

Final presentation

*SISNET development
as part of EGNOS TRAN*

25/9/2003

Presented by: E.J. González, C. Barredo

- Project presentation:
 - SISNET E-TRAN CCN project
 - ShPIDER receiver
 - Internet consultancy
 - Tests in Rome and Valladolid
 - Advanced SBAS data analysis library
 - ShPIDER and Pocket-ShPIDER features
- ShPIDER demo
- Progress and results (internal presentation)

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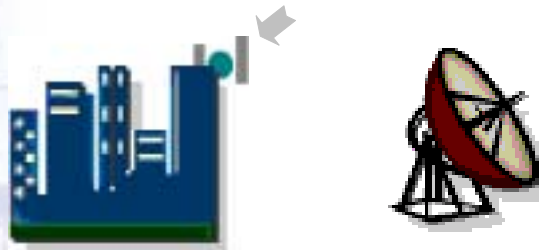
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Project presentation

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- Broadcast of EGNOS messages through alternative methods to GEO may be interesting...
 - to avoid loss of service (GEO blocking)
 - for users interested in EGNOS real-time information.



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- ESA started a set of initiatives to assess these methods:

- ESA ASTE program:
 - EGNOS Terrestrial Augmentation Network (ETRAN)
- ESA project: Provision of EGNOS service through Internet.
 - SISNeT handheld receiver based on a mobile phone
 - SISNeT applied to urban buses



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- GMV's SISNET project (CCN to ETRAN project):

- Development of a "SISNeT Receiver"



- Internet consultancy.



- Demonstration of the SISNeT concept (ETRAN).
- Support in advanced SBAS data analysis library

* SISNeT high Performance Internet-Dependent EGNOS Receiver

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Internet Consultancy

- Performance Improvements:
 - Service limitations
 - Scalability issues
 - Multiserver scenario
 - Protocol optimization
 - Number of users
 - Service availability
 - Communication delays

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- Security Aspects
 - Server side security
 - Communication security
 - Authentication
 - Confidentiality
 - Risk analysis
- "SISNET Improvement Definition" Document.
- SISNET specialist support at SGI premises.

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SBAS analysis library

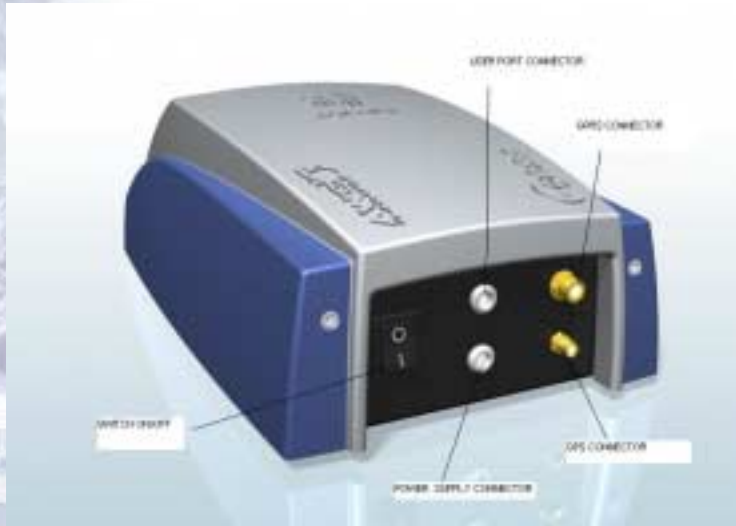
- Libraries:
 - Real-time navigation
 - Offline statistics
- Means to access EGNOS information
 - These libraries could be used together with a plotting engine to build an EGNOS monitoring tool.
- Libraries, documentation and support provided.

