IVS Newsletter

Issue 19, December 2007

Working Group on 'VLBI Data Structures' Established

– John Gipson, NVI Inc./GSFC

At the September 15th IVS Directing Board meeting I proposed establishing a "Working Group on VLBI Data Structures". Although the VLBI database system has served us well these last 30 years, it is time for a new data structure that is more modern, flexible, and extensible. The Board unanimously accepted the proposal and Working Group 4 (WG4) was established.

The VLBI database format and associated software has been in use since the 1970s. It was designed for the VLBI world at that time. Many things have changed over the last 30 years, and it is a testament how well thought out the original idea was that it is still in use today. To put this in perspective: how many personal items do you own that you bought 30 years ago, and that you still use on a daily basis? VLBI2010 gives us the perfect motivation to re-think and re-design how we want to organize, store, and transmit VLBI data.

John Gipson, the chair of the newly established Working Group 4 on VLBI Data Structures.

Broadly speaking, the goals of the working group are (1) to assess current and future (including VLBI2010) requirements for VLBI data, (2) to design a system which meets these requirements, and (3) to design and implement a transition plan to take us from the current database format to the new format. Our aim is to complete these steps by the 2010 IVS General Meeting.

Changing the VLBI data structure affects almost everyone in the VLBI community. Therefore, it is important that the working group have representatives from a cross-section of the community. The following list gives the confirmed members of the working group and their function or representation within the group: John Gipson (Chair); Axel Nothnagel (Analysis Coordinator); Roger Cappallo and Colin Lonsdale (correlators); David Gordon and Leonid Petrov (Calc/Solve); Chris Jacobs (Modest); Oleg Titov, Volker Tesmer, and Johannes Böhm (Occam); Sergei Bolotin (SteelBreeze); Anne-Marie Gontier (PIVEX); and Thomas Hobiger and Hiroshi Takiguchi (K5 correlator).

Communication is crucial to the success of WG4. This includes both communication between the members and communication between the Working Group and the entire IVS community. In this regard we will follow the lead of the VLBI2010 Committee which is a model for open communication. Our e-mail discussions will be publicly available on the IVS Web site. We will have splinter meetings at the AGU, EGU, and IVS General Meetings. These meetings are primarily for working group members, but other interested parties are welcome to attend. We will also make regular presentations at the IVS General Meeting and other conferences as appropriate. Our goal is to make sure that everyone knows what we are doing, and that there will be no unpleasant surprises.

What features will the new format offer? At a minimum, the new data format must be able to store the data currently required to process VLBI sessions. It should also handle the anticipated needs of VLBI2010 and beyond. Without these, there is no point at all in designing a new system. Other desirable features are:

- Minimize data redundancy, perhaps by going to a scan-based system.
- Interface to a variety of computer languages, on a variety of hardware platforms. This could be done by using public domain formats, such as netCDF, FITS, HDF, etc.
- Extensible: It should be possible to add new data types, e.g. source-maps, antenna gain information.
- Track history of the data due to better calibration, modeling, etc.
- Ability to extract the data at different levels of processing. Some users are only interested in the final delays. Others may want data in a more raw format, such as correlator output.

I am sure that other Working Group members and the VLBI community in general have additional ideas, and I welcome you to communicate with me in person or via email (John.M.Gipson@nasa.gov).

http://ivscc.gsfc.nasa.gov/about/wg/wg4/
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Permanent Component

Observatoire de Paris, France

Paris Observatory (Observatoire de Paris; OPAR) serves as an IVS Analysis Center and is one of the three primary IVS Data Centers. Newsletter Editor Hayo Hase interviewed Anne-Marie Gontier via e-mail to learn more about the state of affairs and planned activities.

Anne-Marie Gontier in her office.

Anne-Marie, can you explain in a few words what OPAR's main activities are and how the IVS activities fit into the organizational structure?

