Scientific and Technical Subcommittee
United Nations Committee Peaceful Use Outer Space

The start of the Q/V Band Experimental Program: new possibilities for fast telecommunication infrastructure developments

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On July 25th 2013 from Kourou spaceport, Alphasat, Europe's largest telecommunications satellite, was successfully launched on board an Ariane 5 flight and it is now at its geostationary orbital position at 25° East.

Alphasat carries 4 technology development payloads provided to ESA by the Agency's participant states.

These TDPs have been commissioned and tested in orbit and can now start their operative life.

Acknowloledgment: ESA

Alphasat facts and figures

Launch mass: 6.6 tonnes (3.5 tonnes dry mass)
Solar array span: 40 m
Electrical power: 12 kW
Platform: Alphabus

Payloads: Inmarsat L-Band Payload, Advanced laser communication terminal, Q/V band experiments (two), Advanced startracker, Environment effects facility

GEO location: 25˚ east
Launch vehicle: Ariane 5 ECA
Launch site: Guiana Space Centre, Kourou, French Guiana

Operational lifetime: 15 years

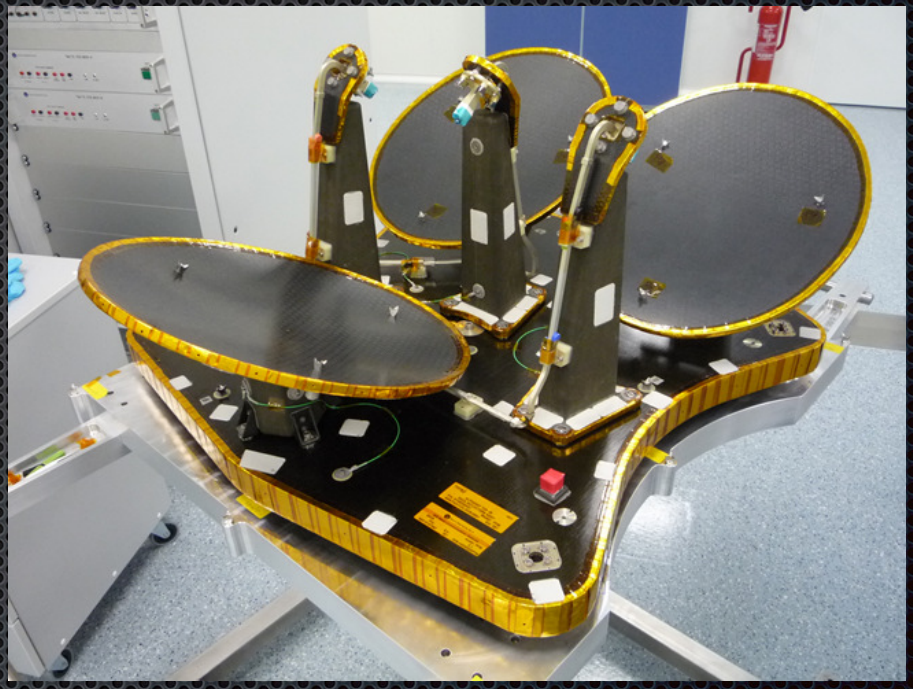
Acknowloledgment: ESA

«Aldo Paraboni» Q/V Band Experimental Telecommunication Payload

Conceived, financed and realized in Italy, it is actulally composed by two separated experimental payload:

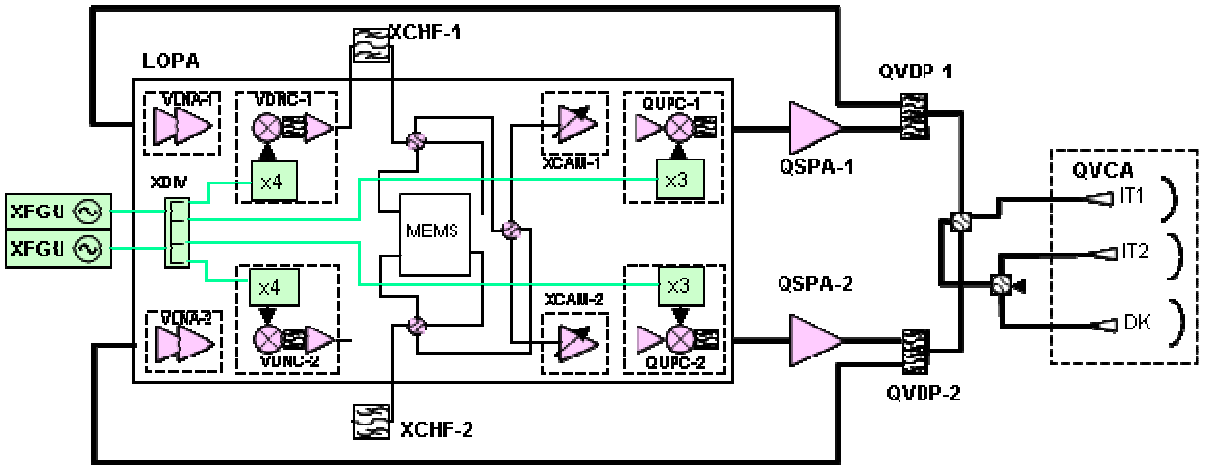
- a 40/50 GHZ telecommunication section which performs a 3 spot transponder