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ShPIDER receiver

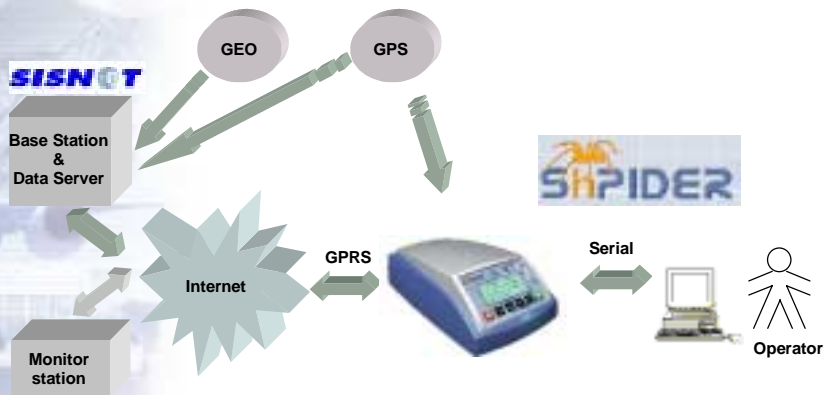


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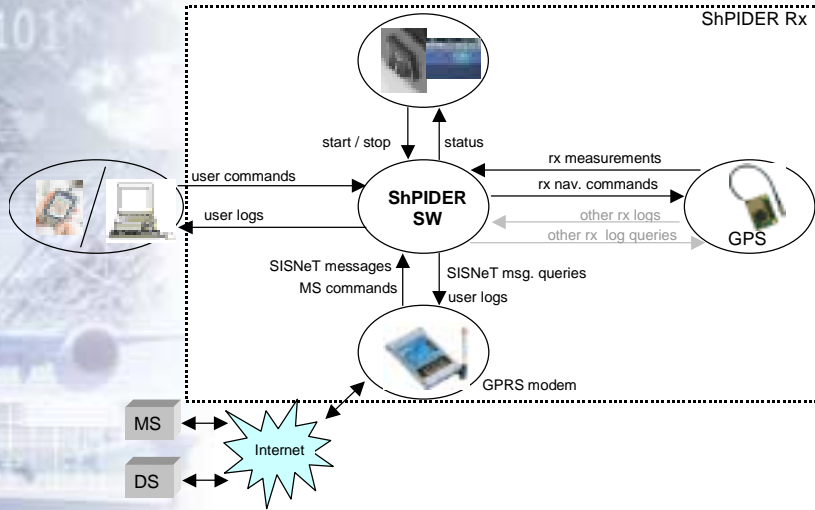


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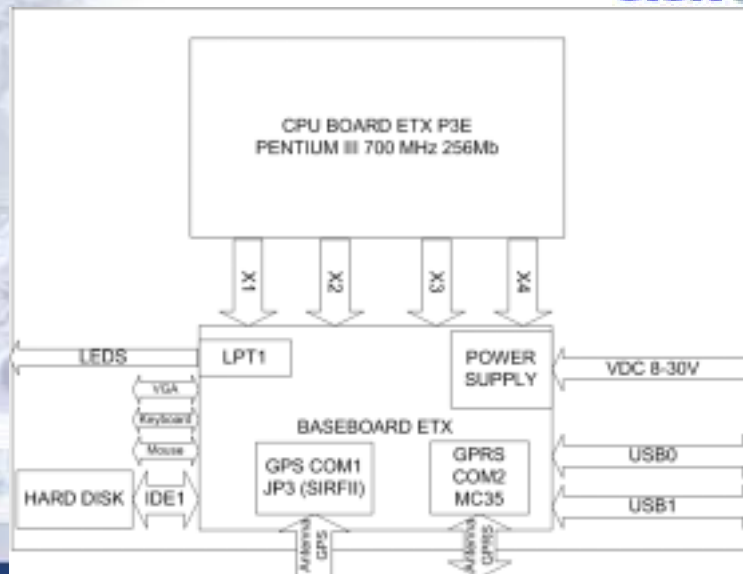
- o GPRS link to BS/DS and Control Centre
- o Serial output.
- o GPS antenna.



