



IGS

EXECUTIVE REPORTS

Perspectives of the IGS Governing Board

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The International GPS Service clearly remains unique in supporting numerous geodetic and geophysical research and engineering activities. The IGS is recognized for providing the best GPS products, from the orbits and clocks of the GPS satellites, to station positions and velocities of the tracking network – the IGS continues to evolve and improve as a premier scientific service. The IGS products are widely used to support many activities and various applications that continue to emerge. IGS is foremost in providing the GPS-based reference frame on a global basis, a strong and essential contribution to the International Terrestrial Reference Frame (ITRF).

It is therefore a great honor to be elected Chair of the IGS Governing Board and to have served the first year of my term during 1999 – a time of transition for the IGS and the Governing Board. During my tenure measures will be taken to sustain and advance the achievements of my predecessor in this position, Prof. Gerhard Beutler of the University of Bern in Switzerland, who served as Chair of the Governing Board from 1993 through 1998.

Transitions of the Board

Changes within the Board were expected from the start of this year and by the end of 1999 new dynamics developed for the IGS and the Board that will reach into the year 2000 and beyond. Four members of the Governing Board retired from their positions in December 1999, each of whom had been members of the Board since the inception of the IGS. Their collective talents greatly helped to shape the organization:

Dr. Yehuda Bock, Scripps Institution of Oceanography

Dr. Jan Kouba, Analysis Center Coordinator of the IGS (1993 – 1998), Natural Resources of Canada.

Dr. Bill Melbourne, Jet Propulsion Laboratory, and Prof. Emeritus Ivan Mueller, Ohio State University.

These gentlemen were celebrated in December during the AGU with an Honors Reception organized by the Central Bureau to provide a venue to recognize their considerable contributions to the IGS. Remarkably, all of these men served on the Governing Board since the IGS was officially established and all were members of the IGS Oversight Committee from 1991-1993, overseeing the successful IGS Pilot Project in 1992. Special

recognition is certainly due Ivan Mueller and Bill Melbourne for their part in creating the vision of what has become the IGS – through initiating the IGS Planning Committee already a decade ago in 1989.

Realizing these changes were imminent, preparations for board elections began in mid-‘99 with the electing body, the IGS Associate Membership, being approved at the Board meeting during the IUGG in Birmingham, England, July ‘99. These elections were managed by Ivan Mueller, with support from the Central Bureau. The results of the election concluded that:

- Dr. John Dow of ESA/ESOC was re-elected as Network Representative;
- Prof. Markus Rothacher, Technical University of Munich as a new Analysis Representative, and
- Dr. Jim Zumberge, JPL as a new Analysis Representative.

For the IGS Appointed positions, the IGS Central Bureau recommended the reappointment of John Manning, Australian Surveying and Land Information Group, and also recommended the appointment of Dr. Carine Bruyninx from Royal Observatory of Belgium as the IGS representative to the IERS Directing Board in accordance with the new structure of the IERS. The Board unanimously accepted both. Gerhard Beutler will remain on the Board as one of two designated representatives of the International Association of Geodesy due to his position as Vice President of IAG, and Prof. Tom Herring, Massachusetts Institute of Technology will also serve as the second representative of the IAG. Dr. Claude Boucher, Institut Geographique National will continue to serve on the IGS Board as a representative of the IERS.

Key Events of 1999

LEO Workshop

One of the first events setting the directions of the IGS was a joint workshop of the International GPS Service, GeoForschungsZentrum Potsdam and the Jet Propulsion Laboratory, titled ‘Workshop on Low Earth Orbiter Missions: Developing and Integrating Ground and Space Systems for GPS Applications’. This timely workshop was held March 9 - 11, 1999 at GeoForschungsZentrum Potsdam, Germany. The IGS LEO working group was key in organizing the workshop and the 1999 IGS Technical Reports provides a section devoted to the workshop and some resulting papers. This was the first international workshop focusing on end-to-end systems and science aspects for supporting an array of forthcoming Low Earth Orbiter Missions over the next decade.

Discussions within the IGS and within the mission representatives resulted in the consensus to convene this workshop. The broad objective was to determine the relative

interest, roles and responsibilities of each interested and contributing party. It is widely recognized that the IGS can play an essential role in the ground support aspects of LEOs -- such a recommendation has been made by the IGS LEO Working Group. The ground network, a subset of the IGS tracking network, is being planned to provide high rate, low latency data for integration with the flight data for atmospheric occultation objectives. Precise orbit determination as performed by the IGS Analysis Center may actually benefit from an array of LEOs that serve as observing stations in space. This synergistic opportunity can signal the next enhancement of successful international cooperation for multi-purpose GPS applications.