- a Ka/Q propagation section providing geographical beacon centered on Europe

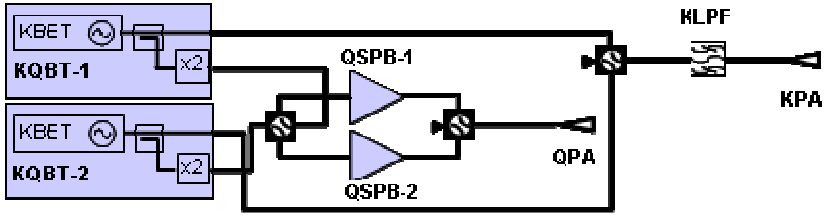


Q/V band Communication Experiment

Communication & Technology Experiment



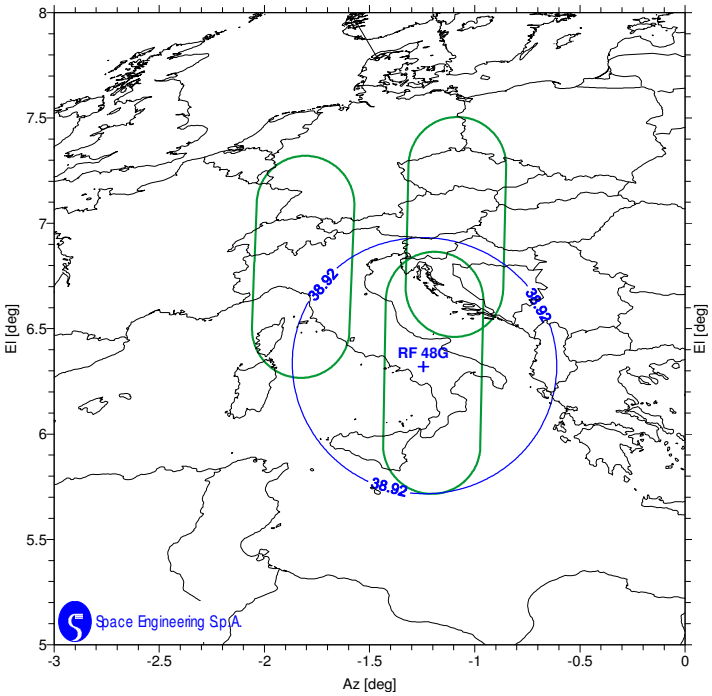
Scientific Experiment



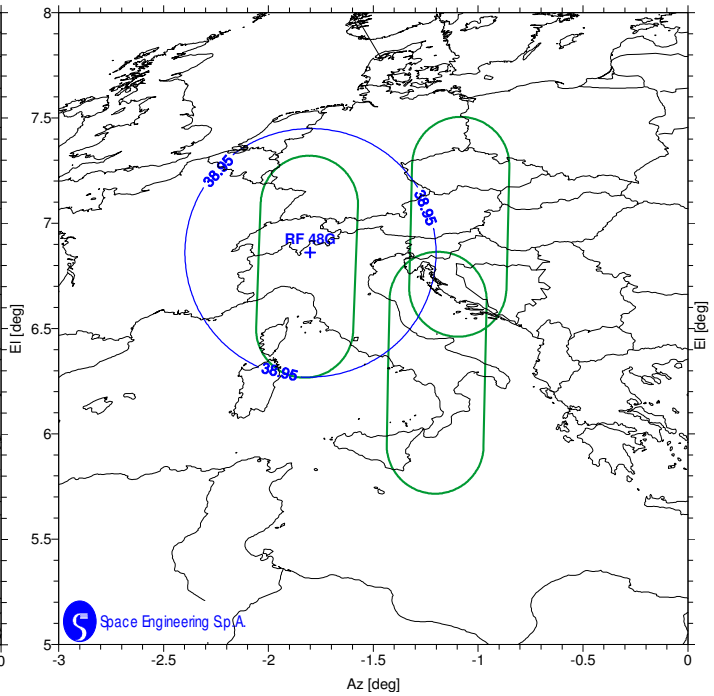
Q/Ka band Propagation Experiment

«Aldo Paraboni» Q/V Band Experimental Telecommunication Payload

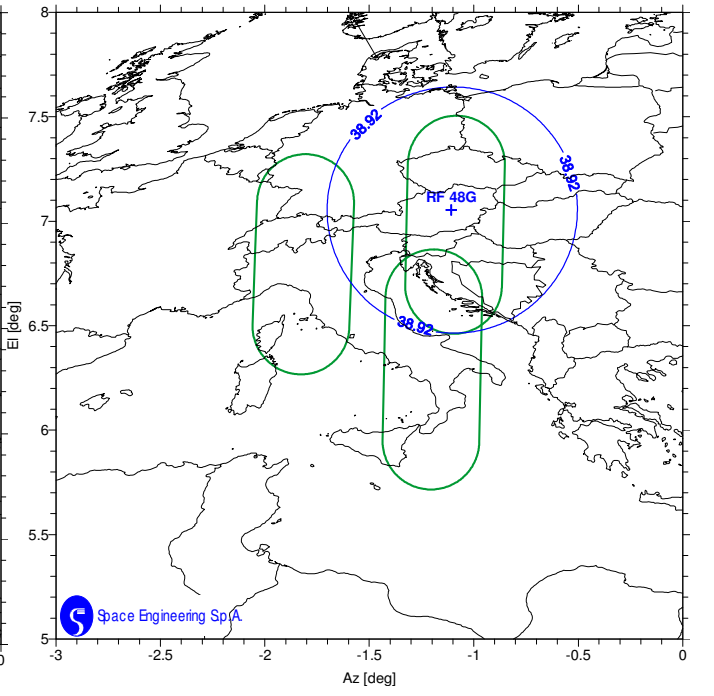
IT1 Beam Measured Gain @ 48 GHz



IT2 Beam Measured Gain @ 48 GHz



EU1 Beam Measured Gain @ 48 GHz



Q/V band Communication Experiment

The main objective of the telecommunication experiment of PARABONI payload is to demonstrate the effectiveness of PIMT (Propagation Impairment Mitigation Techniques) in improving the achievable data throughput in a real Q/V band satellite link.

The following PIMT will be tested:
ACM (Adaptive Coding and Modulation), based on DVB-S2 standard
Up-link Power Control (ULPC)

- Trade off between service availability and efficiency.

- Broadband communications in Q/V band can be effectively designed by means of adaptive transmission schemes, named PIMT performance assessment must be carried out in a real Q/V band satellite channel.

DVB-S2 is the most advanced satellite communications standard, but it is not tested in Q/V band.

Aldo Paraboni will test for the first time DVB-S2 in a Q/V band satellite channel.

ACM mode selection algorithms based on DVB-S2 specification must be developed and tested

Joanneum Research from Graz, Austria is our scientific partner.

