IVS Newsletter

Issue 1, December 2001

Wolfgang Schlüter, IVS Chair

Inaugural Issue

Dear IVS Associate Members and Friends,

It's with pleasure that I welcome you to the first issue of the IVS Newsletter. The suggestion for the Newsletter came from our Technology Coordinator Alan Whitney, stimulated by Arthur Niell from Haystack Observatory who sent an e-mail to the Directing Board with the request to involve all the IVS Associate Members more actively in the "IVS life". The Directing Board discussed this item at its board meeting and decided to publish a newsletter three times a year. The intention is to improve the flow of information among IVS members and to keep everyone aware of major events. The newsletter will give IVS higher visibility not only within the IVS member organizations and affiliated organizations, but also to scientists in related areas such as astronomy, geophysics, and geodynamics. At least the newsletter will help to make us as members feel more a part of IVS.

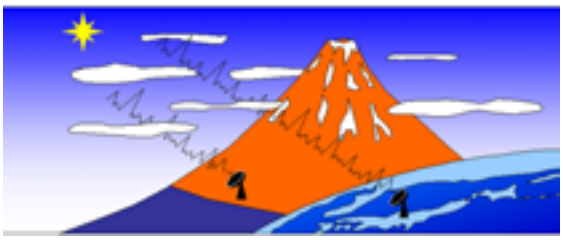
Involve all the IVS Associate Members more actively in the "IVS life".

Everybody is encouraged and invited to support the Newsletter by providing contributions. The Newsletter will cover topics such as new members, programs, results, technology, network, board meetings summaries, meetings of IVS and other services and more. If you have any topic you feel is important for the community send your contribution to the IVS Coordinating Center.

With my best wishes

W. Schlüter

Wolfgang Schlüter



Second IVS General Meeting to be Held in Japanese Early Spring

–Fujinobu Takahashi, CRL LOC Chairman

VLBI technological development in Japan has a history of more than 25 years. Japan has always developed VLBI systems with the latest technologies. On this basis, CRL, GSI, NAO and other Japanese institutes actively continue large-scale and advanced VLBI observation networks throughout the Japanese islands. Moreover, Japanese VLBIers support VLBI research and development in the Asia-Pacific region.

It is meaningful that the second General Meeting of IVS will be held in Japan based on these activities. Participants will be able to observe the newest information technologies as well as the newest VLBI systems.

February 4 when the General Meeting will start is a day called the first day of spring or "Risshun" in the Japanese calendar. It is said on the eastern Asian calendar that spring starts from this day. Since the Japanese islands have a long north-south extent, they will have many areas where still cold winter continues. Please come in early spring to Japan and feel the breath of "Risshun".

Please visit the meeting web page at http://ivscc.gsfc.nasa.gov/meetings/gm2002.

"Lift-the-TIGO containers" training during the visit of our future TIGO colleagues from Concepcion at Wettzell, December 2000. Left to right: Raul Escobar (UCSC), Eduardo Carvacho (UdeC), Oscar Cifuentes (IGM), Carlos Bustamante (UBioBio)

News

TIGO prepares for departure from Germany to Chile.

–Hayo Hase, BKG

With the signature of an "Arrangement" between BKG and the Chilean consortium (three Universities in Concepcion and the mapping authority IGM in Santiago) on June 21, 2000, the TIGO project became a joint project.

The realization of a new IVS network station by the TIGO VLBI module in Concepcion, Chile, is progressing at various levels: policy, staff recruitments, and platform construction.

Based on a bilateral note between Germany and Chile BKG will be able to relocate the fundamental station TIGO and three BKG experts. The approval by the Chilean government has just been received. The Chilean consortium will participate with 11 staff in total who will join the three BKG experts.

The necessary infrastructure for TIGO has been under construction since January 2001 . A 2.5 km access road in the forest of Concepcion was prepared for heavy trucks. Electricity was brought to the TIGO platform. In August and September the concrete foundation was poured for the geodetic monuments for the radio telescope, SLR telescope, GPS, gravity meter, seismometer, and cable ducts. Communications access, water supply and sewage, fencing and security, lighting, and housing should be finished by the end of 2001.

Future TIGO platform prepared for pouring the concrete.

A Scientific Board of TIGO for the supervision of the scientific exploitation of TIGO was selected from among the members of the Chilean consortium and BKG.