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Summary of Features

- Full SISNeT navigation + RAIM, estimation of NSE and PLs.
- GPRS connection.
- Fully configurable logs
- Commands via serial port or GPRS
- Highly autonomous.
- Easily upgradeable.
- Availability-increasing schemes.

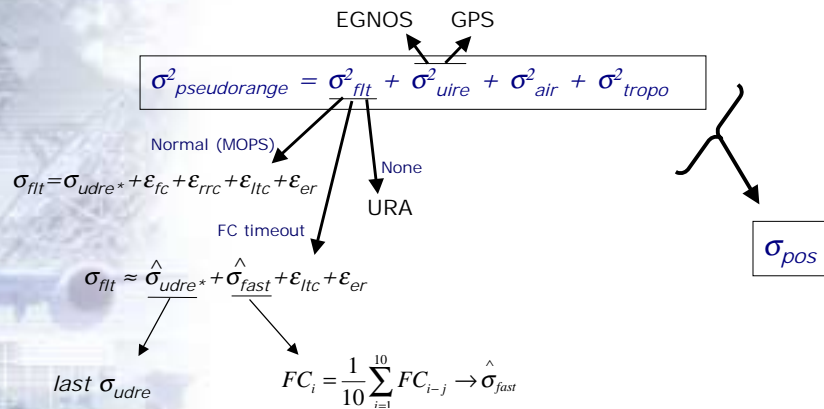
Mechanisms to increase availability

- Facts:
 - The effect of losing a message is different according to its type.
 - Delays of messages (FC timeouts reached):
 - Degraded nav. solution.
 - Pessimistic PLs.

Mechanisms to increase availability

- Proposed actions:
 - Request EGNOS messages at the beginning.
 - Use GPS sats. not monitored in mask by EGNOS.
 - Lengthen timeouts (specially FC's).
 - Reduce degradation factors for FC.
 - Use ionospheric corrections whenever possible.
- *These actions are performed only in a SISNET-compatible "phase of flight" -> Integrity is lost -> only an error estimation is made.*

Error estimation

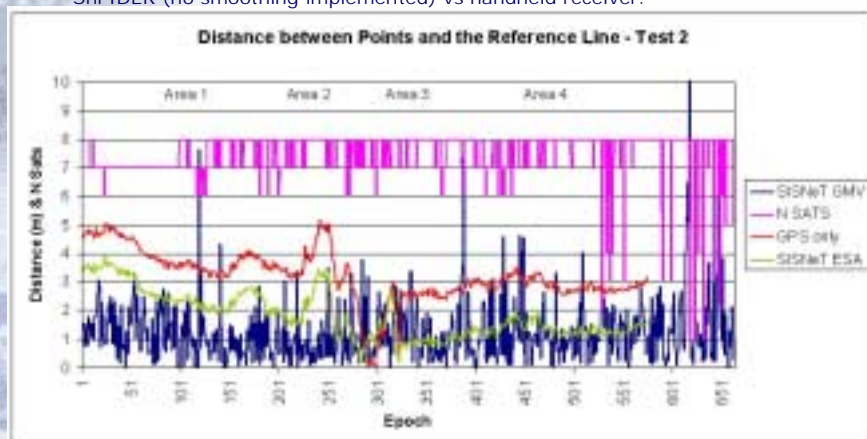


Current experiments

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Static test at Boecillo.

ShPIDER (no smoothing implemented) vs handheld receiver.