Paris Observatory is the main national hub of research in astronomy with the status of a university. Its activities include all fields of present-day astronomy and astrophysics: fundamental astronomy, study of the Sun and the relation Sun-Earth, planets and planetary systems, stars formation, interstellar medium, formation and evolution of galaxies, astroparticle physics and cosmology, history and philosophy of sciences. The Observatory is organized in seven laboratories and the IVS activities are hosted at the SYRTE (Systèmes de Référence Temps Espace). The SYRTE conducts studies mainly in three domains: time/frequency metrology and inertial sensors, reference systems and Earth rotation, and history of astronomy. In parallel to these research activities, the laboratory contributes to the national time and frequencies references and to international services such as IERS, ILRS, and IVS.

Could you briefly introduce the members of the VLBI group?

The VLBI group consists of the engineer Christophe Barache, who is working in VLBI since 2004 and is operating the IVS Data Center. Christophe also is responsible for all technical aspects of the Analysis Center. Two scientists—Sébastien Lambert and myself— work on software development and data analysis.

What are your current research topics?

Our current research work is mainly focused on the celestial reference frame and on geophysical issues. We assess the stability of extragalactic radio sources by using VLBI radio source coordinate time series. We conduct studies on various selection schemes and their impact on the stability of the ICRF axes. This work will contribute to the selection of the best subset of radio sources to provide the next realization of the ICRF.

We also analyze EOP variations to provide information on the Earth's interior (e.g., mantle anelasticity, Earth's core, and inner core rotation)..

What challenges do you see for the VLBI analysis as well as for the Data Center?

The Data Center will have to archive more and more observations in the future and, at the same time, maintain access to older data. The data storage requirement together with a need for rapid access to the observations and VLBI products will have to be faced in the future. Giving access to VLBI data and products through the virtual observatory will contribute to the promotion of our work in the astrophysical community.

To deal with more accurate VLBI observations, improvements in modeling and analysis strategies have to be reached. All mechanisms, from the behavior of extragalactic radio sources to the Earth's interior, need to be precisely modeled and interdisciplinary collaboration will become a necessity.

The OPAR VLBI group (from left to the right) Christophe Barache, Anne-Marie Gontier, and Sébastien Lambert standing in front of the office building of Paris Observatory.

How is your work related to the IERS?

As VLBI is the only technique that provides a consistent terrestrial and celestial frame plus the interconnecting EOP, it is an important technique for the IERS. Paris Observatory hosts two IERS components: the EOP Product Center and the ICRS Product Center, the latter run jointly with USNO. Sébastien Lambert is the VLBI expert of the EOP Product Center. Christophe Barache and myself, we are team members of the ICRS Product Center. We also participate in the IERS Conventions, with our contributions mainly being related to Chapter 2 "Conventional Celestial Reference System and Frame" and Chapter 5 "Transformation between the Celestial and Terrestrial Systems".

We know that France is very active in space geodesy. With DORIS, it successfully runs its own global space geodetic technique. How are VLBI activities in geodesy and astronomy organized in France?

In France, the VLBI activities in geodesy and astronomy are organized through Paris Observatory and Bordeaux Observatory. Students either study mathematics or physics and, before beginning their PhD, they follow one year of specialization in astronomy and geodesy or study in an engineering college in geodesy. In that framework, VLBI is taught as one of the space geodetic techniques.

France still has overseas territories, that is small pieces of land outside of Europe. For the densification of the IVS network with respect to the goals of VLBI2010, we would like to see that new network stations will come up in some of these remote places in the foreseeable future. Do you have plans to launch an IVS network station project?

Currently, we do not have plans to launch an IVS network station project. The idea of operating a VLBI station, however, is a recurrent theme in France. Each time the issue is raised, we try to demonstrate that the best location would be in the southern hemisphere, e.g. in Tahiti, as it will strengthen the global VLBI network.

How do you address the VLBI2010 vision to improve the analysis work? What shall be done for a better service?

With VLBI2010, the amount of VLBI observations and the measurement accuracy will increase. Together with shortened product delivery times, this means that we have to develop more automatic VLBI analyses and strategies. More precise geodetic measurements will contribute to a better understanding of the internal structure and the coupling between the various layers of the Earth. Further improvements in the modeling and a better understanding of the System Earth will be possible; this is very exciting from an analyst point of view.

Finally a more personal question: what do you like about working with the VLBI community? Any wishes for the future?

The VLBI community is welcoming and friendly. Competition between the various analysis centers is a good incentive. Working in VLBI gave me the opportunity to meet people from various nationalities and to form friendships.

