Satellite Navigation for mountain tourism: experiences and prospective

7th Snow and Mountain Tourism World Congress
11th and 12th April, 2012
Satellite solutions

Integrated Solutions: “Transversal Integration”

Remote Sensing

Communication

Positioning / navigation

Cartography

Damage assessment

Data gathering

Alert / localisation

Secure TLC

Survey

Search & Rescue

Prevent → Foresee → Alert → Crisis → Post-crisis

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1. Satellite navigation, status and future
2. Examples of applications, services and projects for mountain environment
3. Advantages in using satellite services and future applications
Satellite Navigation

• For most of the satellite navigation mass market users the radio-localisation and the navigation is a given.
• Most of are familiar with navigation portable devices, smart phones, in-car navigation devices, etc.
• The signals from space enabling all these applications are provided by complex, sophisticated and strategic space infrastructures named Global Satellite Navigation System (i.e. the US GPS, the Russian GLONASS and the coming EU Galileo).
• Galileo is the first GNSS born for civil use while its predecessor are military system with partial civil use.
Position determination by means of 3 satellite signals

Note: a fourth signal is required for time reference
GALILEO: the system

30 Medium Earth Orbit Satellites
Altitude 23616 km
Inclination 56 deg
Period: 14 hr 22 min,
Ground track repeat about 10 days.

Walker 27/3/1
+ 3 in-orbit spares (1/plane)

Users & Service Providers

5 TT&C Stations
9 mission
Uplink stations

30-40 Galileo
Sensor Stations

3 Control Centres
Augmentation Systems
EGNOS and the others SBAS

EGNOS is an integral part of currently 3 inter-regional systems.
EU GNSS scenario 2011-2020

- **EGNOS**
  - **Now:** fully operational, 3 GEO’s, qualified and certified, OS, SoL and CS (EDAS, non SIS services)
  - Future evolution: Augmentation of GPS L5/L2 and Galileo for 2018-> (EGNOS + Galileo for future SoL services over ECAC)

- **Galileo**
  - **2011-2012** In Orbit Validation (IOV) 4 satellites 2 launches, no services provision but validation objectives
  - **2013-2014** rump-up for Initial Operations Capability (IOC or FOC1) 14 satellites 7 launches, OS, PRS and SAR services
  - **2015-2016** constellation completion Full Operations Capability (FOC or FOC2) TBD satellites (27+3 target, may be less), services full performance: OS, SoL (descoped?), PRS, CS (?) and SAR full performances
  - **2018->** Galileo Second Generation replacing S/S with new satellites and new orbits (MEO+IGSO?)
Advantages of satellites services

• Satellite communication, in most of the cases, is the only available alternative to VHF communication in the Mountain environment where traditional network are not available or fully reliable

• Satellite radio-localisation (GNSS and SBAS) is available with full performances in mountain, the only limitations comes from canyons and heavy coverage of trees

• The availability of low cost GNSS/SBAS devices allows to develop myriad of applications for tourism, environment protection and emergency management in the mountain scenarii
NavSAS, with the participation of Soccorso Alpino e Speleologico Piemontese (CNSAS) has tested on mountain environment an end-to-end prototype system based on radio communication and precise radiolocalisation for the support of emergency resources in mountain rescue events (site: Cantalupa, Piedimonte Italy)
VHF Radio device (standard for Alpine rescue team) integrated with the NAVCOM platform

Part of the rescue team has been equipped with a dedicated smart communication/localisation device

All the rescue resourcers involved during the NICE test have been equipped with this device to allow their real time tracking and interaction with the Control Central Unit
Real Time tracking and monitoring of rescue team

Example of routing and tracking of rescue Alpine team during the tests of NICE
The rescue Alpine team has fully appreciated the performance and the advantages of the NICE field demonstration:

- Simplify and speedup rescue operation while increasing safety for the team and resources involved
- Reduce the intervention time that is fundamental to save life

Moreover the central control unit is able to monitor in real time all the operations deployed on the field with automatic events/alarms management.

