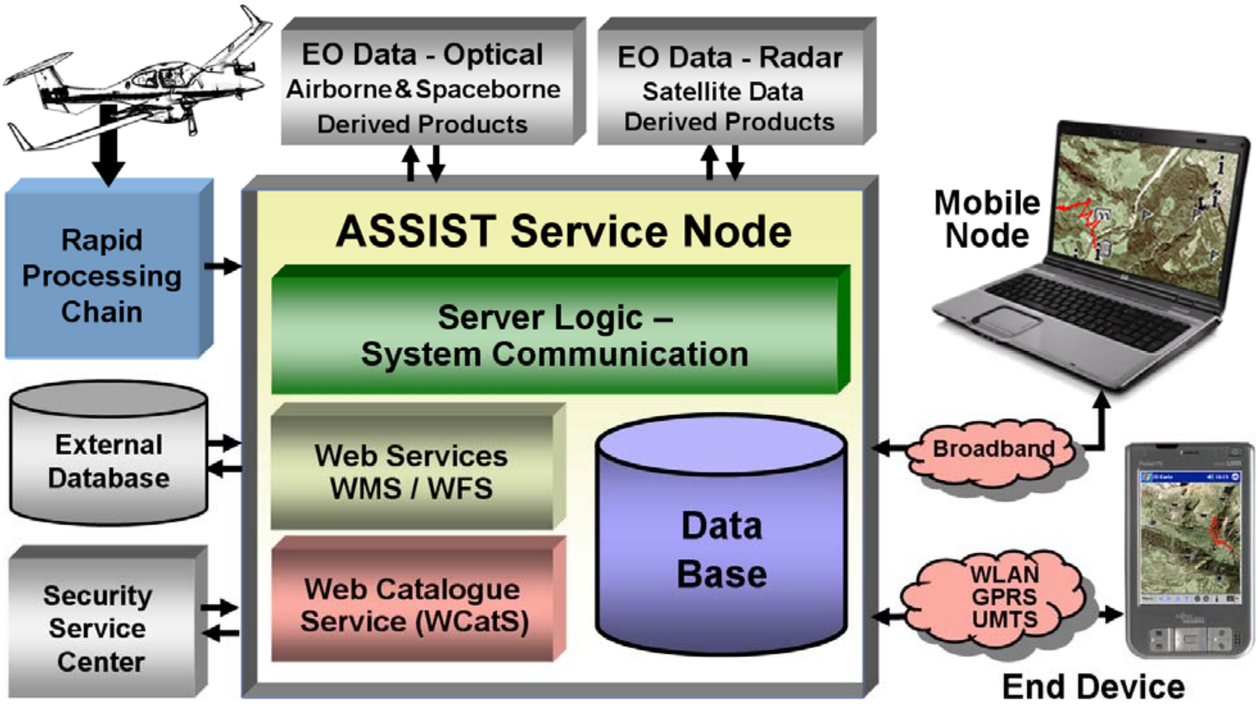


Figure 3: ASSIST Demonstrator Overview

The validation of the demonstrator has started in February 2007 with a long-term test to prove the functionality for product import and exchange. Products which were provided by the partners with EO data processing capabilities (i.e. Joanneum Research and Gamma Remote Sensing), were fed into the ASN hosted at VCS together with corresponding metadata along the OGC definitions.

In parallel to these import tests, the partners involved in the product processing algorithms for crisis prediction and management services performed the validation of the developed algorithms. Algorithms for the following purposes were developed / enhanced:

- Quickbird Data Processing for Landslide Susceptibility
- Avalanche Outline Mapping by SAR Imagery
- Snow Cover Mapping by means of ASAR Data
- Alpine Landslide Survey and Monitoring with Interferometric SAR Techniques

