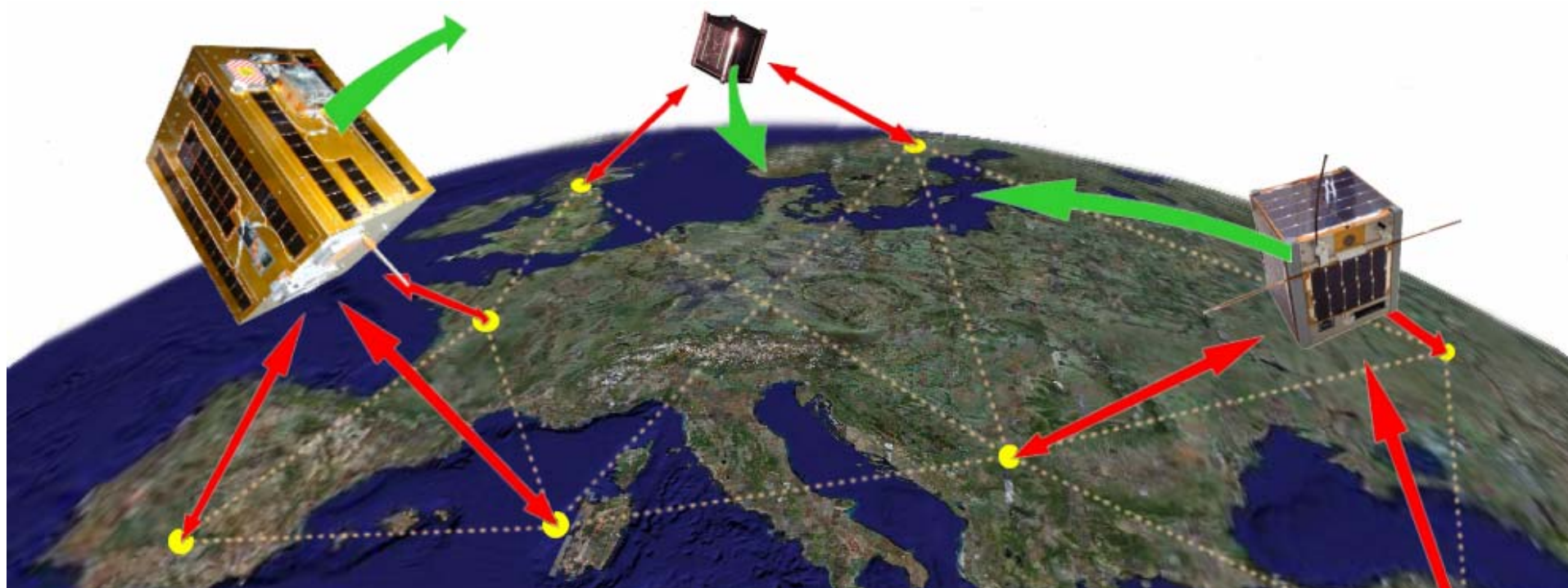


GENSO 元素

A Global Educational Network for Satellite Operations



The Current Situation



A Typical Student Space Segment

- Satellite in Low-Earth Orbit, often Sun Synchronous,
- Low-power transmitters,
- Standard communications protocols (such as AX25),
- Use of the Amateur Radio bands: VHF, UHF and S-Band.

A Typical Student Ground Segment

- A single, local, groundstation, usually at the host university,
- Capable of communication on one or two of the Amateur Radio frequency bands,
- A single rotator and a single elevator to track the spacecraft,
- A single PC controlling the groundstation hardware and the mission data.