Views of Paris Observatory's historical building.

The IVS Newsletter is published three times annually, in April, August, and December. Contributed articles, pictures, cartoons, and feedback are welcome at any time.

Please send contributions to ivs-news@ivscc.gsfc.nasa.gov.
The editors reserve the right to edit contributions. The deadline for contributions is one month before the publication date.

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The newsletter is published in color with live links on the IVS web site at http://ivscc.gsfc.nasa.gov/.

NEWS...

News from the IVS Directing Board

– Dirk Behrend, NVI Inc./GSFC

The 18th Directing Board meeting was held at the University of Bonn, Bonn, Germany on Saturday, September 15, 2007. The new chair of the IVS, Harald Schuh (TU Vienna), presided over his first meeting mostly continuing the successful format that was established by his predecessor Wolfgang Schlüter (BKG). A significant innovation, though, was to place emphasis on selected topics by allotting more agenda time to two of the reports (plus discussion) from the coordinators, working group chairs, and committee chairs. This board meeting, therefore, had extended reports for the analysis work and the VLBI2010 work.

The participants at the IVS Directing Board meeting in Bonn.

The board welcomed Ray Norris (ATNF Australia) as the new representative of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS), succeeding Roy Booth (HartRAO) in this function. We thank Roy for the support during his term and hope to stay in close contact also in the future.

A GGOS Unified Analysis Workshop will take place in Monterey, CA, USA in December 2007. This workshop is on invitation only; the IVS Chair nominated Axel Nothnagel, Johannes Böhm, Dan MacMillan, Arthur Niell, and Volker Tesmer as the five IVS representatives. The Institute of Geodesy and Geophysics (IGG) will resume the rapid combination of the weekly TROPO solutions for IVS-internal session validity checks and to satisfy user demands, and will continue the long-term combination with an update interval of about 6 months. IGG had stopped the rapid combination work for the IVS weekly solutions, when the IGS (International GNSS Service) ceased to create a combined GPS solution resulting in the loss of a guaranteed bias-free comparison product data set. However, several users (e.g., EUREF) had complained about the loss of the rapid IVS combination product, which they used for validity checks.

Axel Nothnagel (left) during the Analysis Coordinator's report to the Board.

The current geodetic media pool can sustain the observing program for 2008: there are 453 modules required and 466 are available. The small margin does not allow going to higher observing rates for any of the session types. The observation window for the planned continuous VLBI campaign CONT08 was fixed to May–August 2008. The likely observing rate is 512 Mbps. Assuming the rate of 512 Mbps and a participation of 12 stations, about 90 additional D-size (2000 GB) modules would need to be purchased to support CONT08. A general call to purchase more modules will be ushered by the Coordinating Center.

The Analysis Coordinator Axel Nothnagel hinted at a deficit in the CONT05 campaign, where the 30-min gaps between the individual observation days resulted in peaks in the UT1−TAI time series. If practical, this should be avoided in the planned CONT08. The IVS standard EOP format (EOP files .eops and .eopi) was extended by an additional field to include the station network used in the solution. On the SINEX-file level, a new SINEX file is needed for each network configuration.

The main thrusts of the VLBI2010 Committee lay on simulation and prototyping efforts. Monte Carlo simulators have been developed to predict VLBI2010 performance; to study the impact of strategies, system parameters, and specifications; and to understand the error processes. The NASA supported prototyping efforts focused on testing the "broadband delay" concept and on gaining real world experience with the next generation VLBI subsystems (cf. article on Page 6). The slew rate specification for the new antennas shall be fixed by the end of 2007. The VLBI2010 system shall be fully defined by 2010.

The current IVS standard for data exchange and archiving are databases. In addition, a data format called NGS Cards is used. The system was designed to meet hardware and software requirements of the 1970s/1980s and was created for Calc/Solve. It was designed for S/X data, has lots of redundancies, and is inadequate for VLBI2010. The Board followed a proposal by John Gipson and established IVS Working Group 4 on VLBI Data Structures (cf. article on Page 1).