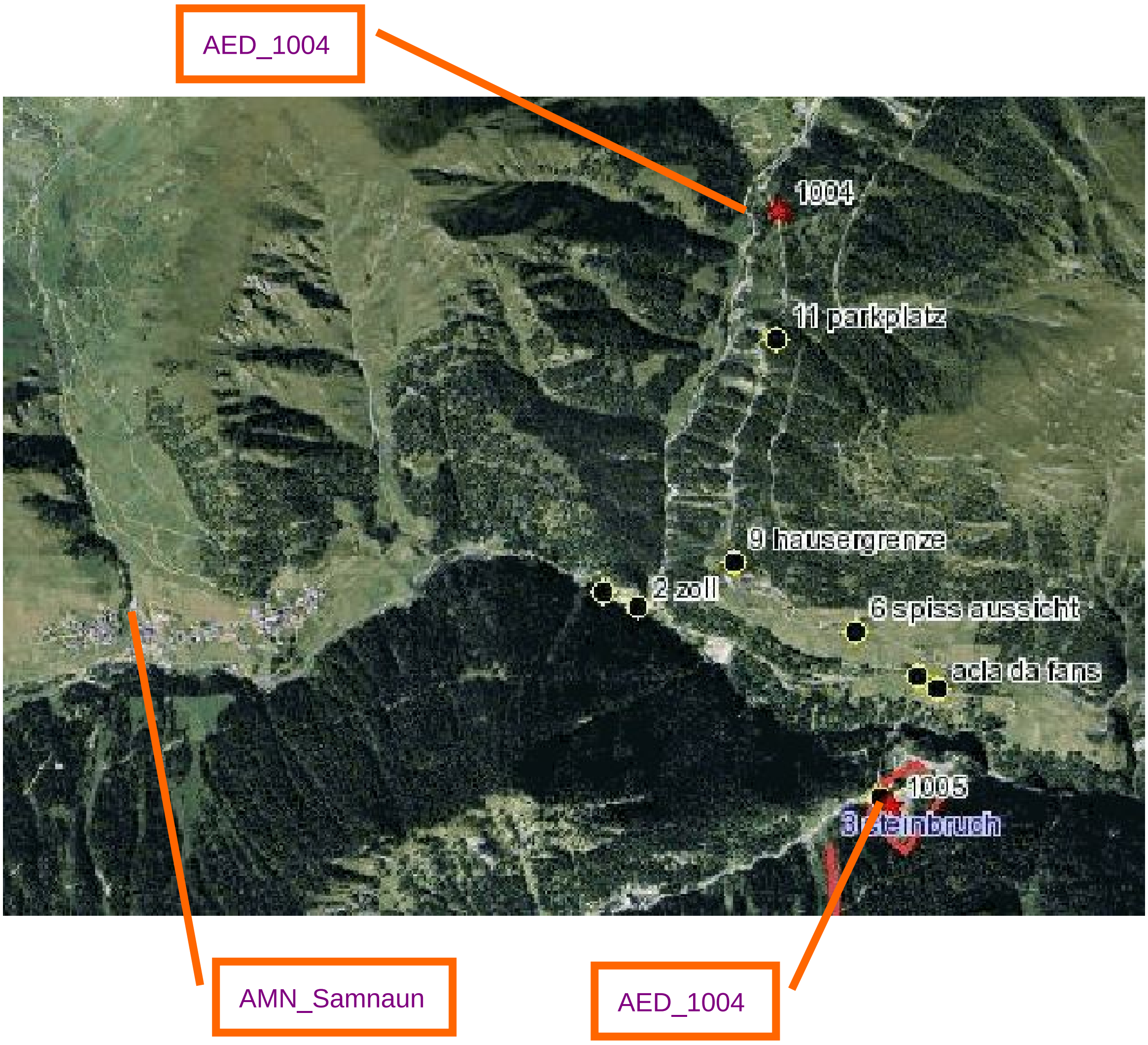
In April/May 2007 tests covering the mobile communication and the tracking of end devices were conducted at VCS premises (due to the complexity of the mobile communication infrastructure, these tests were anticipated before moving to the designated alpine test area).

After demonstrator readiness review had been achieved, the tests in the designated test area had to be prepared and co-ordinated with the Integrated Users attending the tests and demonstration. The In-Field Tests were finally performed from 12.06.-14.06.2007.

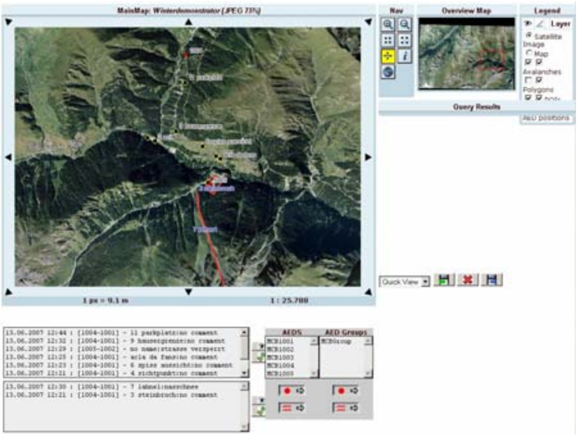
During the test in the Samnaun area two AMNs were used. One was located in the Davos SLF headquarter, the other one in the base station office of the funicular of Samnaun. Both locations have good DSL-grade Internet access.