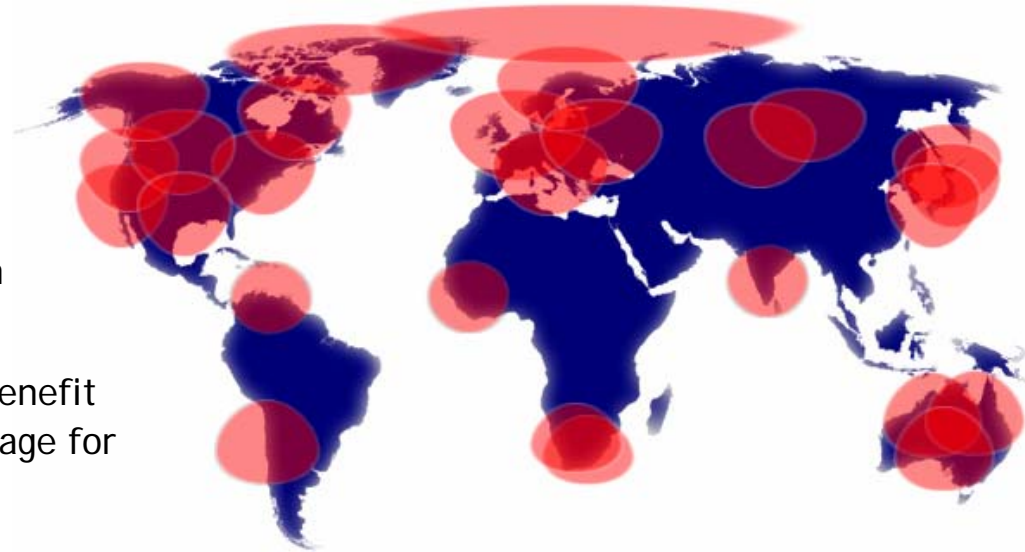
Typical Limitations

- From ~15 orbits there are around six passes a day, averaging perhaps five minutes each,
- Satellite is in communications range less than 3% of the mission time,
- For 97% of the time the groundstation is idle,
- The groundstation is not configured to communicate with other educational spacecraft,
- The spacecraft is only configured to communicate with the specific groundstation.

A Better Approach

Advantages of sharing resources

- Provides near-global coverage for all participating missions,
- Allows for a dramatic increase in mission return,
- Many critical operations would benefit from having uninterrupted coverage for several hours,
- Powerful error-correction could be applied when using multiple downlink stations,
- Enables access to a large amount of live spacecraft data at low cost,
- Encourages formation of a coherent space education community.



The Solution:

Develop a flexible global software standard which allows existing educational ground stations worldwide to link together, communicate with each others' satellites, and stream the mission data to the operators via the Internet.

Assessment Study

- ESA conducted an Assessment Study at the request of the International Space Education Board (ISEB),
- ISEB consists of the combined Education Departments of CSA, ESA, JAXA and NASA,
- The study ran from June to October 2006,
- An international team was involved, and two workshops were held, one in Tokyo, Japan, and one in ESTEC, the Netherlands.

Conclusions:

- The project was shown to be technically feasible by the Assessment Study team,
- An Implementation Plan was developed showing how the project could be executed,
- ISEB met on 5 October 2006 and unanimously approved the implementation phase,
- ESA was appointed for project coordination, in collaboration with an inter-agency system engineering team.



Example of a university ground station (Luleå)



GENSO Objectives

- 1) Unparalleled near-global levels of access to educational spacecraft in orbit,
- 2) Remote access for operators to real-time mission data, even in cases when their local groundstation is experiencing technical difficulties,
- 3) Scheduling of remote **uplink** sessions via trusted ground stations,
- 4) Optional automatic remote control of all participating ground stations,
- 5) Downlink error-correction by comparing multiple data streams,
- 6) A global standard for educational ground segment software,
- 7) An optional well-defined standard solution for educational ground-segment hardware (in order to expedite participation in GENSO),
- 8) An optional well-defined standard design solution for educational space-segment communications hardware (in order to expedite participation in GENSO),
- 9) Support a common interface for applying for frequency allocation and coordination.

Project Schedule

19 June 2006 Kick-off of ESA Assessment Study

18-19 July 2006 Workshop 1, organised by UNISEC

28-29 Sept 2006 Workshop 2, organised by ESA at ESTEC

5 October 2006 **Presentation of Assessment Study to ISEB**

12 Oct - 30 Nov 2006 Kick-off, assignment of work packages

1 Dec 2006 - 15 June 2007 Design and Development Phase

15 June - 31 Aug 2007 Core Testing and Development,
"First Pilot Phase" (~7 stations)

October 2007 **Presentation of First Pilot Phase to ISEB at the 58th IAC**

15 Oct 2007 - June 2008 System Testing and Development, "Second Pilot Phase" (~20 stations)

June - Oct 2008 Preparation for Network Deployment

October 2008 Deployment Readiness Review Workshop

October 2008 **Presentation of Results to ISEB and Network Inauguration at the 59th IAC**

Nov 2008 - Onwards Network deployment, operation and maintenance



Tutorial Session at Workshop I in Tokyo

Participants:

Assessment Study
teams only

Implementation
teams only

With Development
Ground Stations

Open to all
Missions / Stations



Getting Involved

For the moment:

The selection of Implementation Teams closes 30 November 2006. At this time work packages will be assigned which are necessary to develop the software, hardware and infrastructure. The Implementation teams will then develop and test their solutions until the end of August 2007.