During October 2001 the TIGO containers were loaded for transport, with a planned departure from Hamburg on November 30. After a five-week sea voyage TIGO will arrive in Puerto Lirquen near Concepcion and be moved to its permanent home the following week. Installation and check-out will occupy the first few months. The TIGO crew anticipates beginning operations in the second quarter of 2002. ■

Mark 5 VLBI Data System to deploy in 2002

–Alan Whitney, MIT Haystack Observatory

The first prototype deployment of the Mark 5 disc-based VLBI data system is expected in Spring 2002. This system, called Mark 5A, is the first stage of Mark 5 development and will directly replace an existing Mark 4 or VLBA tape drive. The Mark 5A builds on the success of the Mark 5 demonstration system shown at the IVS TOW meeting at Haystack Observatory in March 2001. Approximately 10 Mark 5A prototype systems will be delivered to sponsors of the Mark 5 development effort, including BKG, EVN/JIVE, KVN, MPI, NASA, NRAO and USNO. These systems will be used to validate proper operation with existing stations and correlators and to evaluate the Mark 5A system for effectiveness and robustness.

Continued on next page

Mark 5 demonstration model.

Mark 5 Deploy cont.

The Mark 5 system is based almost entirely on commercial off-the-shelf (COTS) components to provide a low-cost data platform capable of sustained operation at data rates up to 1024 Mbps. The data is collected on an array of up to 16 discs which are mounted in removable carriers (see photo) for ease of use. Current disc prices, based on $/GB are comparable to the price of Mark4/VLBA tapes but continue to fall rapidly. By 2004-5 , it is expected that disc prices will fall well below 1 $US/GB. In addition, storage capacity of discs is rapidly increasing, with 100 Gb discs now readily available and expected to increase to 1000 GB within the next 3 years. Loaded with sixteen 100 GB discs a Mark 5 system supports about 2.5 times the capacity of a single Mark4/VLBA tape. Loaded with sixteen 1000 GB discs, a Mark 5 system will support continuous recording at 1 Gbps for about 34 hours.

Other features of the Mark 5 system include the ability to support e-VLBI either by direct real-time data transmission over a network or buffered through the Mark 5 discs. In work supported by DARPA, this capability will be tested over the next year with an e-VLBI demonstration at near-Gbps speeds using antennas at Haystack Observatory and NASA/GSFC, with correlation at Haystack.

The second stage of the Mark 5 effort is the development of the Mark 5B system, which will be fully VSI compliant and is expected to be ready in late 2003. Considerable effort is being made to support interoperability between Mark 5A and Mark 5B systems for maximum flexibility and usefulness.

For more information on the Mark 5 system, please visit http://fourier.haystack.mit.edu/haystack/vlbi.html where there are also links to more detailed information, including the Mark 5 memo series for detailed technical information.■

IVS is a service of the IAU

IVS has been recognized as a Service of the International Association of Geodesy (IAG) since July 1999 when the General Assembly was held in Birmingham/England. Since the XXIVth General Assembly of the International Astronomical Union (IAU) held in Manchester/England, August 2000 the IVS is also recognized as a Service of the IAU. Below is a reprint of the IAU resolution B1.1.

IAU Resolutions B1.1 Maintenance and Establishment of Reference Frames and Systems

The International Astronomical Union

Noting

1. that Resolution B2 of the XXIIIrd General Assembly (1997) specifies that "the fundamental reference frame shall be the International Celestial Reference Frame (ICRF) constructed by the IAU Working Group on Reference Frames",
2. that Resolution B2 of the XXIIIrd General Assembly (1997) specifies "That the Hipparcos Catalogue shall be the primary realisation of the International Celestial Reference System (ICRS) at optical wavelengths", and
3. the need for accurate definition of reference systems brought about by unprecedented precision, and

Recognising

1. the importance of continuing operational observations made with Very Long Baseline Interferometry (VLBI) to maintain the ICRF,
2. the importance of VLBI observations to the operational determination of the parameters needed to specify the time-variable transformation between the International Celestial and Terrestrial Reference Frames,
3. the progressive shift between the Hipparcos frame and the ICRF, and
4. the need to maintain the optical realisation as close as is possible to the ICRF

Recommends

1. that IAU Division I maintain the Working Group on Celestial Reference Systems formed from Division I members to consult with the International Earth Rotation Service (IERS) regarding the maintenance of the ICRS,
2. that the IAU recognise the International VLBI Service (IVS) for Geodesy and Astrometry as an IAU Service Organization,
3. that an official representative of the IVS be invited to participate in the IAU Working Group on Celestial Reference Systems,
4. that the IAU continue to provide an official representative to the IVS Directing Board,
5. that the astrometric and geodetic VLBI observing programs consider the requirements for maintenance of the ICRF and linking to the Hipparcos optical frame in the selection of sources to be observed (with emphasis on the Southern Hemisphere), design of observing networks, and the distribution of data, and
6. that the scientific community continue with high priority ground- and space-based observations (a) for the maintenance of the optical Hipparcos frames and frames at other wavelengths and (b) for links of the frames to the ICRF.

