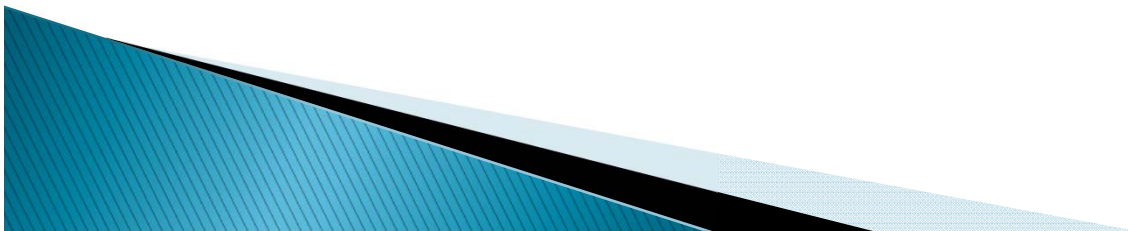


GENSO Presentation for Cal Poly Spring Workshop April 2012

Connor Lange
Cal Poly

Craig Kief and Brian Zufelt
COSMIAC

Fernando Agelet and Antonio Vazquez
University of Vigo



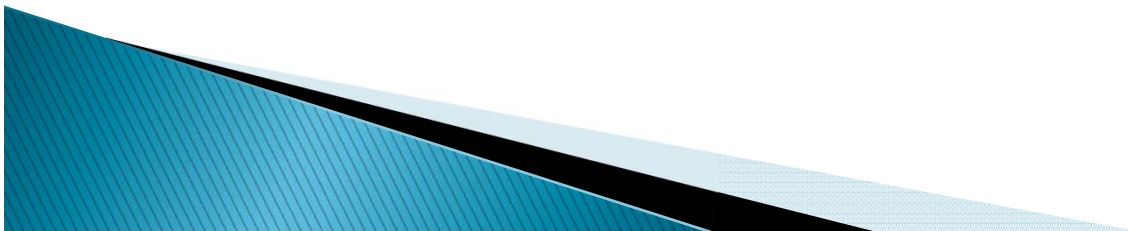
Problems to be Solved

How do we break the mold of one ground station – one satellite for science missions?

For a 3–6 month mission, is it worth it to build a ground station?

How do we facilitate the Ground segment to make it easier to get educational missions to space?

Can a larger community capitalize on these efforts?



Background – GENSO

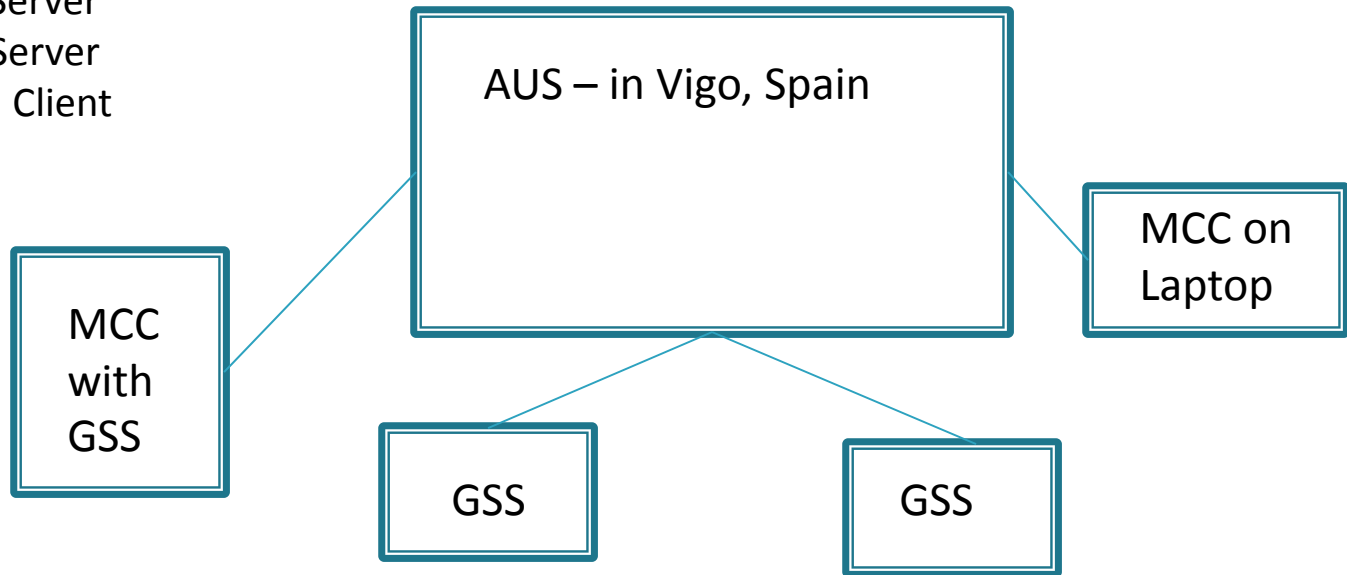
Global Education Network for Satellite Operations (GENSO) is a software standard which allows each ground station on the network to communicate with non-local spacecraft and transmit data to different ground terminals that have access to the specific satellite.