During this time all expressions of interest and support are greatly appreciated. A project website will provide all relevant news on our progress: www.genso.org

Joining as a 'Development Ground Station':

From October 2007 the project should enter a second pilot phase, during which a larger number of ground stations will be used for testing the software and infrastructure of the network.

If you would like to be considered for participation in this phase then please contact us in due course, specifying your interest and giving details of your ground station.

Once GENSO is operational:

It is currently envisaged that GENSO will be fully operational as of October 2008 (although, as with all space projects, this deadline may change).

Once the network is operational any educational, or amateur radio, spacecraft and ground stations will be most welcome to participate. There will be some simple user agreements, with which we will be happy to have you 'on board' this exciting project.



Project Participants

Currently Operational Compatible Spacecraft:

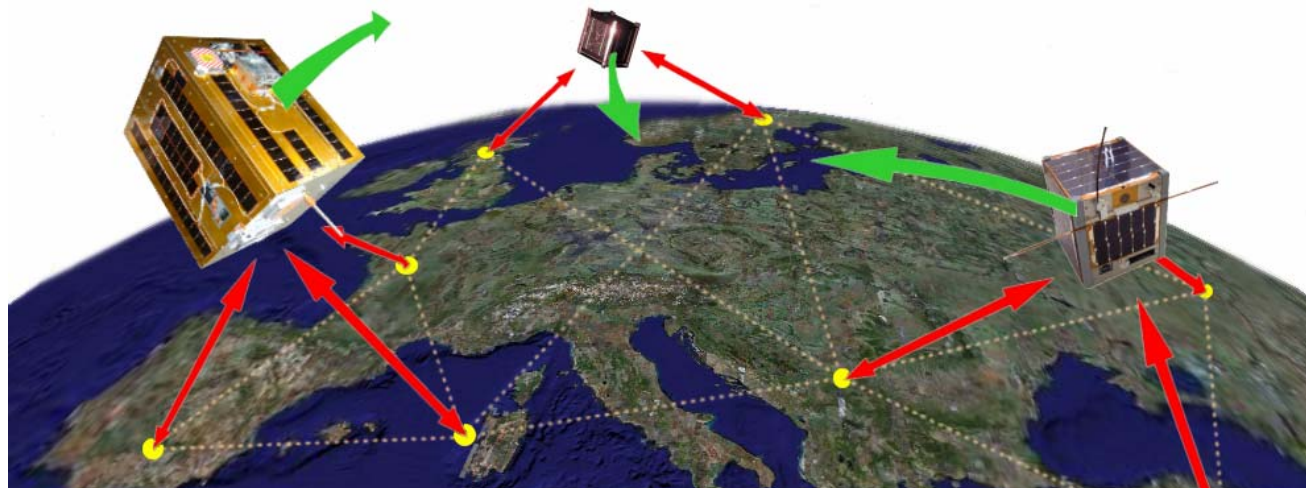
AO16, AMSAT
AO51, AMSAT
CAN-X, Canada
CUTE-1, Tokyo Institute of Technology
GO32, AMSAT
Hitsat, Hokkaido Institute of Technology
International Space Station
LO19, AMSAT
QUAKE-SAT,
Xi-IV, University of Tokyo
Xi-V, University of Tokyo

Implementation Teams & Development Stations:

AMSAT-UK, UK
Aalborg University, Denmark
CalPoly, USA
ESA - ESTEC, Netherlands
University Narvik, Norway
Luleå University, Sweden
SSETI Association, France
TU Delft, Netherlands
TU Vienna, Austria
University of Tokyo, Japan
University of Würzburg, Germany

Interested Missions / Ground Stations (so far) for when the network is operational:

EPFL, Switzerland
Hokkaido Institute of Technology, Japan
International Space University, France
Kagawa University, Japan
Kyushu Institute of Technology, Japan
Kyushu University, Japan
Nihon University, Japan
SOHLA (industrial consortium), Japan
Soka University, Japan
Stanford University, USA
Sugadaira Space Radio Observatory, Japan
SvalSat, Svalbard
TU München, Germany
Tohoku University, Japan
Tokyo Institute of Technology, Japan
Tokyo Metropolitan College, Japan
University of Aachen, Germany
University of Bologna
University of Chile, Chile
University of Manitoba, Canada
University of Mauritius, Mauritius
University of Toronto, Canada
University of Patras, Greece
University of Porto, Portugal
University of South Australia, Australia
University of Stuttgart, Germany
University of Tokyo, Japan
University of Warwick, UK
University of Weingarten, Germany
Yamaguchi University, Japan





Contact Us

Website (coming very soon!)

www.genso.org

Project Coordinator

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"GENSO - Creating Clear Horizons"