The ASN was running in the Bochum VCS premises in the DMZ. The FOS I/F server was located in the TPI premises in Bozen.

Two AEDs combined with one MCB each were used for mobile use.

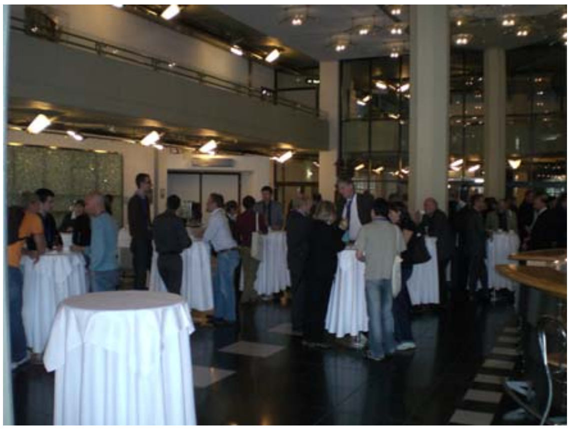


The following figures show a subset of screenshots and photos taking during this in-field validation campaign.



During the complete project lifecycle, dissemination activities were performed to promote the intermediate and final results of the project by the following means:

- A project web-site under www.assist-gmes.org
- Papers and presentations at various conferences (for details please see D8.3)
- The presentation of a video trailer during the Berlin Airshow 2006
- Presentation of the final results at the conference "Managing Alpine Future" from 15.-17.10.2007 in Innsbruck with more than 300 participants




1.6 Results Achieved

1.6.1 Harmonization of Ingestion and Access to EO Data Products

With the established concept of metadata handling along the OGC specifications, the integration of different kinds of products has successfully shown to be feasible. A variety of different products from optical and SAR sensors (both space-borne and air-borne), as well as derived products as e.g. line plots can be handled by the ASSIST demonstrator.

Also the standardized web-based way of querying the archive and accessing the archived via an OGC compliant catalogue service for web (CSW) could successfully be shown. It was however encountered, that the OGC standardization seems to be ahead of implementations in the market. At time of starting the implementation the open source "degree" catalogue service seemed to be the only implementation of an OGC compliant CSW. In the version, which was actual when starting the development, this product showed however a couple of minor bugs, which hampered integration into the ASSIST demonstrator. It is however expected, that these problems will be solved in future versions, and that other products implementing OGC Catalogue Services for Web will become available. With this perspective also the access to remote catalogues will be fostered as several providers of EO data are actually in the process of adopting their previous proprietary catalogue access methods to these standards.

1.6.2 Integration of Mobile Communication

The integration of mobile communication has provided some major challenges to the project, as mentioned above. One reason for the problems was certainly the majority of newly developed or adapted components from three technical partners, which had to be integrated to provide the full end-to-end communication.

On the other side also the mobile devices' hardware/operating system provided some problems. The used Windows Mobile PDAs (which is de facto the only operating system for PDAs with a market share justifying the selection) does e.g. not provide a Bluetooth stack supporting the Bluetooth PAN profile needed for TCP/IP based communication over Bluetooth. As solution to this problem a series of open source Bluetooth stacks were tested, until a stack was found, which worked on the rugged PDAs procured for this project. Even after that problem was solved, it figured out during the communication tests, that the Bluetooth connection between PDA and MCB encountered spurious interruptions, that could not be traced.

Also the long chain of communication end-to-end from PDA via MCB, via (Globalstar Server in the case of satellite communication), via FOS, via ASN, to AMN increased the number of interface and link problems.

As lesson learned from this exercise (and considering the general enhancements in mobile communication since the design of the ASSIST demonstrator started), for an operational system, different means for connecting mobile field staff to central sources of information would be considered, as e.g. PDAs with an integrated WLAN interface, that connects to a set of rugged WLAN access points spanning up an easily deployable WLAN network for emergency operations.

Such a rugged access point could provide e.g. high bandwidth connectivity via DVB-RCS or other satellite services with return link capability to the ASN directly.

Other technologies as e.g. WiMax or TETRA could as well be considered to provide the connection to mobile field staff, given the corresponding interfaces are integrated into the portable device.

1.6.3 Handling and Acceptance of Mobile Devices for In-Field Staff

The market for rugged PDAs is not that wide compared to standard PDAs. In order to cope with harsh outdoor environment conditions, a rugged version based on the Fujitsu Siemens PocketLoox device was selected. The rugged version provides

- Shock Resistance acc. to MIL810F (i.e. 26 drops from 122 cm height onto concrete)
- Water Resistance acc. to IP65 (only as long as the seal on the microphone hole is mainainted, otherwise acc. to IP54)

Further a specific battery pack was used providing supply up to 12,5 hours.