All these aspects are essential on difficult mountain environment with bad weather and visibility conditions.
• POP-ART (Precise Operation Positioning for Alpine Rescue Teams) is a successive evolution of NICE tests
• GPS raw data sent via VHF to the Operation Coordinator
• Data are fused with EGNOS data constantly available **Improved positioning**
• Rescuers are localized with accuracy on a digital map by Operation Coordinator
• Position is sent back to rescuer for visualization on PDA
POP-ART Architecture

Remote Terminal

Operation Coordination

VHF

Network
Precise Positioning

Wireless

Mission Control
Project Outline
Problems addressed by WalkEGNOS:

- Available maps are often not up to date and/or inaccurate.
- Professional mapping is too expensive.
- Mapping on a voluntary basis is not validated.
The solution: Social web 2.0 mapping
EGNOS Powered

www.walkEGNOS.com will follow the social network approach

- hikers and bikers will have the possibility to share theirs tracks.

A post processing EGNOS server relying on EDAS:

- collected data will be post-processed in order to improve accuracy and give quality assurance e measure and augmented and validated.

A built-in evolution toward Galileo with the sister site:

www.walkGalileo.com
An **average confidence level** is calculated for each track available on the website: the reliability is indicated by a **colour coding**.

WalkEGNOS Data Base will contain reliable routes for:

- high quality leisure/touristic services
- improved search and rescue operations
- Organisations entrusted with paths maintenance
Examples of products for Emergency civil protection

**Heli-transportable Trailer**
Multi-Telecommunication systems on board:
- Satellite SkyplexNet
- WiFi
- Simulcast system
- Gateway Radio Platform (interoperability with available Tetra/Analogical networks)
- Messages and phone auxiliary system
- 2 roughed PC portable

**Optional Systems**
- TETRA field system
- Radio Base WiMAX
- Set of Radio TETRA terminals and accessories
Innovative applications: Geo-time reference for digital camera

• Digital Photo Cameras with GNSS Receiver
• Automatic recording of where and when the picture has been taken
  – The Camera embarks:
    • Standard digital camera features
    • GPS (SBAS) compact receiver
    • Maps on compact flash memory
    • Connectivity with computers and Bluetooth GPS
Innovative applications: Geo-time reference for digital camera

- Geo/time referenced images can be processed on computers for different applications (personal use/tourism, commercial and professional use, real-estate, etc) and published on the web and GoogleEarth
Innovative applications: micro size tracking device

- GPS-GSM micro size tracker (1)
- Applications:
  - Track vehicles / pets via SMS message of a cellphone
  - Regular auto-reporting / Remoting polling / Panic button for saving you / your loved ones from danger

GPS information is sent as SMS messages from G-19 to your cellular phone by GSM wireless network.
Innovative applications:
Full Satellite personal tracking

- Personal trackers and emergency messenger fully based on satellite (positioning + communications)
- Uses GPS satellite network to acquire its coordinates, and then sending its location – with a link to Google Maps – and a pre-programmed message via a commercial satellite network. And because it uses 100% satellite technology it works around the world – even where cell phones don't.
- Additional private SAR (USA and Canada only)
The evolution of the Man Machine Interfaces

Next generation
The potential of Satellite Services for mountain environment

• New Galileo performances integrated with satellite communications and high end technologies may enable new high demanding applications:
  – Automatic guidance of emergency rescue helicopter in difficult mountain environment / weather conditions
  – Unmanned aerial vehicles guidance for:
    • Delivery of goods during humanitarian and emergencies
    • Survey/patrolling and data collection for environment protection, cadastre, GIS
  – Continues real time communications services with permanent and temporary deployed networks (transparent switch from terrestrial to satellite communication)
• Miniaturisation of receivers and full integration with other technologies (RFID, short-range wireless comm’s, satellite comm’s, Earth Observation)
**Service description**

Telespazio offers bi-directional satellite broadband connectivity services on fixed or mobile terminals supporting both “on the move” and nomadic (using portable equipment from static points) communications, which provide broadband connectivity in areas where there is no terrestrial infrastructure.