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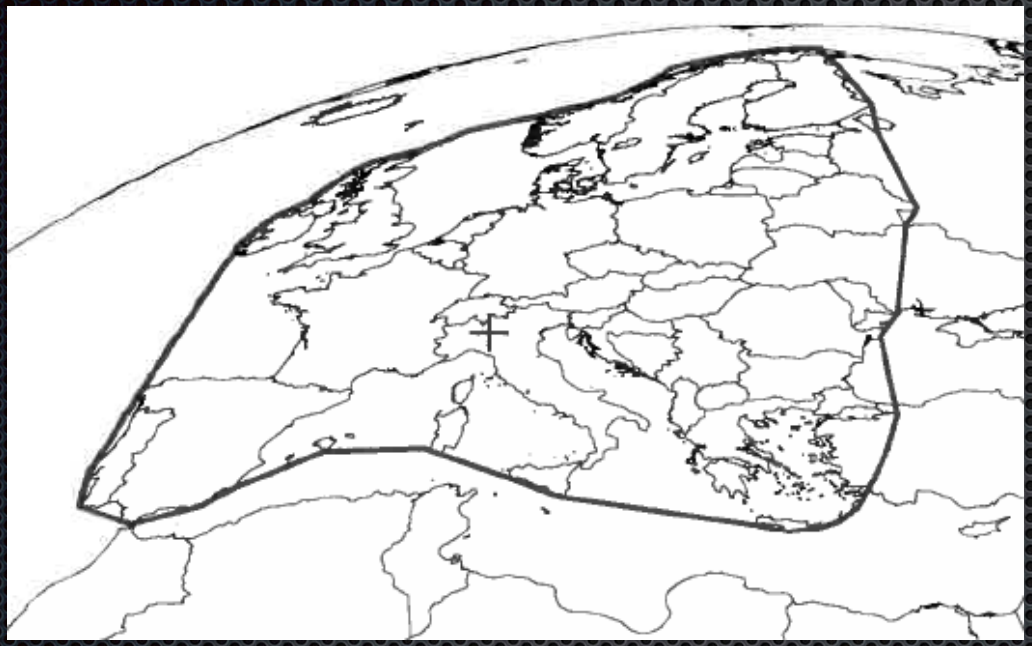
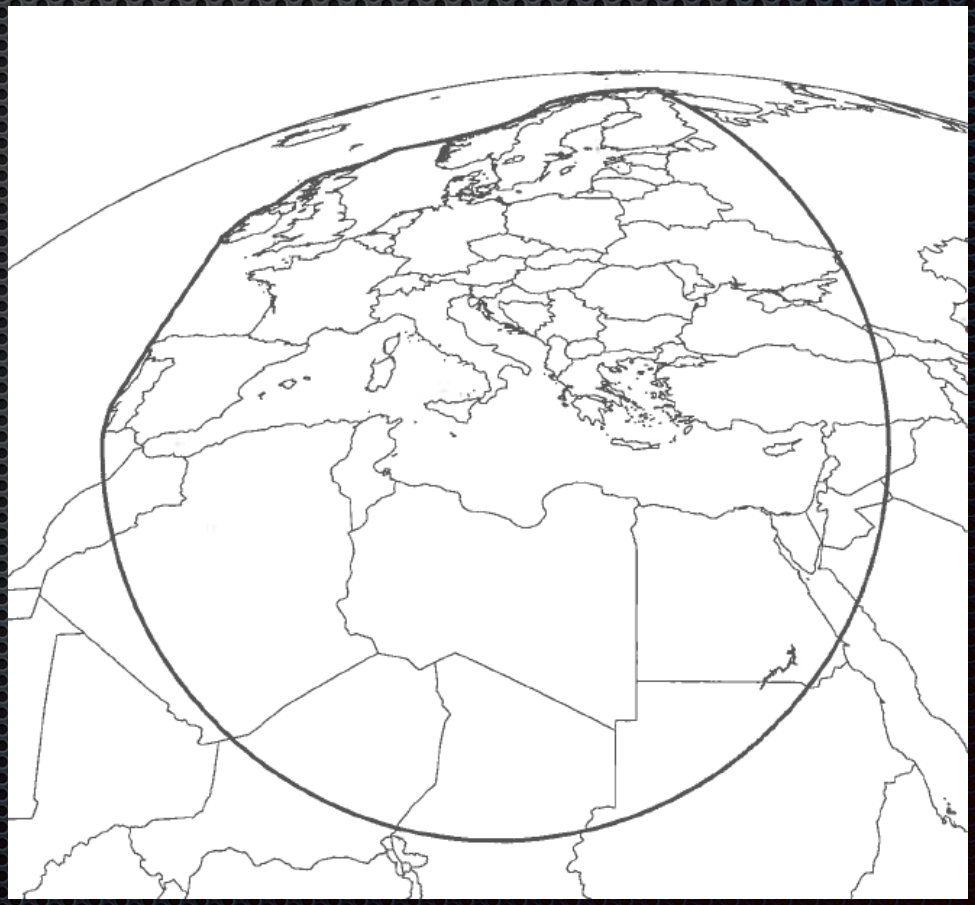
Q/Ka band Propagation Experiment