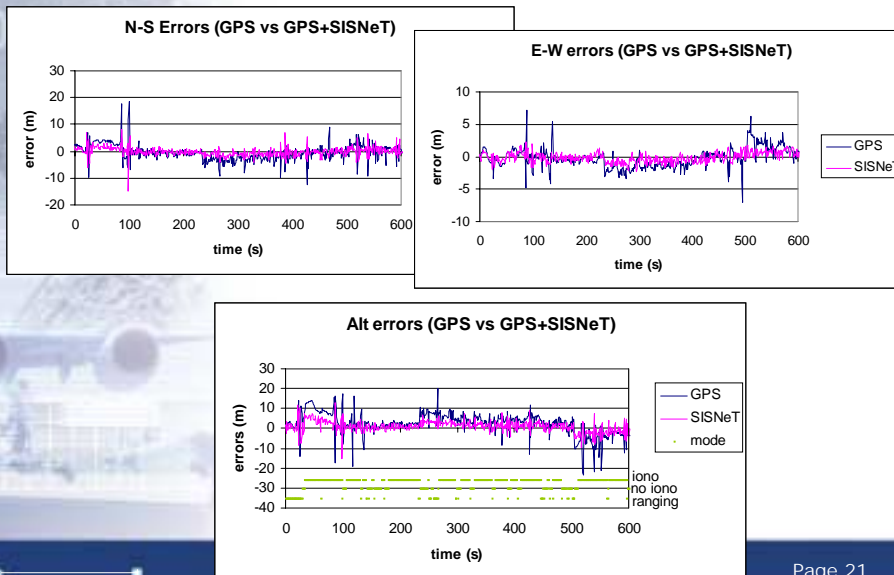


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GPS vs GPS+SISNeT



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Rover for experiments (ShPIDER and NovAtel)



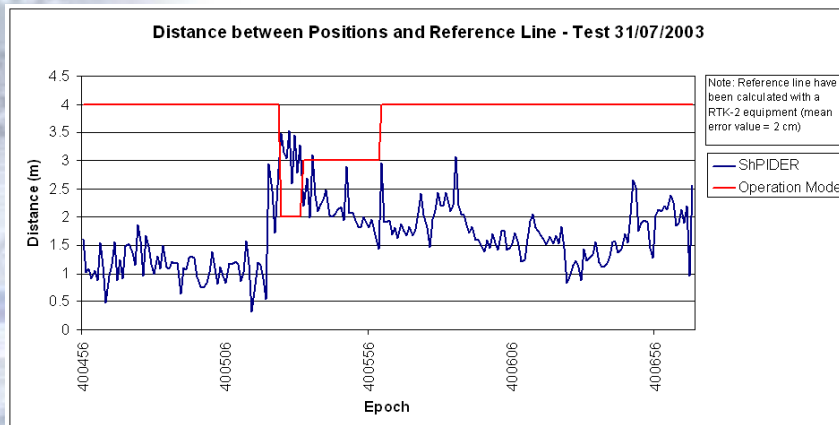
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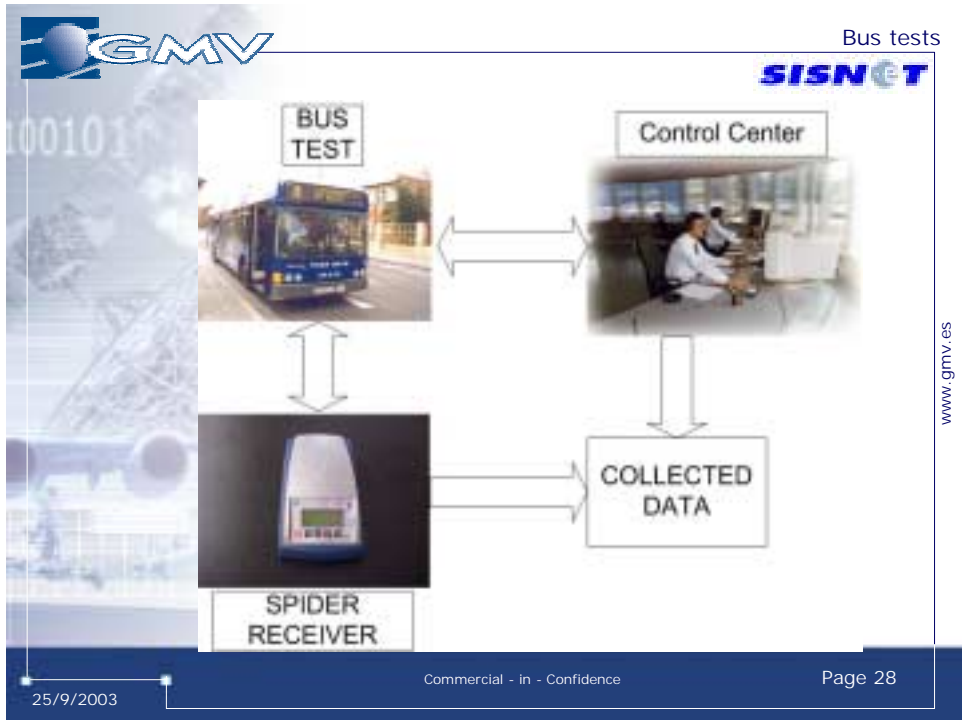