In practical handling it showed, that the PDA can only be recharged, when a part of the closure is removed by means of tools, which hampers practical usage. During outdoor tests and demonstrations, it showed further, that the display reflectance hampers the view to the data. This could be overcome by particular foils or other means to enhance the display.

In general the ergonomics is always a trade-off to the size of a device. Although in the design of the PDA application care has been taken to minimize the need for using the stylus, this cannot completely circumvented (e.g. to mark POIs or to enter text messages). It is expected, that with further feedback and iterations of the PDA GUI, the ergonomics for the use in field can be optimized to the users' needs.

Another topic concerning usability is the size and weight of the MCB. It is expected, that carrying the separate MCB in a back pack is acceptable to routine outdoor operations. In emergency and rescue operations it is expected, that another solution has to be found, in order not hamper the in-field rescuers in their core tasks.

1.6.4 Use of SAR EO Data for ASSIST Objectives

The avalanche map as well as the snow cover map are in good agreement with validation data and are produced on a regular base using C-band satellite data.

Limitations of the products are due to the observation geometry, repeat time, and the wavelength of the available radar systems. For the improvement of the presented products and the development of new products the proposed CoReH2O mission is of particular interest. With its 2 frequency ScanSAR and at a repeat rate of 3d (Phase 1) and 15d (Phase 2) it will become an important source for new cryosphere related applications.

Due to the higher frequency the system is much more sensitive to the snow structure than the current C-band satellites and the concurrent measurements at 2 frequencies allows to be sensitive to different structure sizes and with different penetration depths at the same time. Modeling and the sparse data available at these frequencies prove the potential.

A lack of concurrent reference data of snow at 9.6 GHz and 17.2 GHz with proper ground information was identified. The lack of reference data is a major constraint for model development and validation as well as for application development. It was stressed that the characterization of the snow cover needs to be reproducible and feasible in the field. Unfortunately the widely used snow characterization is not well suited to map the relevant structural parameters for the scattering. A promising description of the snow structure is by using the correlation length. Unfortunately, the correlation length is not easy to measure in the field. Recent developments allow to overcome this limitation, providing tools to determine the vertical snowpack layering at very high resolution using a micro penetrometer and the SSA (and therefore the optical grain size) by means of a NIR camera. SnowScat, an ESA funded project, is setup to address the need for simultaneous X- and Ku-band scattering information of well characterized snow. It is planned to build a coherent X- to Ku-band scatterometer and conduct a joint radiometric and physical snow campaign taking into account the recent advances in snow characterization.

The two applications developed in the scope of the ASSIST project work with current SAR systems and are quite robust. However for both products limitations remain. Avalanche mapping is difficult on slopes because of layover and foreshortening.

Furthermore the degree of visibility of the avalanche depends also on the avalanche type. Dense or wet snow gives a stronger change in signal than dry snow avalanches. The snow cover map is very reliable for the isothermal state of the snow pack. During the period when the snow thaws during the day and freezes again in the night, the time of acquisition is important. For the ASSIST test area the acquisitions at about 9:30 and 22:00 are not ideal.

The methods to support landslide survey and landslide monitoring are based on differential SAR interferometry and interferometric point target analysis.

Both technologies proved to be well suited. The strong topography in the area under investigation is challenging and needs to be addressed. Both landslide survey as landslide monitoring benefit from the availability of precise height information. In both cases it was possible to receive a more robust processing and product quality through the use of a height dependent atmospheric model. Results received are in good agreement with existing information. For further validation in-situ information is needed.

1.6.5 Use of Optical EO for ASSIST of Objectives (Landslide susceptibility analysis)

The landslide susceptibility analysis using univariate statistical models is a complex and sensitive task. The selection of appropriate input parameters and representative training data sets are crucial for the successful application of any model. The resulting quality of the applied functional models is directly dependant on the quality of the inputs in terms of spatial resolution and classification accuracy. In order to fulfil these requirements it was a major task to look for the best data sources available. The use of QuickBird data was an excellent choice in a series of possible spaceborne remote sensing data due to its very high spatial resolution. The classification of QuickBird data proved to deliver statistically accurate landcover results, which later have been integrated as variables in the susceptibility analysis. Additionally, a ‘pseudo-stereo’ image was generated from the QuickBird satellite image which has shown to be very useful for the visual interpretation of landslides in a time- and cost-saving manner.