40 GHz (Q-Band) Open Beacon Coverage



20 GHz (Q-Band) Open Beacon Coverage



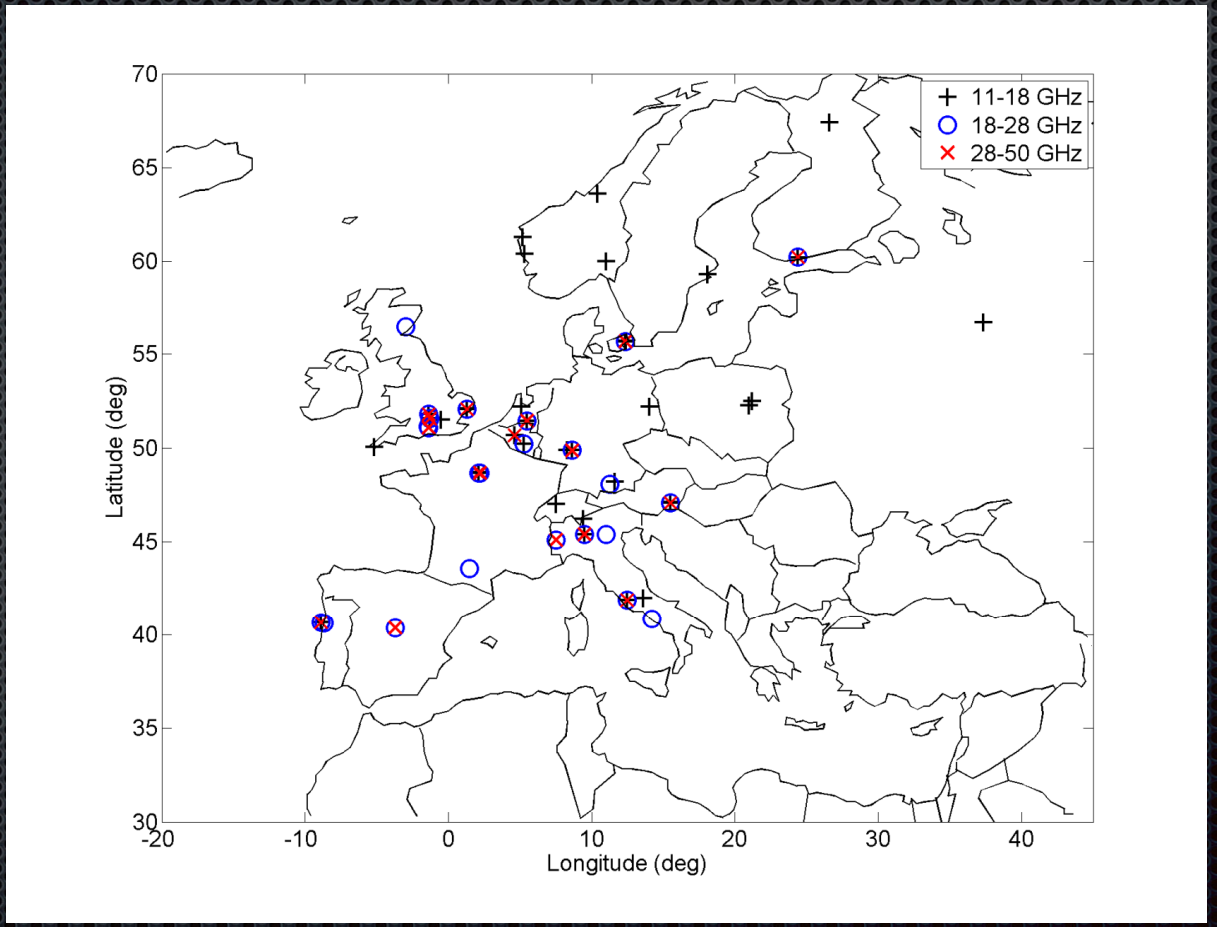
Q/Ka band Propagation Experiment

Long-term scientific objectives:

- **First and second order statistics of propagation impairments**
- **Coordination of measurements from European Earth terminals**
- **Plan for a synergic use of Weather Forecast (ECMWF) and of Earth Observation products (MSG, TRMM, Cloudsat, etc.)**
- **Concurrent communication and propagation measurements**
- **New data to design future Fade Mitigation Technique, FMT, systems.**