Some results (operation mode 4=full SISNet)



Bus tests at Valladolid

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Urban Environment



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Measurement site ID	(test 05)
Date of measurement	18/09/2003
Time of measurement	387235 - 390791 (Seconds)
Type of measurement	Dynamic
Description of location	Urban environment
Special remarks	Test done with 2 different user terminals : Trimble Lassen SK8 with RTCM and Shpider Receiver.

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Total number of observed epochs:	3556
Total position availability (number/percentage):	3201 / 90.01%
Total differential position availability (number/percentage).	1189 / 37.15
Total positions with > 4 satellites in view (number/percentage)	2106 / 59.22

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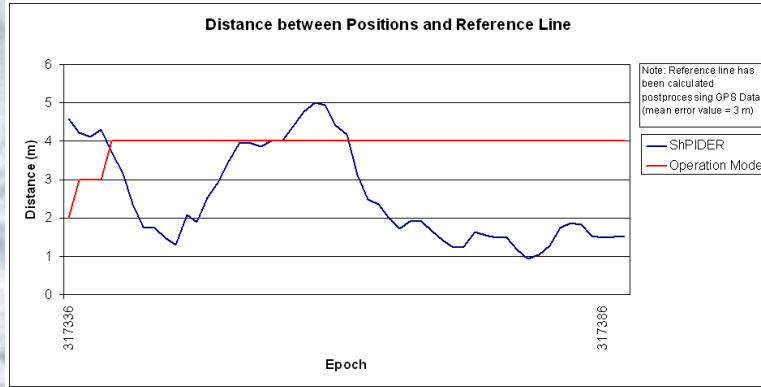
Sub-Urban Environment



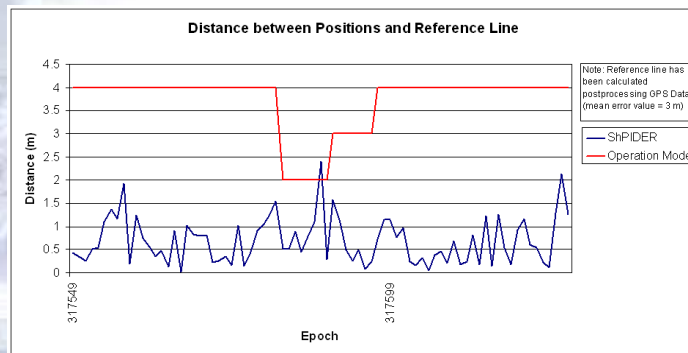
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Measurement site ID	Test N°2
Date of measurement	06/08/2003
Time of measurement	317336 – 317388 (Seconds) 317549 – 317627
Type of measurement	Dynamic
Description of location	Sub- Urban environment
Special remarks	Test done with Shpider Receiver and reference line with Novatel and postprocessed with TGO.