The meeting took place at the Institute of Geodesy and Geoinformation (formerly Geodetic Institute) of the University of Bonn in a very friendly and hospitable atmosphere. On behalf of the Board, I would like to thank the local organizer Axel Nothnagel for the excellent organization, in particular for arranging the Skype and Telecon connection to our external participants which worked very smoothly.

The notes of the 18th Directing Board meeting are available on the IVS Web site at http://ivscc.gsfc.nasa.gov/about/org/board/dbmeet18.txt.

News...

6th International e-VLBI Meeting Held at MPIfR

– Alessandra Bertarini, MPIfR Bonn

As part of the meeting program the 100 m Effelsberg radio telescope was visited. Effelsberg now has a fiber connection to Bonn that is presently being lit up and will be useful for e-VLBI and LOFAR.

The 6th International e-VLBI Workshop was held in September at the Max-Planck-Institute for Radio Astronomy (MPIfR) at Bonn, Germany. The workshop was supported by the EXPReS project of the European Union (http://www.expres-eu.org/) and the MPIfR.

The meeting attracted some 60 scientists from around the world, with various backgrounds but with the common interest of developing and using electronic transfer of VLBI data from the telescopes to the correlators. Some of these groups have already achieved good performance, while others will be joining the e-VLBI club soon.

A lot of interesting e-VLBI-related topics were presented at the meeting. The presentation files can be found at http://www.mpifr-bonn.mpg.de/div/vlbi/6th_evlbi/program.html. The most advanced group appeared to be the Australians, who presented a fully functional digital backend, a software correlator, and a record of already performed real-time e-VLBI experiments within Australia as well as with the JIVE correlator in the Netherlands. The advantages of e-VLBI are obvious. As Steven Tingay (Curtin University of Technology) put it in his presentation, "it took about three weeks between the observations and the submission of the publication."

"Europe is also making substantial progress toward real-time e-VLBI transfers," was pointed out by Arpad Szomoru (JIVE). He reported that the EVN had already 17 e-VLBI science projects accepted since 2006 and showed images from a real-time e-VLBI transfer successfully correlated at JIVE.

Yasuhiro Koyama (NICT) added that "also the geodesists are producing very rapid turnaround. A Japanese–Swedish–Finnish team delivered the database of an Intensive session (1–hour observing) to the analysts 20 min after the end of the observation. They obtained this result by transferring the data in real time to the Kashima correlator and correlating each scan during the telescopes' slewing time." Christian Dulfer (Institute of Geodesy and Geoinformation, Bonn University) presented the results of the weekly Int3 Intensive series with stations in Norway, Japan, and Germany, which is correlated at Bonn. The delivery time of about seven hours after the final observation is not as fast as obtained by the Japanese–Scandinavian group, but "is in line with the aim of the Bonn Correlator to support near-real-time e-VLBI" as was stated by the meeting chairman and Bonn Correlator group lead Walter Alef.

There are two other personal highlights of the meeting that I would like to mention:

(1) The presentation by Alan Whitney (Haystack Observatory) on the Mark 5C. Mark 5C, which is fully compatible with Mark 5B, has a 10 GigE interface to support digital backends and has a Linux-based file system. The new Mark 5C system represents a step forward for e-VLBI and software correlators. A Mark 5C prototype should be ready by mid 2008.

(2) A presentation by Jan Wagner, a young scientist working at Metsähovi, describing the attempt to port the correlator to a PlayStation. In response to Jan's talk Alan Roy (MPIfR) commented that "the capabilities of these 'video games' machines are extraordinary, but unfortunately the code proved to need time-consuming tuning to exploit the processor architecture of the PlayStation and this seems to violate the concept of platform independence of the software correlator."

Guifré Molera (Metsähovi) presenting to the audience hardware details that enabled the ultra rapid dUT1 measurements by e-VLBI

In the final panel discussion, Tasso Tzioumis (CSIRO) asked for a standardized code for transferring e-VLBI data. The result was the reinvigoration of a working group led by Alan Whitney, which was tasked with finalizing the VSI-E standard definition within a year.

Being at Bonn, I could also help a bit with preparing the meeting. I particularly enjoyed the sample lunches at the restaurant for selecting the menu and the layout of the tables. So, if anyone has anything to say either in favor or against the blue serviettes, then you have to report it to me. For comments on the soup, talk to Walter!