The development of automatic and semi-automatic tools for a fast and cost-efficient derivation of these variables has to be considered as a step further. It can be stated that the surplus of the above described investigations can be used for summer risks as well as for winter risks. The extent of forest, the occurrence of gaps as well as the curvature in the terrain are, for example, also important information for avalanche analysis. In this context it has to be emphasized that the delineation of the upper forest border is very important in mountainous terrain and a key element in the generation of the forest mask. Until recently the delineation of the upper forest border was a cumbersome work based on field work and/or aerial photo interpretation. In this investigation an algorithm was developed to derive it from QuickBird data automatically on a very high statistical accuracy, and this can be considered as an important step for alpine related investigations.

Another excellent data source was the incorporation of LiDAR data from a flight campaign initialised during the course of the project by the local government of Tyrol. It could be demonstrated, that the different qualities of the used DTMs are clearly discernable in the final susceptibility maps. Although the difference in the overall statistics is only moderate, it is recommended to use a DTM with the finest resolution available, in order to pinpoint the hazardous spots in detail.

The applied statistical model for landslide susceptibility could not yet be evaluated in real situations, since no recent landslides within the study area have occurred during the lifetime of the project. Up to now the only possible way for its evaluation was to focus on the approach encompassing a model-development area and a model-evaluation area. This test showed that the model is not unrestrictedly transferable. However, the results computed from the “weights of evidence model” showed a realistic distribution of the classes according to the experience from the field campaign and the knowledge on prior hazardous events.

It can be concluded, that the anticipated goals of Scenario 3 are successfully realized on a high technical level, yielding excellent results from new remote sensing data sources. The transfer of the derived models to other regions was tested, but could not be performed successfully during this project. Reasons can be found in the general sensitivity of the models and in the regional specifications. More investigations are needed in the context of model development, which was not part of this project. Future research needs in this field can be seen in the development of tools for automatic extraction of buildings, which is important in vulnerability and risk analysis.

1.7 Conclusions

Although the ASSIST project has successfully reached all its objectives and provided a proof-of-concept for the benefits of a harmonized exchange of EO and terrestrial data for crisis management, a couple of tasks remain to be further elaborated to pave the way for an operational use of such concepts.

Due to cost, limited availability and missing timeliness, the high-resolution EO data as needed for observations of events with limited extent will not solely be sufficient as input data to crisis management decisions. They have to be complemented by terrestrial or ad-hoc air-borne observations. Although the combination of data from several sources has successfully been demonstrated, there are other data sources, which could not be integrated in the constraints of the project. This refers for example to the integration of slope monitoring systems based on differential GPS. Here first contacts to providers of such systems have been established, the technical implementation of such an interface was however beyond the project scope.

Further security questions and questions concerning access rights could only partially be covered in the project. It is obvious, that data in the scope of crisis management have (at least partially) a high degree of sensivity. The exchange of data has to be secured and the non-repudiation has to be assured. The technical means are available; there are rather organisational issues to resolve. Questions as “Who defines the access rights to data provided by a crisis management organisation?” have to be addressed. Here it is expected, that the INSPIRE initiative will be beneficial to address these issues.

There is also a lack of standardisation on the technical side (product formats, product request procedures), although during the project execution time, it has shown, that more and more data providing organisations are about to adopt the available standards. E.g. EUMETSAT as the central European provider of meteorological data is in the process of modifying their catalogue system towards OGC-/ISO-compliance.

Finally there are also usability issues to be addressed and resolved. As mentioned above, there is always a trade-off between size and weight of a mobile device and its ergonomics in use. In the scope of ASSIST, there is also the harsh outdoor environment to be considered. Standard PDA devices like the ones used in the ASSIST demonstrator pay off concerning size, weight and (when ruggedized) the harsh environmental conditions, they are however not optimal concerning ergonomics. To provide e.g. rescuers in field with the optimum information they need, without distracting them from their main task by using their information device requires certainly further work in hard- and software development.

2 Dissemination and Use

2.1 Exploitable knowledge and its Use

This section presents exploitable results, defined as knowledge having a potential for industrial or commercial application in research activities or for developing, creating or marketing a product or process or for creating or providing a service.

2.1.1 Structure Definition Language & Corresponding Code Generator

The Structure Definition Language with the corresponding code generator developed by VCS allows defining almost arbitrary structures for data files and protocol packets. The corresponding code generator allows the automatic generation of C++ classes to provide read/write access to the separate sub-structures. This component is laid out for further use within successive activities. It is not intended to market this as a product.

2.1.1.1 Possible Market Applications

Not intended for marketing, but for re-use in future research and commercial projects.