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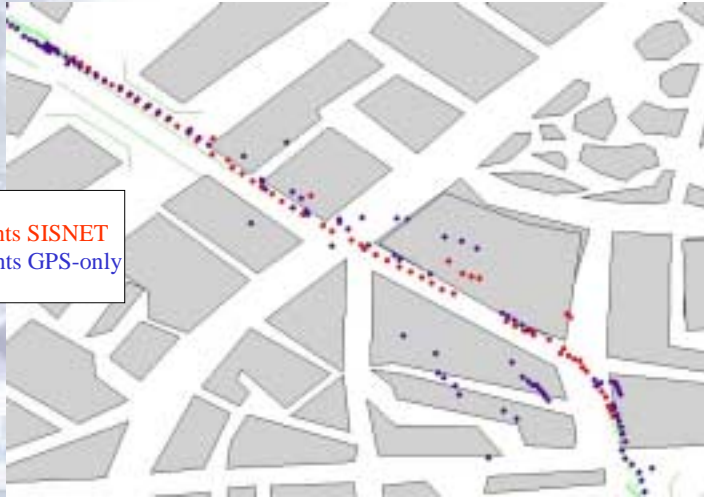


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Same path with and without SISNET – urban canyon environment

RED points SISNET
BLUE points GPS-only



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ETRAN experiments

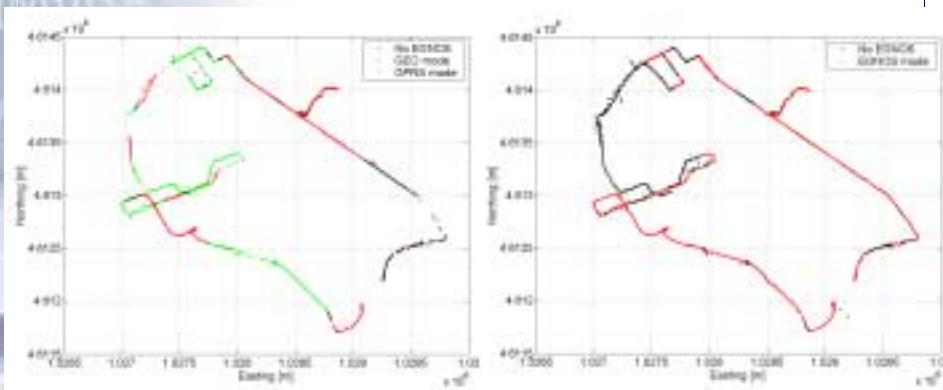


o Experiments at Rome



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o Experiments at Rome



EGNOS TRAN trajectory

ShPIDER trajectory

Availability in the ETRAN experiments.

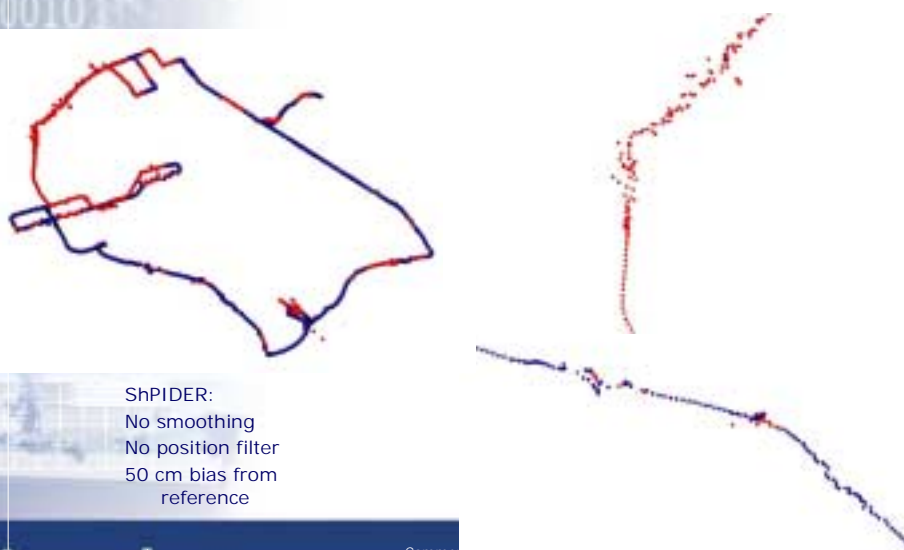
Availability	Total position availability		Total augmented position availability	
	samples	%	samples	%
Ref. pos:	644	24.79%		
ETRAN Rx:	2277	87.64%	1704	65.59%
ShFIDER:	2598	100.00%	1727	66.47%

Total number of observed epochs: 2598

Accuracy in the ETRAN experiments.