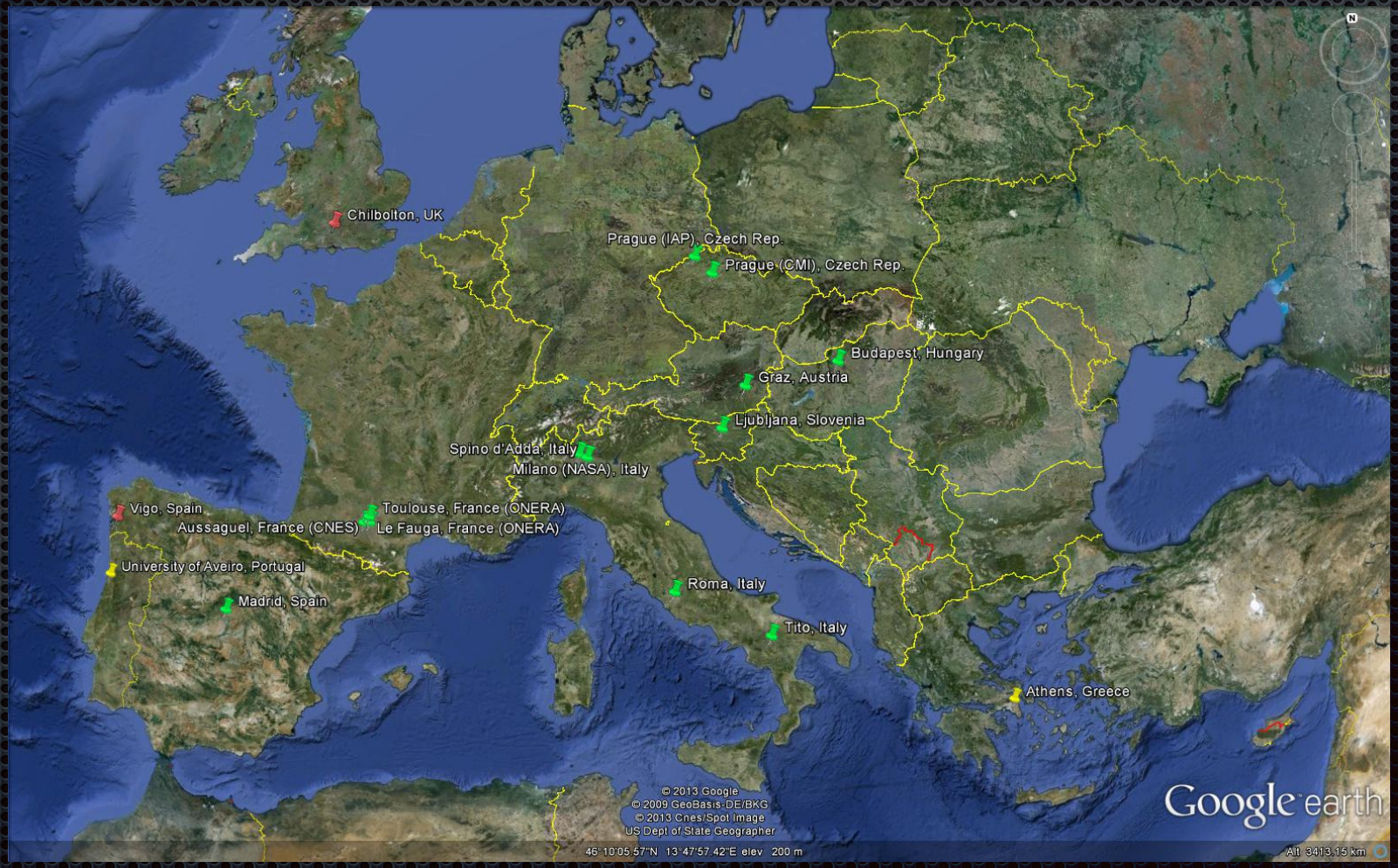
Q/Ka band Propagation Experiment

Past European Beacon Experiment (ITU-R database)



Q/Ka band Propagation Experiment

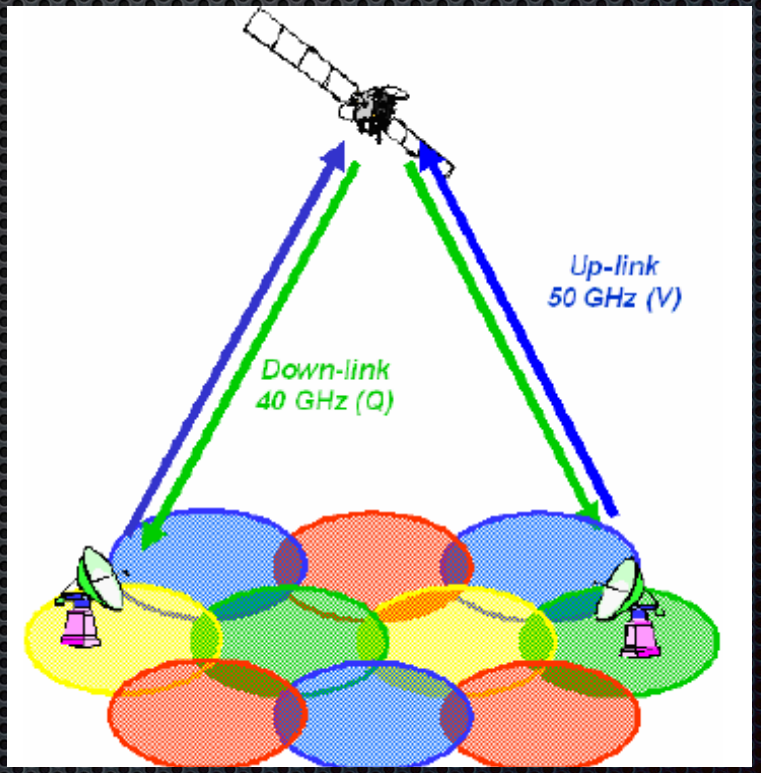
Network of Alpahasat Propagation Terminals)



Motivations for joining the experimentation

The use of the proposed frequency bands in areas other than those already involved will allow the use of new technologies for countries where a fast telecommunication development is needed.