**Broadband IP applications**

- Telespazio, via its dedicated state-of-the-art platforms, provides advanced fixed and mobile solutions both in Italy and abroad, such as:
  - internet connections
  - intranet connections
  - FTP
  - email
  - web applications
  - back-ups
  - private IP networks
  - management data exchange
  - remote telephony (VoIP)
  - IPTV
  - video-conferencing
  - video communications
  - telemedicine
  - e-learning
  - remote surveillance (only with fixed solutions)
  - disaster recovery (only with fixed solutions)
  - network monitoring (only with fixed solutions)
Coverage and service performance

- Telespazio has developed different Broadband IP solutions based on different platforms, depending on the customer’s geographical footprint and needs. Telespazio manages services for over than 30,000 fixed and mobile Vsats. Fullsat is the Telespazio’s brand for the Broadband IP services.
Overview of Telespazio’s Broadband IP services

**Coverage and service performance**

- Telespazio has developed three different solutions based on three different platforms, depending on the customer’s geographical footprint:

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Grade of Service</th>
<th>Peak speed (Kb/s)</th>
<th>AAB (Kb/s)</th>
<th>IP Addresses</th>
<th>Dedicated Connectivity Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FullSAT Italia</strong> (Italian Coverage)</td>
<td>Small Office</td>
<td>3072 - 384</td>
<td>64 - 20</td>
<td>1</td>
<td>8 Mbps/ 1 Mbps</td>
</tr>
<tr>
<td>Entry</td>
<td>3072 - 384</td>
<td>128 - 20</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxi</td>
<td>4096 - 384</td>
<td>512 - 128</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FullSAT Europe</strong> (Europe and Morocco, Tunisia, Algeria)</td>
<td>Small Office</td>
<td>3072 - 384</td>
<td>64 - 20</td>
<td>1</td>
<td>8 Mbps/ 1 Mbps</td>
</tr>
<tr>
<td>Entry</td>
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<td></td>
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<tr>
<td>Maxi</td>
<td>4096 - 384</td>
<td>512 - 128</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FullSAT Middle East</strong> (Middle East)</td>
<td>IP Access 1</td>
<td>512 - 128</td>
<td></td>
<td></td>
<td>8 Mbps/ 1 Mbps</td>
</tr>
</tbody>
</table>
**Overview of Telespazio’s Broadband IP services**

## Coverage and service performance

<table>
<thead>
<tr>
<th>Grade of Service</th>
<th>Peak speed (Kb/s)</th>
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<tbody>
<tr>
<td><strong>FullSAT Africa</strong> (C BAND AFRICA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP Access 1</td>
<td>1024 - 128</td>
<td>20 - 5</td>
<td>-</td>
<td>2 Mbps/ 256 Kbps</td>
</tr>
<tr>
<td>IP Access 2</td>
<td>2048 - 128</td>
<td>40 - 5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>FullSAT Med</strong> (Europe, ME, NA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAXI</td>
<td>2048 - 256</td>
<td>128</td>
<td>1</td>
<td>8 Mbps/ 3,2 Mbps</td>
</tr>
<tr>
<td>SUPER</td>
<td>2048 - 512</td>
<td>256</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Broadband IP – ARG, BRA

Coverage and service performance

<table>
<thead>
<tr>
<th>Grade of Service</th>
<th>Peak speed (Kb/s)</th>
<th>AAB (Kb/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>640 – 128</td>
<td>20 - 20</td>
</tr>
<tr>
<td>Medium</td>
<td>1024 - 128</td>
<td>40 - 40</td>
</tr>
<tr>
<td>High</td>
<td>1024 - 256</td>
<td>80 - 80</td>
</tr>
<tr>
<td>Super</td>
<td>2048 - 256</td>
<td>128 - 128</td>
</tr>
</tbody>
</table>