Accuracy	sam- ples	East		North		Position	
		mean	σ	mean	σ	mean	σ
ETRAN	643	-0.520	1.913	1.450	2.596	2.783	2.240
ETRAN DGPS	397	-0.850	2.273	1.492	2.686	3.145	2.548
ShFIDER	643	-0.930	5.467	0.948	7.267	7.082	5.851
ShFIDER DGPS	522	-1.089	4.752	0.427	6.106	6.258	4.678
GPS	644	-1.84	3.216	1.304	5.610	2.648	6.467

Total number of epochs with reference: 644



ShPIDER:
No smoothing
No position filter
50 cm bias from
reference

Other initiatives

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o Pocket-ShPIDER



- o ShPIDER software, within a COMPAQ iPAQ H3970 PDA.
- o Bluetooth communication with a Sony Ericsson T68i GPRS mobile phone
- o SiRF-based GPS receiver (EMTAC, 38400 bps)
- o GIS

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- GIS:
 - Rotating map
 - Best-route calculation.





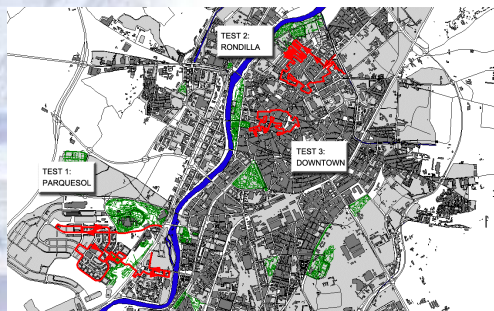
ShPIDER



Pocket-ShPIDER

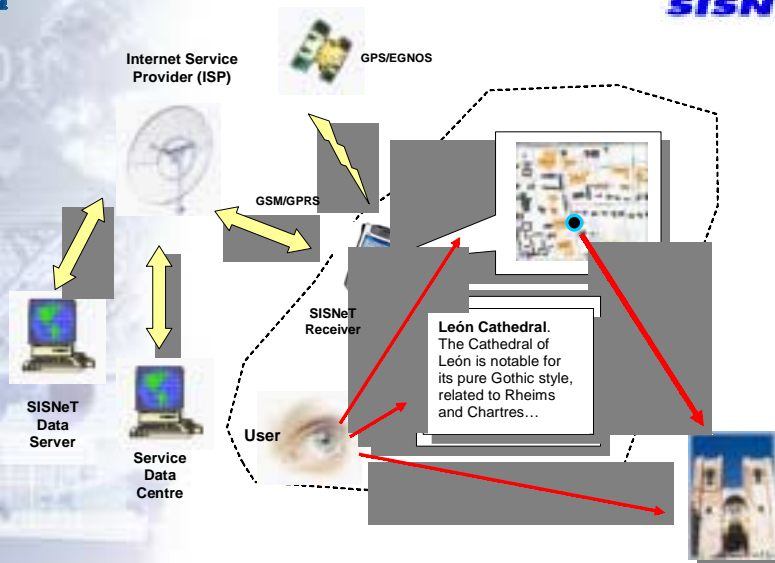
o **SISNeT to help the Blind**

- Origin at GMV-Sistemas TORMES project.
- "Sonobrilles" interface.
- SISNeT in a set of experiments in Valladolid.



This is only the beginning. Future tasks are...

- To process results and upgrading of algorithms.
- To put to practice ideas for promotion
- To enhance the application of EGNOS corrections.
- To exploit the ability of providing location-based services:
 - tourism information based on SISNeT
 - advertisement
 - remote control...