To conclude, many thanks to the organizers and the speakers. I hope to see you next year in Shanghai, China at the 7th e-VLBI meeting.

NEWS...

First Fringes in VLBI2010 Broadband Delay Demonstration

– Arthur Niell, MIT Haystack Observatory for the Broadband Development Team (BBDev)*

On November 19, 2007, the combined effort and hard work of a group of scientists and engineers working on experimentally demonstrating the VLBI2010 concept came to fruition. On that day first fringes were found with the proof-of-concept hardware that has been installed at the MV-3 antenna at Goddard's Geophysical and Astronomical Observatory (GGAO). Although the development work is clearly not finished with this accomplishment, it constitutes a significant step forward.

Jay Redmond and Bruce Whittier installing the Dewar on the 5m MV-3 antenna.

VLBI2010 is the next generation geodetic VLBI system being developed under the auspices of IVS. This system is envisioned to make use of comparatively small but cost-effective 12-m class antennas together with very broadband feeds (2−15 GHz) and multiple IF channels to reliably resolve RF phase. Simultaneously using several (four or more) frequency bands will result in a typical delay precision of about 3 ps (equivalent to 1 mm of radio path length). This compares to a per-observation delay measurement error of about 10−30 ps of the current group delay system. The delay constructed from this system using more than two bands has come to be called "broadband delay". Another advance that enables the use of small antennas is the significant increase in data acquisition rates that has been made possible by the development of the Mark5B+ recorders and the Digital Back Ends (DBE).

In order to demonstrate that the "broadband delay" concept is feasible, we had proposed to implement all of the components of the broadband delay system on the Westford and GGAO antennas. The combined sensitivity of these two antennas is somewhat less than that of two 12-m antennas but is sufficient to demonstrate that the concept can be achieved. The proposal was funded by NASA's Earth Surface and Interior Focus Area through the efforts of John Labrecque, Chopo Ma, and Herb Frey, and we started to work on it about a year ago.

To receive multiple bands the proposed system consists of a broadband feed, which covers the frequency range ~2 GHz to ~13 GHz in two linear polarizations, and two low noise amplifiers (LNAs). The feed and LNAs are both cooled to approximately 20K. The output of each LNA is carried over wideband "RF" optical fiber to the control room where the signals are split into four paths corresponding to the four frequency bands. An Up-Down Converter (UDC) translates both polarizations of each band to a common intermediate frequency (IF) to be digitized and filtered by the Digital Back End and recorded on a Mark5B+ recorder. To observe in four bands requires four UDCs, four Mark5B+s, and two dual-board DBEs at each site.

We constructed the components for one frequency band and installed it on MV-3 the last week of October. The Dewar was mounted at the Cassegrain focus in the location of the original X-band feed (see figure). For the first test we observed at X-band in the usual geodetic band. Westford used the operational NASA X-band receiver and local oscillator but recorded using a DBE and Mark5B+. Since only one band was being recorded, the data rate was only 2 Gb/s.

The first goal was to obtain fringes between MV-3 and Westford at X-band with the new dual-linear polarization system at MV-3 while still using the existing circular polarization and X-band receiver/LO at Westford. Intrepid geodetic VLBI aficionados will recall that the geodetic feeds are circularly polarized and might wonder about the effects of attempting to cross-correlate linear and circular polarization. Fortunately the loss in signal to noise ration is only about 30%.

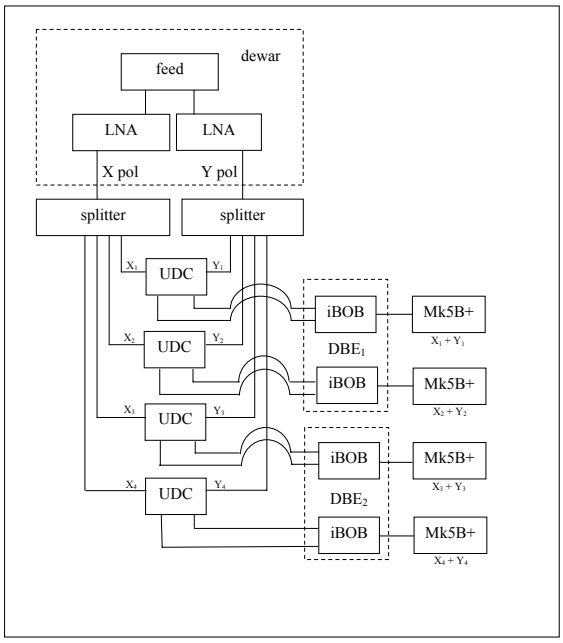


Diagram of the development system for the "broadband delay" demonstration using the Westford and GGAO antennas.