2.1.1.2 Stage of Development

Software development is completed.

2.1.1.3 Collaboration Sought or Offered

None.

2.1.1.4 Intellectual Property Rights Granted or Published

IPRs are held by VCS Aktiengesellschaft.

2.1.1.5 Contact Details

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2.1.2 Common C++ Components

Some generic C++ common components developed in the scope of the ASSIST project are intended for re-use in other projects, as e.g. components for logging, monitoring & control, file and network I/O, etc. Also these are not intended to be separately marketed.

2.1.2.1 Possible Market Applications

Not intended for marketing, but for re-use in future research and commercial projects.

2.1.2.2 Stage of Development

Software development is completed.

2.1.2.3 Collaboration Sought or Offered

None.

2.1.2.4 Intellectual Property Rights Granted or Published

IPRs are held by VCS Aktiengesellschaft.

2.1.2.5 Contact Details

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2.1.3 OGC-compliant Archive & Catalogue service

2.1.3.1 Possible Market Applications

It is envisaged to continue the development of the archive and catalogue service to obtain a marketable software product addressing industrial and public sector customers maintaining EO and other data with geo-graphical relevance and intend to comply to open standards.

2.1.3.2 Stage of Development

This result is in prototype status.

2.1.3.3 Collaboration Sought or Offered

Collaboration is sought in the possible customer base (industrial or public sector) to obtain further input in terms of requirements to the future development.

2.1.3.4 Intellectual Property Rights Granted or Published

For the results of the work on the catalogue performed by VCS, VCS holds the IPR, the underlying deegree catalogue service framework is subject to the Lesser GNU Public License (L-GPL) of the Free Software Foundation (http://www.fsf.org).

2.1.3.5 Contact Details

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2.1.4 Secure communication server

The Field Operations Server developed during the ASSIST project is a separate server handling the communication between the server of a central service station and mobile or local devices alternatively via GSM or satellite connection. It provides the bi-directional forwarding of information via secured connections.

It is not intended to market this as a product but envisaged to build up a service upon it.

2.1.4.1 Possible Market Applications

Not intended for marketing, but for re-use in future research and commercial projects.

2.1.4.2 Stage of Development

The development is completed.

2.1.4.3 Collaboration Sought or Offered

None.

2.1.4.4 Intellectual Property Rights Granted or Published

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2.2 Dissemination of Knowledge

The following table lists the events, which were used to disseminate intermediate and final results of the project to a broader audience.

Date	Event	Number	Audience
September 2005	Benefits from Space for Sectorial Policies For High Mountain Security, Genève, Switzerland	200	Experts and representatives of both the European Commission and the United Nations.
October 2005	BIC Südtirol Inhouse Presentation, Bolzano, Italy	250	Local and regional authorities and companies
November 2005	GeoForum Umhausen Ötztal, Austria	n/a	Geology and context related disciplines
November 2005	GMES INSCRIT Workshop on Crisis Management, Brussels, Belgium	100	Meeting for Emergency and RS specialists in the GMES frame.
November 2005	AHORN Innsbruck, Austria	100	National authorities, developers, users and technology partner in the field of Navigation, Communication, Safety Issues / Rescue Services
April 2006	EGU 2006 European Geosciences Union, Vienna, Austria	several 1000	European Geologists
May 2006	Euresearch SME meeting, Bern, Switzerland	50	SME
October 2006	ICAR (International Commission for Alpine Rescue) Annual Congress, Kranjska Gora, Slovenia	2000	Delegates from the Alpine rescue organizations, rescue specialists, rescue material firms
August 2006	International Disaster Reduction Conference (IDRC), Davos (Switzerland). Presentation of ASSIST project	500	International Representatives of NGOs, Governmental Organisations and Industry
September 2006	Presentation of ASSIST project to DLR-DFD, Oberpfaffenhofen	10	Representatives of DLR Remote Sensing Institute
September 2006	European Disaster Management Congress, Bonn. Promotion of ASSIST project	100	Representatives from industry and governmental organisations
September 2006	Participation to eoVOX workshop addressing also future GMES services, Frascati (Italy)	200	Representatives from industry and governmental organisations as well ESA and European Commission
October 2006	Participation to “GMES bavAIRia” foundation, Munich	200	Representatives from industry and governmental organisations dealing with civil security and crisis management
November 2006	Business Trip to China, Beijing	ca. 50	Several meetings with governmental organisations and industry in the area of meteorology, remote sensing and national initiatives on risk and crisis management
November 2006	National GEOSS Workshop, Bonn	500	National Meteorological Services and domain experts in the field of Climate Change, Environmental Protection and crisis management
December 2006	Presentation of ASSIST project to ESA-ESRIN, Frascati (Italy)	20	Decision makers and qualified staff involved in GMES Services build-up
February 2007	Workshop 'Applied Remote Sensing in Mountain Regions' - European Academy (EURAC), Bolzano (Italy)	50	Representatives from industry and governmental organisations
February 2007	National information day FP 7: Presentation of ASSIST project, Düsseldorf	300	Representatives from industry and governmental organisations. PREVIEW, LIMES and other projects have also been presented
February 2007	“GMES Alpine” workshop at DLR, Oberpfaffenhofen	300	Representatives from industry and governmental organisations. PREVIEW, LIMES and other projects have also been presented