GENSO was developed primarily by volunteers in the educational / amateur radio community. ESA took the lead under auspices of the International Space Education Board



GENSO Network Details

- *AUS = Authentication Server
- *GSS = Ground Station Server
- *MCC = Mission Control Client



One MCC will be assigned for each GENSO registered spacecraft when fully functional

All GSS receive and distribute a piece of the puzzle but only one MCC sees the entire picture. Since the GSS is tied to a physical ground station, it only sees what is available during a pass whereas the MCC has access to the aggregate of all downloaded data.

GENSO Network Entities – AUS

- ▶ AUS
 - Security
 - Entities authentication
 - Management
 - Network Management and Statistics
 - Metadata on accesses results
 - User Management
 - Information
 - TLE autoupdate

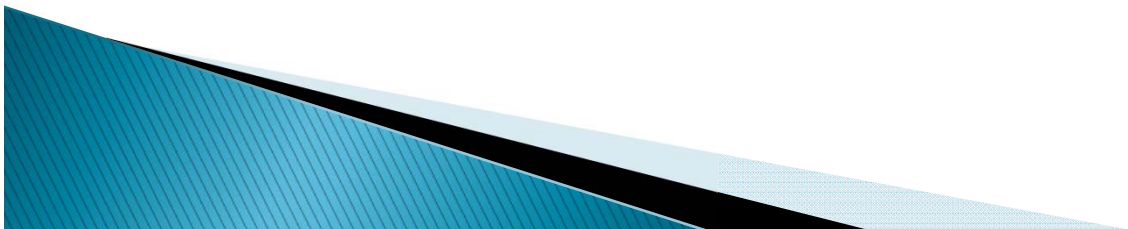


GENSO Network Entities – GSS

- ▶ GSS
 - Autonomous tracking and telemetry downlink
 - Automated sending of passreports to Mission Controllers
 - Real-time connection to MCC (requires manual request and confirmation)



University of Vigo Backup Station, GENSO Station



GENSO Network Entities – MCC

▶ MCC

- Passreport viewer
- Scheduling over network stations
- “Wallplug” to Mission Software (Serial port interface (virtual modem) / audio stream)

Map

GS List

Passreports

Bookings

Snapshot of GENSO R2 MCC (ongoing development)

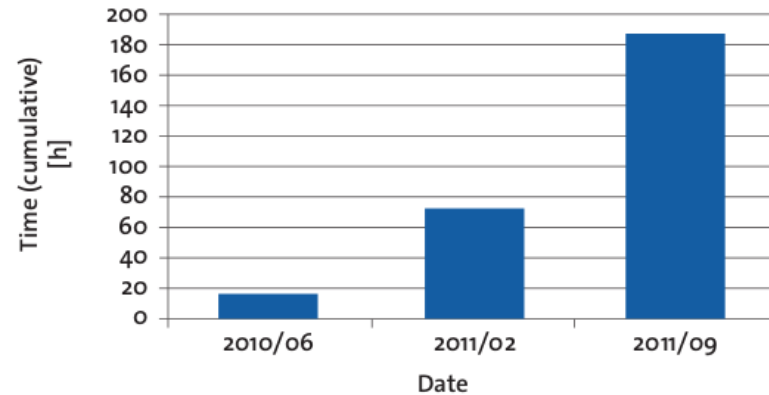
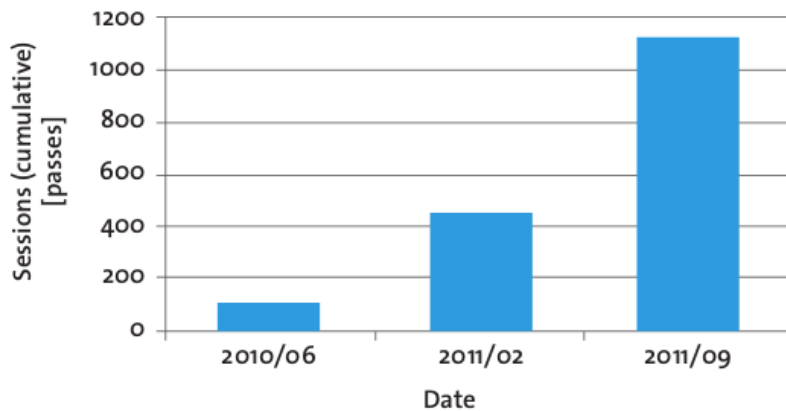
R1E – Release 1 for ELaNa