On November 19, fringes were found for both linear polarizations from MV-3. Vertical polarization was carried on optical fiber, horizontal polarization on coax. The SNRs were 127 and 117 for 125 seconds of data. This was in excellent agreement with the expected SNR values, which were computed to be 111 (vertical) and 124 (horizontal).

What are the next steps? We intend to extend this test and observe one source for a continuous six hours to evaluate the differential phase stability between the two polarizations. We have also begun construction of an identical system for Westford where the Dewar will be mounted at prime focus. Eight UDCs and four dual-board DBEs will be constructed to observe in four frequency bands. When these components are completed, the next round of testing will evaluate the efficiency of the broadband system mounted on the Westford antenna. Depending on the availability of Mark5B+s, this may be done at all four bands or one band at a time.

Acknowledgements: This is a team project with important contributions by all participants. In addition, the system could not have been put together without the work of Sandy Weinreb and Hamdi Mani of Caltech, whose design of the Dewar, feed, and LNAs has been copied directly. Beyond that they have generously provided advice as we constructed the front end for MV-3. We also want to thank Dan MacMillan, Peter Bolis, Don Sousa, and Dave Fields for their help, Photonics Systems Inc. for loaning us the fiber optic link, and Shep Doeleman of Haystack for his significant contributions to the successful implementation of the basic DBE.

** BBDev Team (in reverse alphabetical order): Bruce Whittier, Mike Titus, Jason SooHoo, Dan Smythe, Alan Rogers, Jay Redmond, Mike Poirier, Arthur Niell, Chuck Kodak, Alan Hinton, Ed Himwich, Skip Gordon, Mark Evangelista, Irv Diegel, Brian Corey, and Tom Clark.*

Upgrading Mark5's Operating System

– Chester Ruszczyk, MIT Haystack Observatory

For the last few years many have been using the Mark 5A recording system with the unsupported RedHat 9 Operating System (OS) distribution. Though this OS has been stable and reliable, if your system is attached to a network, there are security issues that must be addressed. In particular, there have not been any patches created for the applications that run on the system causing it to be susceptible to hackers and script kiddies to take over your machine.

In this note, we address the issue of upgrading the Mark 5 OS to the Debian Sarge distribution, and how to install a new instance of the Mark 5A application. Please follow these instructions (download area is http://www.haystack.edu/tech/vlbi/mark5/downloads/):

1. Download '*Upgrade_notes_a.pdf*' (step-by-step instructions).
2. Download iso images '*Mark5OSdisk-1.iso*' and '*Mark5OSdisk-2.iso*'.
3. Create a bootable CD for each iso image and label them '*Mark5 OS Distribution Disk 1*' and '*Mark5 OS Distribution Disk 2*', respectively.
4. After installing the Mark 5 OS, update the '*ntpdate*' configuration file ('*/etc/default/ntpdate.conf*') by modifying the NPTOPTIONS line to NTPOPTIONS="*–v –p 8*" and by adding your NTP servers ahead of the standard with NTPSERVERS="*your.ntpserver.name*".
5. If needed, install the network time protocol daemon by running '*apt-get install ntpd*' and then adding your NTP server (or two or three) to the configuration file ('*/etc/ntp.conf*') with '*server your.ntpserver.name.here*'. Finally, reload the new configuration by executing in the directory '*/etc/init.d*' the command '*ntpd reload*'.
6. Install the Mark 5 application software: download '*MakeMark5*', then execute as root first '*chmod a+x MakeMark5*' and then '*MakeMark5*'.
7. For Mark 5B systems the following additional steps are required: (1) create a soft link under '*/usr/src*' to point to the appropriate kernel header (e.g., '*ln –s /usr/src/kernel-headers-2.4.27-3-386 /usr/src/linux*'). You can determine your kernel version by executing '*uname –a*' and find the matching header directory under '*/usr/src*'. (2) Download one of the development Mark 5A tar balls and copy it to '*/tmp/Mark5A.tgz*'. (3) Execute under '*/home/jball/bin/*' the following routines: '*Mark5Update.dev*' and then '*cc5B*' (for a Mark 5B system) or '*cc5Bx*' (for a Mark 5B+ system).