Only for customer who has contracted before May 1st 2010

<table>
<thead>
<tr>
<th>Grade of Service</th>
<th>Peak speed (Kb/s)</th>
<th>DW CIR (Kb/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>128 - 32</td>
<td>16</td>
</tr>
<tr>
<td>Type 2</td>
<td>256 - 64</td>
<td>32</td>
</tr>
<tr>
<td>Type 3</td>
<td>512 - 128</td>
<td>64</td>
</tr>
<tr>
<td>Type 4</td>
<td>768 - 192</td>
<td>96</td>
</tr>
<tr>
<td>Type 5</td>
<td>1024 - 256</td>
<td>128</td>
</tr>
</tbody>
</table>
Advantages of Telespazio's Broadband IP services

**Value proposition distinguishing features**

- internet **connectivity anywhere**, including in areas with no terrestrial coverage (isolated areas, ships, on the move)
- **high levels of security** and reliability provided by advanced data encryption and controlled access systems
- full **interoperability and integration with other systems** used by customers (ADSL lines)
- **quick and easy** installation
- **scalability** - Telespazio's solutions are **tailored to the customer’s needs** and can easily be "expanded" to support rising traffic volumes
- services offered **in addition** to connectivity - possibility of supporting a **wide range of applications** (video communications, video-conferencing, content delivery, VoIP, WiFi)
- the **service can be implemented within a week of being requested**, anywhere in the country; implementation times for overseas customers are agreed in accordance with the services required
- a fair access policy **maximises the network capacity** reserved for each customer
- **Help Desk** and technical support offered **round the clock, 365 days a year**, differentiating Telespazio from its main competitors
Business SAT: Telecom Italia’s satellite broadband service

- Business SAT is a complete satellite solution for the provision of broadband services to the business market where there is no terrestrial infrastructure.

- It is the result of a partnership between three companies that are leaders in their respective markets:
  - Telecom Italia (marketing)
  - Telespazio (management)
  - Hughes Network Systems (technical equipment)

- Business SAT is part of Telecom Italia’s INTERBUSINESS service and is a natural addition to TI’s core ADSL service, enabling it to offer broadband anywhere in Italy.

- Potential customers are Italian firms with premises not covered by terrestrial broadband. The service offers navigation in full internet mode, with the level of performance required for typical business internet access, both in terms of available bandwidth and basic connectivity services (mailboxes, domain names, IP addresses).

- There are four different Business SAT service levels available:

<table>
<thead>
<tr>
<th>Grade of Service</th>
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<th>AAB (Kb/s)</th>
<th>IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uranus</td>
<td>3072 - 384</td>
<td>64 - 20</td>
<td>1</td>
</tr>
<tr>
<td>Neptune</td>
<td>3072 - 384</td>
<td>128 - 20</td>
<td>1</td>
</tr>
<tr>
<td>Jupiter</td>
<td>4096 - 384</td>
<td>612 - 126</td>
<td>8</td>
</tr>
</tbody>
</table>
Mobile post office

- TELESPAZIO's services have enabled the Italian post office to set up a network of mobile offices very quickly and at a low cost.
- The mobile post office can provide information and/or sales services that are normally effected in fixed locations designed for that purpose, but with no geographical and/or environmental limitation.
- These services can be provided via satellite, through a direct connection to the Poste Italiane mainframe, entirely independently of the terrestrial network infrastructure of the remote site.
- The mobile units are equipped with:
  - motorised antenna system developed exclusively by Telespazio
  - bi-directional VSAT (HN7000)
  - dual mode terrestrial and satellite solution
- The satellite network and remote terminals offer:
  - broadband connectivity via satellite
  - network security - network and access configured and managed on a customised basis as required
  - quick and easy roll-out –
  - flexible operation
  - network and operator security - multi-mode communications systems, on-board security sensors, remote control
  - available anywhere - thanks to the use of secure wireless technology (via satellite) and dedicated technical solutions (motorised antennae, remote configuration, etc.)
  - scalability - equipment operation and modular and scalable solutions that can be configured as required
- The nomadic Post Office solution may be replicated where our broadband Ku solutions are present (Europe, ME, Lat Am) for similar Customers (i.e. Post, Banks etc.).
Satellite solutions tested by a global oil major

