GGOS Networks, Communications and Infrastructure Working Group

GGOS Retreat

Mandalay Beach, CA

February 19 – 21, 2007

GGOS Networks, Communications and Infrastructure Working Group

• **Introduction**	**Mike Pearlman**
• **Network Scoping Activity**	**Erricos Pavlis, Chopo Ma, Dan MacMillan**
• **Colocation Ground Control**	**Dirk Behrend**
• **Status of GPS Retros**	**Mike Pearlman**

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Charter

- **Working with representatives from the IAG services, to develop a strategy for building, integrating and maintaining the fundamental geodetic network of instruments and supporting infrastructure in a sustainable way to satisfy the long-term (10 - 20 years) requirements identified by the GGOS Science Council. At the base of GGOS are the sensors and observatories situated around the world providing the timely, precise and fundamental data essential for creating the GGOS products. Primary emphasis must be on the infrastructure for sustaining the evolving global reference frame while at the same time ensuring an infrastructure that provides data to support the scientific and applications requirements.**

Work Plan Tasks

Inventory

- **Work with the Measurement Services to take stock of all station information (site logs) including site surveys, and co-location data, set it into a standard format, integrate it, and provide it in a user friendly web format;**
- **Work with the Data and Information Systems (DIS) WG to take stock of all data bases (observational data and data products), and make them available in an integrated basis in a user-friendly web format;**
- **Work with the DIS to document the quality of the products from each network (see above);**
- **Document the status and quality of current co-location network (sites, distribution, surveys, etc.);**
- **Document the evolution to date in quality of the key data products (including the ITRF and gravity field), noting the timeline of key improvements in satellites, systems, networks, colocation, analysis capability, and integration strategy.**

Inventory Tasks

- Tables of data and product tables are provided by the services: http://indigo.nasa.gov/indigo_serva.html.

- Lists of stations in the separate ground networks: http://indigo.nasa.gov/sgp_locations_full_db_site.html

  These links provide progress to date. We have yet to include gravity and tide gauges.

Network Plan Tasks

Projection of Network Capability

- **Using the latest version of the current analysis packages, test the sensitivity of key products to system capability, network configuration, co-location, and integration time (both short and long term);**
  - **Can we engage the IERS to help with this?**
- **Examine the effects of station and network deterioration; sustaining the network;**
- **Document the system, network, and space segment improvements planned for each of the space geodesy techniques over the next 10 years (VLBI 2010 Vision, SLR2000, new class of GPS satellites, Galileo, GOCE, etc) (Service responsibility);**
- **Project the potential capabilities of the stations with the anticipated technologies; project the design and capability of future co-location sites (including survey capability).**

Network Plan Tasks

Building the Networks to Meet Anticipated Need

- **Quantify the projected requirement for the key data products (specified by the GGOS Science Council);**
- **Determine what additional capabilities are necessary to meet these requirements;**
- **Test network configurations with the anticipated station capabilities and co-locations toward satisfying these requirements (Work with the IERS?);**
- **Look at the balance among the techniques, number of stations, redundancy, station outage backup options, and measurement time to achieve the GGOS requirements;**
- **Work with the Measurement Services to examine transition strategies to ensure continuity of integrated data products into the new configuration;**
- **Interpret network degradations and enhancements in terms of their effects on observables (ocean surface, ice surface, vertical motions, etc.)**

Retroreflector Array on GPS III

- **Several meetings have been held with the JPO;**
- **Utility and Technical Documentation submitted to the Partnership Council (AF, NRO, NASA) and JPO;**
- **Interagency Study Group to develop a multi-agency agreement;**
- **Draft Report developed for the Space Communications Architecture Working Group (Partnership Council)**
- **Recommendations and letter from GGOS and the Services**

There seems to be considerable interest

Status of the Current SLR Network

- **“The best” stations**
  - **range to LAGEOS in both daytime and night-time;**
  - **range to GLONASS at night with some success in daylight;**
  - **range to GIOVE-A at night;**
  - **GPS 35/36 at night;**
- **Some stations are upgrading hardware and operational procedures**
  - **So we should expect some improvement**