- SISNeT technology, as a solid synergy between SBAS systems and the Internet, will open the door to a large amount of innovative applications for Satellite Navigation.
- SISNeT is already showing its capabilities by means of developments such as ShPIDER or Pocket-ShPIDER, and will surely become a mature technology in the field of location-based services.

ShPIDER demo

Internal presentation

25/9/2003

- Tests
 - Preliminary results
 - Tests in Rome
 - Tests in Valladolid
 - Tests versus reference position (RTK)
 - Tests in urban buses
- Problems
 - Smoothing struggle
 - Server problems
 - Test Bed problems
- Outcomes
 - Results presented today
 - Demonstration report

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- SISNeT connection
- Future improvements: discussion/summary
- List of final meetings actions/results
- Review of project deliverables
- Conclusion

- SISNeT in ION GPS/GNSS 2003 (Portland, 9-12 September):
 - Significant interest of audience
- SISNeT in IAIN (Berlin, October)
- ShPIDER brochures
- Video about blind pedestrians

○ Possible enhancements

- Server side:
 - SISNeT 3.0 (later on 3.1 with asynchronous protocol)
 - Ephemeris for AGPS
 - Further studies: bandwidth saving, etc.
 - Server side co-located with MCC.
- Receiver side:
 - Deeper analysis of anomalies in tests / new tests
 - Graphical user interface
 - Counterpart of server side enhancements
 - Position filter (fixed height, position with 3 satellites), outlier exclusion...
 - Aided GPS
 - Use of GEO signals (GEO ranging / EGNOS messages through SISNeT).
 - Accelerate time to first fix of commercial EGNOS receivers.
 - Reacquisition of previous EGNOS messages in case of connection outages.
 - Estimate SISNeT performances improvements using alternative figures of merit (application-driven).
 - Downloadable SISNeT SW for PDAs.
 - Increase integration (into PCMCIA's, into the GPS receiver itself...)

○ More ideas:

- New data servers
- ESTB through Internet
- LBS possibilities
- Testing of Pocket-ShPIDER with wi-fi connection (for example in the city of Zamora).
- Conversion of SISNeT-EGNOS to RTCM.
- NEMESIS project incorporating SISNeT.

1. To assess improvement of position availability using up to 3 GEOs plus GPS versus GPS only, in an urban environment (simulation with Elcano).
2. Tests of ShPIDER/Pocket-ShPIDER (with smoothing) versus GPS only versus elevation angle. After that, consider GPS Journal of Navigation publication with ESA. ESA will send the draft paper.
3. Send upgrade of SW to correct lack of SISNeT solution with 4 SVs.
4. Assess the possibility of providing an executable of Pocket-ShPIDER SW, disclosure terms to be agreed.
5. Send pending deliverables.

- ShPIDER receiver:
 - List of HW items detailed in user manual, code GMV-SISNET-UM: already delivered.
 - Paper copies of all documents of ShPIDER project, number of copies 5 (TBC), to be delivered. All electronic copies have already been delivered.
 - ShPIDER source code to be delivered.
 - Official delivery item list, already delivered.
 - Warranty period applies on the basis of the contract (1 year since the final meeting, to be confirmed).

Conclusions

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- Technical assessment:
 - SISNeT technology, as a solid synergy between SBAS systems and the Internet, will open the door to a large amount of innovative applications for Satellite Navigation.
 - SISNeT is already showing its capabilities by means of developments such as ShPIDER or Pocket-ShPIDER, and will surely become a mature technology in the field of location-based services.

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- Contractual conclusion
 - ESA and GMV agree that, upon delivery of pending deliverables (paper copies + SW source code), the contract may be concluded at both satisfaction. Upon reception of these deliverables and closure of pending actions, final payment may be executed.

- GMV wants to express:
 - Positive outcome of the project.
 - Open to discuss ESA comments
 - Willing to continue using this technology and to explore potential future cooperation (several ideas already discussed throughout the meeting)

- ESA expresses recognition for the good work performed.