News

State of the Service: IVS After 2.5 Years

–Wolfgang Schlüter, BKG
IVS Chair

With only 2.5 years of existence, IVS is internationally recognized as a vital community. Evidence of our spirit can be seen by the support for our publications and by participation in IVS meetings. Nearly all the IVS components published contributions in the 1999 and 2000 Annual Reports. Many components provided important inputs to the Proceedings of the IVS 2000 General Meeting. Participation was much more than expected in the 2000 IVS General Meeting, in two Analysis Workshops and in the Technical and Operations Workshop (TOW). On one side it is an indication of interest and willingness to support IVS by the collaborating agencies. On the other side it has to be recognized that the expectations of the agencies, the IAG and the IAU are high for generation of reliable, high quality, timely products.

Very impressive responses were given to the Pilot Projects in data analysis organized by the Analysis Coordinator, Axel Nothnagel. Most of the IVS Analysis Centers contributed solutions and the comparisons were very encouraging. We anticipate that more Analysis Centers will become involved in regular data analysis which will significantly improve the level of confidence in IVS products. So far the Earth Orientation Parameters time series are derived by solutions of five IVS Analysis Centers, combined by the Analysis Coordinator. The combined results are accepted as the official IVS products by the IERS. The stability of the combined time series is improved by roughly 20% and the results are much more robust with respect to outliers.

The Mark 4 correlators became operational and the processing backlog is nearly gone. From now on we can pursue more and improved observing programs for better high quality products. The specification for the VLBI Standard Interface (VSI) was released, and it is hoped that it will lead to more involvement of the various VLBI technologies (Mark 4, K4, S2) in the observing programs. The global VSI Working Group, chaired by the IVS Technology Coordinator, Alan Whitney, and strongly supported by some IVS Associate Members, was extremely successful (see the article on page 6 about the award from the Japanese Ministry). Standard software interface specifications are currently under development. The development of Mark 5 and of e-VLBI will allow us to make data transfer more efficient and will open new applications.

Two working groups set up by the IVS Directing Board have performed their obligations successfully. The working group (WG1) for mapping the GPS antenna phase center, chaired by Brian Corey, evaluated an error budget for possible VLBI contributions in order to map the phase center of the transmitting antennas of GPS satellites with respect to quasars. The WG1 reports indicated the limits of current VLBI possibilities. One result has been not to propose an observing campaign as no gain can be expected. The working group (WG2) on the IVS product definitions and related observing programs, chaired by Harald Schuh, has written a report that will be important for evolving the IVS service functions over the next few years. Clear specifications for the products are defined and related observing programs are proposed to generate the best time series for the products with respect to the available resources.

Since its beginning IVS has been a service of IAG (International Association of Geodesy). Due to the unique importance of VLBI for the realization of the CRF, IVS is also recognized as a service of IAU (International Astronomical Union). IVS is also a service of FAGS (Federation of Astronomical and Geophysical Data Analysis Services).

A change in the IVS Terms of Reference (ToR) was made to improve the information flow with related groups by adding a membership category for Affiliated Organizations. Another change in the ToR allows a better balance within the Directing Board in the representation of IVS components. The latter change resulted in increasing the number of At Large positions from two to three, so that a total of 15 members now serve on the board. ■

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/.

A Taste of History....

30 Years Ago....

The first hardware VLBI correlator was put into operation in 1971. This unit, designed at MIT Haystack Observatory, was attached to a CDC3300 general-purpose computer to correlate data taken with the Mark I system, which recorded data onto standard 1/2" open-reel computer tapes at 720 kbps. The Mark I correlator served faithfully until the late 1970s when it was replaced by the Mark III correlator. How things have changed!

NEWS

News from the IVS Analysis Coordinator

–Axel Nothnagel and Christoph Steinforth, Geodetic Institute of the University of Bonn

The IVS combined solution for 24-hour NEOS-A derived EOPs is generated using the following regular file submissions from IVS Analysis Centers:

- bkg00001.eops (BKG)
- gsf2001c.eops (GSF)
- iaao0106.eops (IAA)
- spu00001.eops (SPU)

In order to maintain consistency with the IERS C04 series, the biases as listed in table 1 are subtracted prior to the combination process. These biases were determined from data up to September 30, 2000. The weight factors for each Analysis Center are listed in the last column.

	x_p [µas]	y_p [µas]	dUT1 [ms]	w.f. [-]
AUS	-35.9	367.3	6.9	1.37
BKG	116.3	-14.5	-17.3	0.84
GSF	-43.0	281.7	8.4	0.77
IAA	-135.5	263.9	9.3	1.07
SPU	-46.3	155.1	16.6	1.18

Table 1. Biases of each series relative to IERS C04 and weight factors.