- ▶ First mission test case
- ▶ Network created specifically for ELaNa I with GSSs running the R1 software
- ▶ Allow real-time distribution and use of TLEs in early mission stages
- ▶ Deployed February 2011
- ▶ Many schools and individuals trained



R1E – Release 1 Statistics

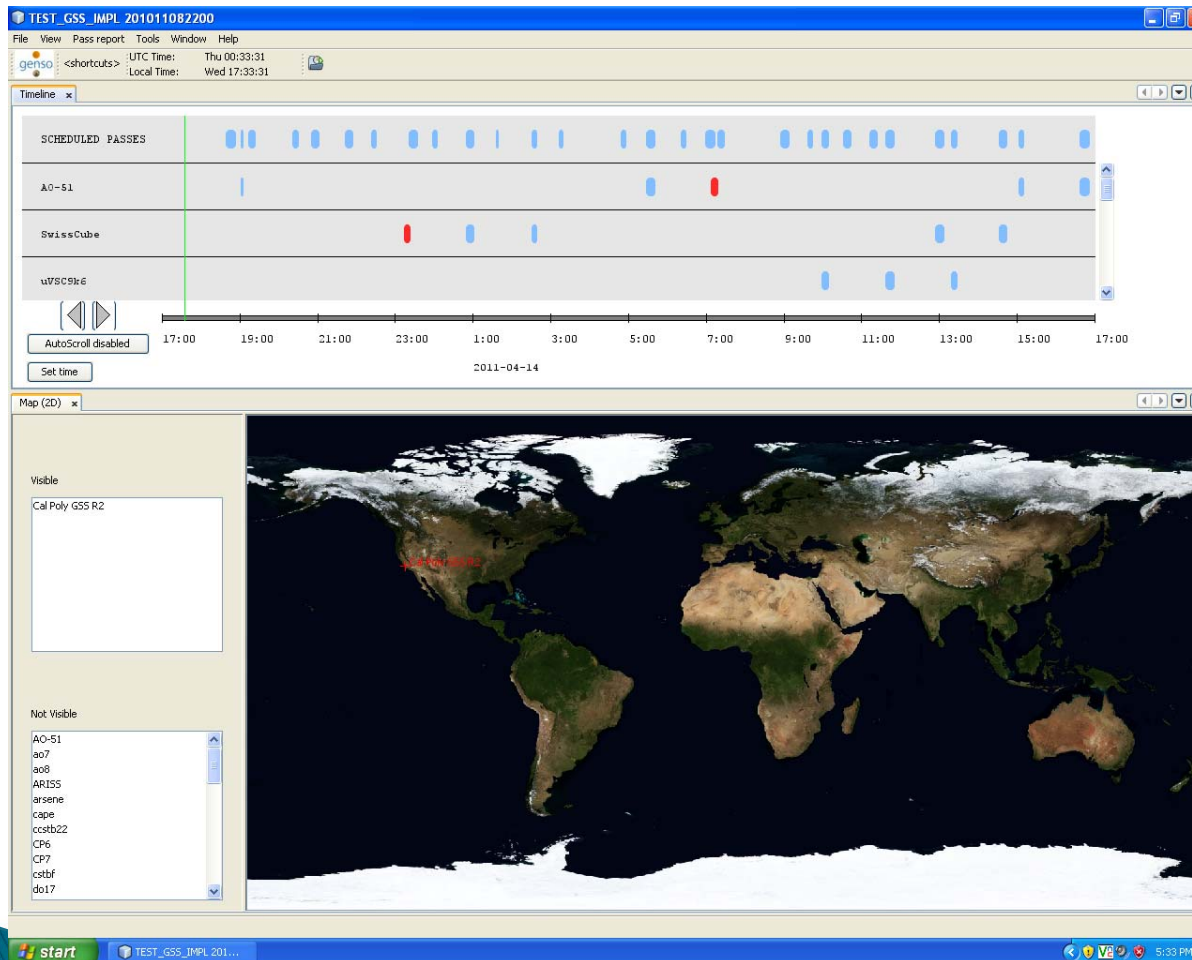
- ▶ Currently supporting five CubeSats from ELaNa 3 including ISS and AO-51, Fast1, Fast2 and Vega launch cubesats
- ▶ All AFRL UNP teams trained



↑ GENSO stations passes providing telemetry services

↑ GENSO Stations Telemetry Support Time

R2 – Improved Capability



- ▶ Released in 2011
- ▶ Required major upgrades/fixes
- ▶ Rereleased in 2012
- ▶ Currently undergoing testing
- ▶ Plans for ESA to release this as open source soon

Summary

- ▶ R1 – Stable testing release
 - Successful proof of concept test
- ▶ R1E – Mission–support test release
 - Successfully supporting FASTRAC
- ▶ R2 – Currently being developed
- ▶ Beyond – Open–source release
 - Follows R2 completion
- ▶ Training sessions are available and limited assistance