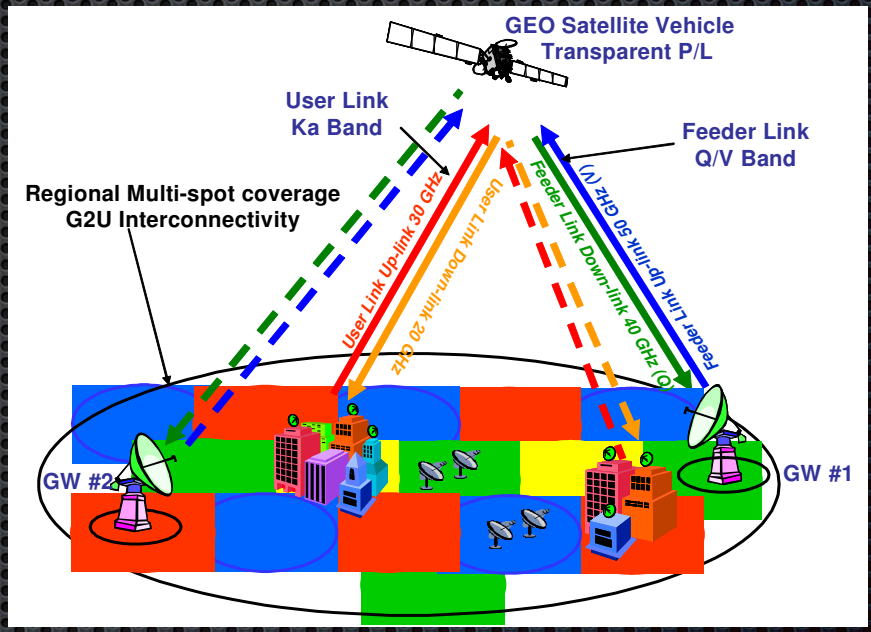
Larger bandwidth availability will help to spread fast telecom services channels such as voice, television, internet etc



Motivations for joining the experimentation

New telecommunications infrastructure will benefit from large bandwidth availability allowing possible future applications.

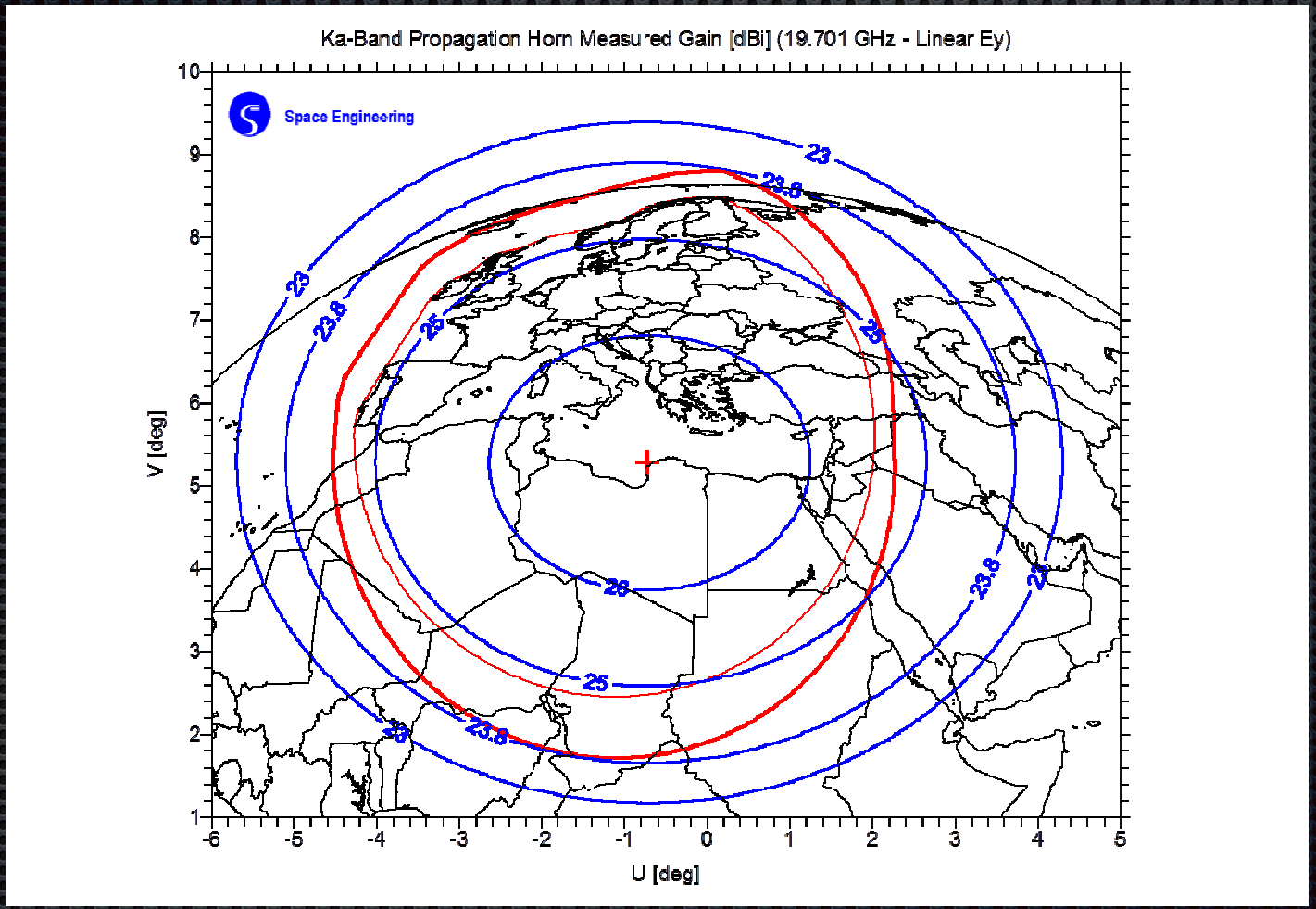
The advantage gained is not only for the scientific community but has to be viewed as an general opportunity for technological improvement.