- Telespazio provides AGIP petrol stations located in areas not covered by terrestrial broadband with connectivity services to supplement the company’s terrestrial network.

- The typical applications used are:
  - internet navigation
  - virtual private networks
  - payment using POS terminals
  - business continuity
  - file transfer
  - email
  - tank monitoring
  - warehousing
Satellite network for UK lottery operator

- Telespazio, in conjunction with Hughes Europe, has implemented a satellite technology network to link Camelot’s 27,500 receivers. The distinguishing feature of this network is its two redundant satellites (four hubs between Germany and Italy), which provides a high level of service reliability and network uniformity, thereby lowering maintenance costs.
- Other benefits of the service are:
  - eye-catching presentation, updated information (e.g. new games, scratchcards), advertising and public information messages (multicast service)
  - increased harmonisation of points of sale, immediate and standardised jackpot information
  - training targeted at points of sale, in some cases by category
- Telespazio has also supplied these services to Lottomatica and SNAI in Italy to supplement their coverage in areas without terrestrial broadband.
Satellite services centre in Iraq

- The Italian foreign ministry’s services centre was designed and built by Telespazio, and meets all the telecommunications infrastructure needs of Italian companies working on the reconstruction of Iraq.

- The services are provided in two ways: flat bandwidth or dedicated bandwidth.

- In addition, through the interface with other networks, the satellite services centre can provide the same services in other areas involved in the foreign affairs ministry’s co-operation and development activities.

- Telespazio has also installed a satellite broadband connectivity service in 65 internet cafés in Iraq (with a total of 1300 computers), making internet access available to US Army personnel.
Satellite Telecommunication service

• Telecommunication service (Satellite IP Protocol) for ‘ARNET SAT’ satellite ADSL services
• Supply of telecommunications service (satellite IP protocol), including delivery of equipment under loan for use with 130 points operating as of today’s date, located throughout the country.
• Service includes supply under loan for use of equipment, antennas and installation materials, including project management, survey, link verification, logistics, storage, installation, commissioning, technical assistance and maintenance.
Satellite Internet Access service for San Luis Province Data Highway.

- Satellite Internet Access Service for 120 satellite points, being 118 fixed points and 2 mobile points, located in police stations, schools, hospitals, etc. covering all the Province of San Luis.
- Service includes supply under loan for use of equipment, antennas and installation materials on a turnkey basis, covering project management, survey, link calculation, logistics, storage, installation, commissioning, certification, documentation, technical assistance and maintenance.
The following table summarizes the technical and economic characteristics of new KU offer conveyed to Business market with the brand "Business Sat".

<table>
<thead>
<tr>
<th>Customer profile</th>
<th>Main Characteristics</th>
<th>Service name</th>
<th>Street price €/month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Office</td>
<td>384 – 7168Kb/s - 10GB/mese</td>
<td>Saturno</td>
<td>36€</td>
</tr>
<tr>
<td>Medium</td>
<td>384 – 7168Kb/s – FLAT</td>
<td>Urano</td>
<td>60€</td>
</tr>
<tr>
<td>Entry</td>
<td>384 – 7168Kb/s – FLAT</td>
<td>Nettuno</td>
<td>99€</td>
</tr>
<tr>
<td>Maxi</td>
<td>384 – 10240 Kb/s – FLAT</td>
<td>Giove</td>
<td>330€</td>
</tr>
</tbody>
</table>