Date	Event	Number	Audience
April 2007	Brussels Information Day on GMES and Galileo hosted by North-Rhine Westphalia. Presentation of Assist project and lessons learnt	50	Representatives of European Commission and International Industry
April 2007	Presentation to GSW members, Bonn	200	Representatives from industry and governmental organisations dealing with civil security and crisis management
May 2007	Presentation to GALAHAD consortium, Bellinzona (Italy)	50	GALAHAD Consortium members
June 2007	Biennial Conference of the working group of the European Avalanche warning services. High Tatra, , Slovakia	~ 50	Organisations involved in Avalanche forecast and warning. Avalanche specialists
June 2007	GMES Alpine Working meeting, Bozen (Italy)	20	Internal meeting of working group
September 2007	EUMETSAT User's Conference, Amsterdam	200	National Meteorological Services and domain experts in the field of Climate Change, Environmental Protection and crisis management
September 2007	Business Trip to China incl. Visit of Satellite China Conference, Beijing	ca. 30	Highlighting ASSIST project aspects related to communication
October 2007	Managing Alpine Future (15.-17.10.): Practical Demonstration "ASSIST", Innsbruck (Austria)	100	Representatives from industry and governmental organisations dealing with civil security and crisis management

2.3 Public Deliverabless

The following table lists the public deliverables of the project.

ID	Title	Reference	Version
D1.3	Project Synthesis Report	AST-VCS-Mgt-RPT-PU-005	V1.0
D2.1	Scenario Definition Report	AST-ASI-TEC-RPT-PU-001	D0.5
D2.2	User Requirements Specification	AST-ASI-TEC-REQ-PU-002	D0.6
D4.1	Cost Benefit Analysis	AST-TLM-TEC-RPT-PU-002	D1.1
D4.2	Requirements Consolidation	AST-TLM-TEC-RPT-PU-003	D0.9
D6.2	User Manual Service Node	AST-VCS-OPS-TN-PU-000	V1.0
D6.3	User Manual End-Device Applications	AST-VCS-OPS-TN-PU-001	V1.0
D7.1	Final Report on functional Demonstrator Evaluation	AST-SLF-OPS-RPT-PU-000	V1.0
D8.3	Detailed Power Point Presentations		
D8.2	Abstracts, Full Papers, Powerpoint Presentations, Flyers, etc.		
D8.4	ASSIST Web-Site	http://www.assist-gmes.org/	-

2.3.1 Project Synthesis Reports

The purpose of this document (D1.3) is to provide a high-level summary of the project's objectives, achievements and conclusions for public use.

ASSIST aims at improving the capabilities of risk warning and risk management in the alpine region by enhanced use and integration of earth observation and other geo data.

ASSIST deals with the characteristics of these mountain areas. The goal is to provide a proof of concept for the integration and exchange of different data and hence pave the way for the implementation of pre-operational services for integrated safety and information management based on already operational crisis and information and crisis communication systems.

Considering the actual conditions for risk management in the alpine region (poor data quality at borders of responsibility, limited availability of input data in time, missing regulations for exchange of data among different organisations, etc.) the project results are expected to improve on the long run the means for risk management in mountain areas.

2.3.2 Scenario Definition Report

The Scenario Definition Report (D2.1) contains the scenario definitions for the ASSIST pilot products as collected and discussed among the ASSIST Technology Partners, Integrated Users and Associated Users.

The report defines the ASSIST test area which has been chosen considering

- Coverage of the three different countries Austria, Italy, and Switzerland, in view of the development communication systems compatible with the national and/or regional crisis management systems
- A rich natural hazard process area
- Good accessibility and availability of high level practitioners expertise with respect to possibility of ground truth assessment

Following these criteria the test area is situated between Landeck (Austria) and Davos (Switzerland).