Latest measurements have better characterized the geographical extensions of the two beacons:

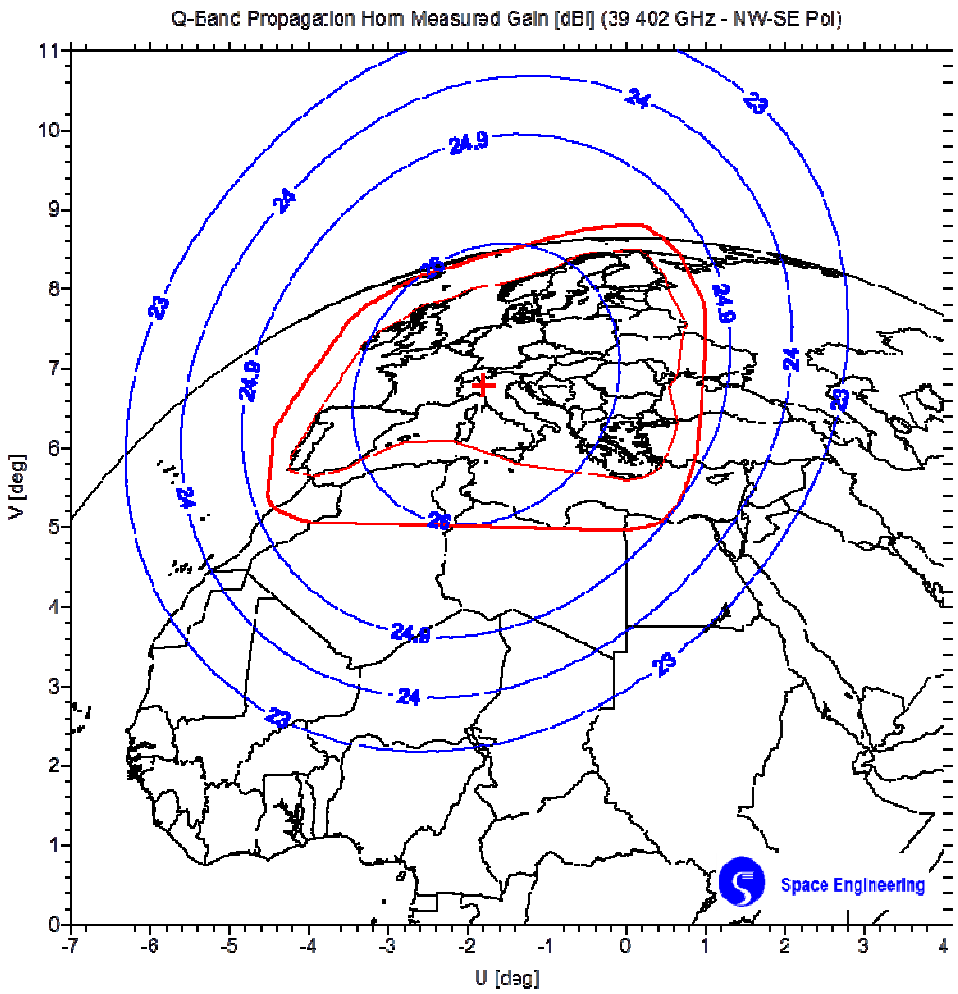
- **The measured performance showed larger coverages for both beacons at Ka and Q frequency with respect to those specified**
- **Both beacons are covering many additional areas especially towards east and south**
- **Many other countries in those regions could be involved in the experimentation.**

Ka-Band Propagation Horn Measurements



Q/Ka band Propagation Experiment

Q-Band Propagation Horn Measurement



Data of propagation characterization coming from other countries are needed in order to prepare the use of Q/V band frequencies for coming application.

Cost of the investment to join the experiment is extremely low when compared with the possible benefits.

Thank you for your attention.

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