The software should now be installed and operational. Please send an e-mail to the author (cruszczyk@haystack.mit.edu) in case of problems.

Upcoming Meetings...

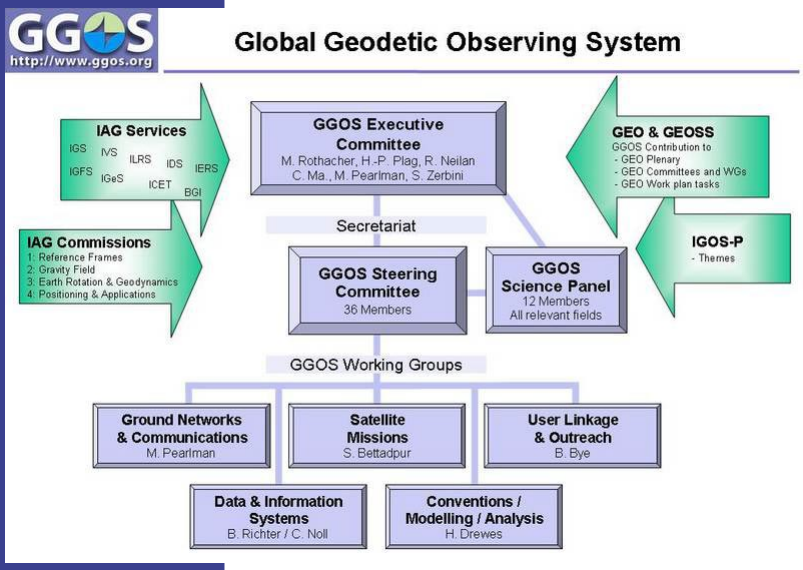
AGU Fall Meeting San Francisco, USA December 10-14, 2007	GGOS Retreat Bertinoro, Italy March 25-28, 2008
5th IVS General Meeting St. Petersburg, Russia March 3-6, 2008	EGU 2008 Vienna, Austria April 13-18, 2008
IVS Analysis Workshop St. Petersburg, Russia March 7, 2008	FIG/IAG Joint Symposium Lisbon, Portugal May 12-15, 2008

http://ivscc.gsfc.nasa.gov/meetings

A Short Update on GGOS

– Dirk Behrend, NVI Inc./GSFC

The GGOS (Global Geodetic Observing System) made strides in 2007. The GGOS strategy document (GGOS2020 Reference Document), which has grown to about 200 pages, is expected to be available as a final draft by the middle of December 2007. At that point it will enter into an external hearing phase with all stakeholders for about two months—to be reviewed by international organizations such as GEO, IGOS-P, and IUGG as well as national and international authorities and space agencies. The final GGOS2020 Reference Document is planned to be available at the 2008 GGOS Retreat in Bertinoro, Italy in March 2008.



Internal structure of GGOS.

At the IUGG General Assembly in Perugia, Italy in July 2007, the IAG (International Association of Geodesy) Council accepted new By-Laws which elevated GGOS from the status of a project to a full component of IAG. Hence, GGOS is now at the same level as IAG Commissions. At the same meeting, the new GGOS Terms of Reference (ToR) were accepted. The ToR also define the internal structure of GGOS (see figure). The IAG Services are important contributors to GGOS, but the formal role of the Services w.r.t. GGOS is still under discussion. Wolfgang Schlüter stepped back from his position as Deputy IVS Representative on the GGOS Steering Committee. The IVS Directing Board unanimously voted for Harald Schuh to fill the vacant position. Dirk Behrend continues to be the IVS Delegate on the GGOS Steering Committee.

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