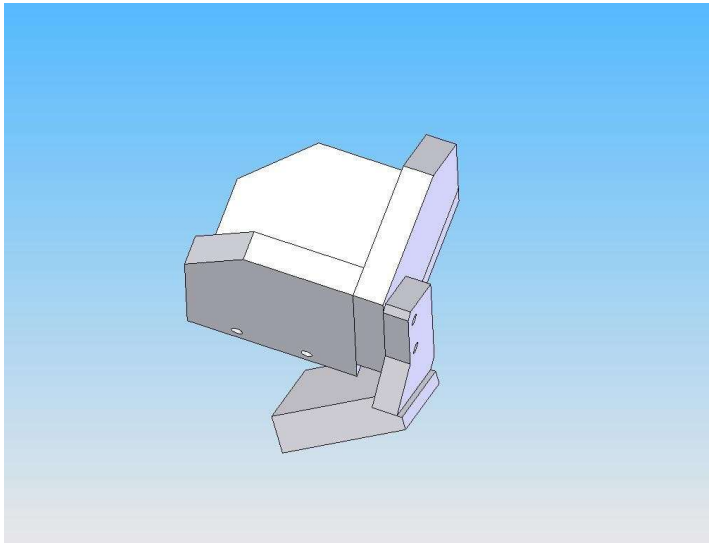
Relative Signal Strength Normalized to LAGEOS

(Effective Cross-Section (ECS) are estimated from the array and cornercube specifications)

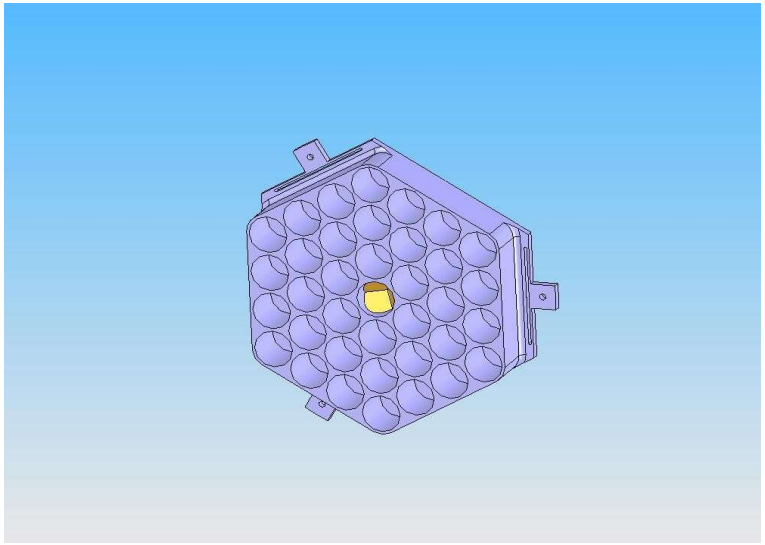
Satellite	Average Range (in 10^3 km.)	Eff. Cross Section (in 10^6 m^2)	R**4 (in 10^{16} m^2)	Rel. Signal Strength normalized to LAGEOS
LAGEOS	6 – 8	7	0.24	1
GLONASS	19 – 21	76	13.3	0.1
GPS 35/36	20 – 22	19	16.0	0.02
GIOVE-A (Galileo)	24-26	45	31.0	0.025

- **We need at least a factor of five increase in effective cross-section of present GPS array;**
- **We need 100 million sq. meters to reproduce early GLONASS results;**
- **A 300 million sq. meter arrray will greatly enhance daylight ranging.**

Hollow Cube Array



Single hollow cube



Hollow cube array configuration

Retroreflectors Testing

- **Design and performance studies currently underway at GSFC to determine the viability of a space qualified hollow cube (see figure 1).**
  - **Area and weight for hollow cube option based on those studies;**
  - **Advantage in savings in weight;**

- **The Laboratori Nazionali di Frascati (LNF) has agreed to test corner cube arrays under space conditions in its new environmental test chamber;**

- **Action Plan**
  - **Complete the design and performance studies at GSFC;**
  - **Test spare GPS array to see if the present performance in GPS 35/36 is nominal (already at LFN);**
  - **Test the LAGEOS array sector as a means of normalizing these and all future array measurements (already at LFN);**
  - **Test a set of uncoated cubes to see if the anticipated improvement can be realized;**
  - **Test the hollow cubes to see if their anticipated performance can be realized.**