The ASSIST test area hosts a rich variety of natural hazard process regions, interfering with settlements and tourist infrastructures, thus representing a very high risk profile. Relevant natural hazard processes, which will be covered by the selected scenarios, include

- Classical geological slope instabilities
- Slope instabilities induced by melting permafrost
- Glacier movement
- Debris flows
- Torrential floods
- Snow avalanches
- Forest Fire

Additionally, two mapping tasks have been identified and will be covered by specific scenarios as well:

- Snow pack property mapping
- Protection forest mapping

The Scenario Definition Report has been assigned the dissemination level “Public” to establish within and beyond the ASSIST project a summary of scenarios to handle by the users. It is available for download via the Public Download area of the ASSIST website.

2.3.3 User Requirements Specification

The User Requirements Specification (D2.2) contains user requirements to the ASSIST demonstrator as collected and discussed among the ASSIST Technology Partners, Integrated Users and Associated Users.

Based on the needs and priorities of the user partners (ASI and SLF) and associated users and the described characteristics of EO data (resolution, coverage, timeliness) it was agreed to assess in detail for the future work the following scenarios:

1. Avalanche Event Detection and Mapping
2. Snow Humidity Mapping
3. Land Slide Detection
4. Meteorological Data for Hydrological Forecast
5. Crisis management

Within scenario 5 nearly the same products as in the other scenarios will be used, based upon as well on demand requests and periodical delivery and for different users. Some users involved in crisis management will use mobile handsets.

The user requirements have been specified following a number of best-practise criteria and have been grouped into

- common requirements applicable independent of the scenario to be supported, assigned to
    - functional requirements

  - regulatory constraints
  - requirements concerning the integration with existing services
  - operational requirements
- and those specific to a particular scenario, divided into
  - functional requirements
  - performance requirements
  - operational requirements

Each stated requirement consists of the following components:

1. Unique Identification
2. Requirement Title
3. Requirement Text
4. Requirement Priority
5. A marker to define the end of the requirement body

The requirement priority has been divided into levels of urgency:

- Baseline
- Goal
- Target

The User Requirements Specification has been assigned the dissemination level “Public” to establish within and beyond the ASSIST project a summary of scenarios to handle by the users. It is available for download via the Public Download area of the ASSIST website.

2.3.4 Cost Benefit Analysis

This document (D4.1) describes the relation between costs and benefit in selected aspects the ASSIST demonstration and operational system. It serves the purpose to give an overview over possible cost reductions in the frame of the ASSIST demonstrator and operational system. This document covers service, communication and infrastructure aspects of the system.

2.3.5 Requirements Consolidation

This document comprises deliverable D4.2 of the ASSIST project. It has been elaborated in the scope of task 4.2 (Requirement Consolidation) within work package 4 (Requirements Analysis).

Together with its companion document D4.1 (Cost / Benefit Analysis) it contains the trade-offs performed during the match of desirable user functionality vs. cost estimations and feasibility assessments.

Within the preceding work packages user and technical requirements have been established, which were formulated partly independent of the technical feasibility and which did partly not distinguish between the envisaged functional demonstrator and a desirable operational ASSIST-alike system. Hence the purpose of this document is, to

1. Identify cost drivers perceived in the expressed requirements/wishes within the previous work packages

2. Discuss for the concerned technical requirements, to which extent they can reasonably be implemented in the demonstrator, and where are the key issues in those requirements on the transition from a demonstrator system to an operational system

2.3.6 User Manual Service Node

This document (D6.2) is the User Manual for the Assist Service Node. The manual provides installation instructions for the initial setup of a service node and instructions for the operation and maintenance of service node.

2.3.7 User Manual End Device

This deliverable (D6.3) describes the functionalities of the ASSIST Mobile End-Device considering the ASSIST winter version and has a strong correlation to the deliverable D5.3.

2.3.8 Final Report on Functional Demonstrator Evaluation

This document (D7.1) serves to document the findings and results of the test campaigns of the ASSIST demonstrator. This document has been assembled after the Demonstrator Validation Review meeting, from the test results recorded during the test campaigns, the minutes of meeting recorded during the Demonstrator Evaluation Review and other publications, etc. to provide an overall overview

2.3.9 Detailed PowerPoint Presentation

This document (D8.3) summarizes the project objectives, logic, results and conclusions in a format suited for a presentation.

2.3.10 Abstracts, Full Papers, Flyers, PowerPoint Presentation

Various of the means listed in the subsection title have been prepared and used at the various events for dissemination. These are summarized under the deliverable (D8.2).