Table 2 lists the current post fit biases and WRMS relative to the IVS combined series for polar motion and UT1-UTC. The small residual biases which should ideally be zero are a consequence of the fact that the initial bias determination as listed in table 1 does not include data between the start of the combination on October 1, 2000 and today. The WRMS values are computed after the biases have been removed.

	x_p		y_p		*dUT1*	
	bias [µas]	wrms [µas]	bias [µas]	wrms [µas]	bias [ms]	wrms [ms]
AUS	-18	145	-43	85	5	4
BKG	-19	90	26	86	-1	7
GSF	9	99	-11	89	3	7
IAA	7	72	-2	69	1	4
SPU	9	62	-6	58	-2	4

Table 2. Biases and WRMS of EOP of each series relative to IVS combined series.

More details can be found on the IVS Analysis Coordinator's home page http://giub.geod.uni-bonn.de/vlbi/IVS-AC.

The units in the tables were incorrect in the printed version. The editors regret the errror.

VLBI HOW TO...

How to Synchronize Formatter Time to GPS Time

–Ed Himwich, NVI Inc./GSFC
–Hayo Hase, BKG

Why measure offsets? The clock offsets between the VLBI formatter and the global GPS time must be known on the sub-microsecond level. The offset is used not only to align the data at the correlators, but it will also be used to improve the final values of the UT1 and UT1 rate observables derived from quasar observations. The IVS is pushing to achieve higher accuracies in its products, in particular the UT1 goal is 2–3 µsec and the UT1 rate goal is 0.3–0.5 µsec/day. More care in handling clock offsets at the stations and during data analysis will be required to achieve this goal.

Measuring the offsets. Every station needs to use the `gps-fmout` command to measure the sub-second portion of the clock offset and `sy=run setcl &` to check for clock jumps of more than one second. With these two commands logged, the correlator can recover the data even if the formatter jumps during an experiment. The value of `gps-fmout` will also be used to calibrate the time of the observations to better than a microsecond.

Two important points need to be emphasized about the offset measurement. (1) The command form must agree with the wiring. Use `gps-fmout` if the GPS 1 PPS starts the time interval counter; use `fmout-gps` if the formatter 1 PPS starts the counter. (2) We really want to use the formatter and not the maser which may have some unknown offset relative to the formatter.

Clock jumps. If the clock jumps during a session, we don't normally reset the clock because this means you have just introduced another jump. The first jump degrades the geodetic solution and the second one would degrade it further. There are only two conditions under which a station clock should be reset, which depend on the size of the jump as well as the correlator. Read the full memo (see reference below) for the details.

For more information on setting up the `gps-fmout` measurement at your station, please read the full clock offset memo on the Network Coordinator's page at http://ivscc.gsfc.nasa.gov/nc.

Upcoming Meetings..

Fall AGU
Dec. 10-14, 2001
San Francisco, CA

Second IVS General Mtg.
Feb. 4-7, 2002
Tsukuba, Japan

Mini-TOW
Feb. 6, 2002
Tsukuba, Japan

Third Analysis Mtg.
Feb. 8, 2002
Tsukuba, Japan

European Geophysical Society
Apr. 21-26, 2001
Nice, France

Spring AGU
May 28 - June 1, 2002
Washington, D.C.

Dates to remember..

Annual Report deadline
January 15, 2002

Registration deadline for General Meeting 2
January 10, 2002

IVS Receives Award from Japanese Ministry on "Radio Day"

—Nancy Vandenberg, NVI Inc./GSFC

The IVS Directing Board received an award from the Japanese Ministry of Public Management, Home Affairs, Posts, and Telecommunications on June 1, 2001.

Within the ministry, the month of June celebrates events related to radio waves and June 1 is known as Radio Day. Awards are presented on this day to begin the month-long celebration.

In February, Dr. Tetsuro Kondo of Communications Research Laboratory (CRL) submitted the nomination of IVS for consideration for these annual awards. CRL strongly supported the nomination, and it was announced in late April that we won! It is a great honour for IVS, and we have to thank Tetsuro Kondo for the initiative and his activity. The international and interdisciplinary cooperation of the group around Alan Whitney and the strong contribution of CRL and personally from Kondo-san resulting in the releasing of the VSI-H specifications has been regarded as an important step in VLBI and worthy for an award. IVS expresses its appreciation and gratitude to the VSI working group, in which IVS and related groups are involved, and explicitly to Alan Whitney and to Kondo-san for the success.

Meeting CRL President Takashi Iida. (left to right: Nancy Vandenberg, TetsuroKondo, Wolfgang Schlüter, Takashi Iida)

Wolfgang Schlüter receiving the award from Minister Toranosuke Katayama

CRL invited Wolfgang Schlüter, IVS Chair, and Nancy Vandenberg, IVS Coordinating Center Director, to Japan to participate in the ceremony and receive the award on June 1, 2001. The ceremony and other events of the day were held in the Imperial Hotel in Tokyo. The full story is available at http://ivscc.gsfc.nasa.gov/radio/.

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