The workshop goal is to bring together interested principals in these endeavors and attempt to derive plausible multi-mission support plans and roles, a starting point for the next decade.

Analysis Center Workshop and Board Meeting, June 1999

All Analysis Center workshops are pivotal events for the IGS. The 1999 AC Workshop titled "Real-Time Applications and Long-Term Accuracy" was convened by Tim Springer and Yehuda Bock June 8-10 at Scripps Institution of Oceanography, in La Jolla. A very good summary of this meeting can be found in the IGS Mail as well as in the 1999 IGS Technical Report section devoted to this workshop. A Governing Board meeting was held in conjunction with the workshop and resulted in a very important step for the IGS, the creation of a new position, IGS Reference Frame Coordinator. The Board designated Dr. Remi Ferland of Natural Resources of Canada to assume these responsibilities, providing the coordination of GPS reference frame realization within the IGS and establishing stronger interfaces with the ITRF.

GPS Symposium 1999 in Tsukuba, Japan

The International GPS Symposium 1999 was held in Tsukuba Japan in October and afforded a dynamic venue for exploring new GPS developments and applications with good representation of the Asian nations and the broad international community. This was organized with the joint endorsement of the International Association of Geodesy, the IGS and the Asian Pacific Space Geodynamics Project (APSG), with significant interest, participation and support by IGS. This was the first formal presentation of the newly developed IGS tutorial, refer to the Central Bureau report for more details.

December Board Meeting

The year ended with the meeting in December as mentioned above, culminating with many changes and yet new opportunities for the IGS. Decisions taken at the December meeting initiated a strategic planning process for the IGS in 2000 to explore where energies and resources are best directed over the next five years. It was also decided to

release a broad Call for Participation in the IGS LEO Project, the consensus of the Board is that this activity will affect every component of the IGS and become the next major initiative of the IGS. With the launch of the CHAMP and SAC-C LEO missions scheduled for the year 2000, the annual report series for next year should prove interesting.

Summary

The year 1999 closed quietly despite the predicted major difficulties envisioned in conjunction with 'Y2K'. The IGS continues to move forward and to be an exciting and worthy endeavor which offers a true international association attracting dedicated participation worldwide.

Acknowledgements

I would like to thank the members of the Governing Board and the Central Bureau for their support during my first year as Chair of the IGS, and look forward to the next years working together. I am very grateful to the IGS Network and station operators, the Data Centers and the Analysis Centers and Associate Analysis Centers for maintaining the high standards of the IGS while pursuing the new initiatives – these are the essential elements of the IGS, without these the IGS would not exist.

Central Bureau Annual Report 1999

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This was a year of continued growth for the IGS as new activities and applications provided exciting exploration and developments in many areas. These include IGS plans in support of Low Earth Orbiter (LEO) missions, incorporation of data from the Russian satellite navigation system 'GLONASS' into the IGS processing streams, and establishing an official position for an IGS Reference Frame Coordinator. While these activities were being pursued within the IGS community, the IGS CB was still busy completing the restructuring process started in 1998 and keeping up with the ever increasing workload of the office.

One of the first duties of the Central Bureau in 1999 was to support a smooth transition in the Governing Board leadership. Prof. Christoph Reigber from GeoForschungsZentrum-Potsdam, Germany began his first year as Chair, succeeding Prof. Gerhard Beutler from the University of Bern in Switzerland who resigned as IGS Chair after serving since 1993. Prof. Beutler remains on the IGS board in his capacity as Vice President of the International Association of Geodesy, one of two representatives from IAG to the IGS Board.

In addition to designated responsibilities, the Central Bureau notes three areas of attention this year:

- Improving coordination, reliability and functioning of the IGS Network,
- development of an IGS Tutorial for expanding outreach to users, promoting broader use and acceptance of IGS data and products, and
- preparing for the Governing Board elections in December 1999 where significant changes in representation were anticipated.

The enhanced and proper functioning of the IGS network was a very hot topic at the beginning of 1999. This was also the first year that the IGS could realize tremendous benefit from a designated Network Coordinator enabled through the restructuring of the IGS Central Bureau. This position was assumed by Dr. Angelyn Moore, jointly appointed as the Deputy Director of the Central Bureau. It is evident that this was an excellent decision, the continued expansion of IGS stations and pressures on the analysis centers to deliver highest quality products in less time demand coordinated robust and reliable network operations. The quality of IGS products can only be achieved if all contributors to the infrastructure observe established conventions and standards. At the

conclusion of 1999 many discrepancies were resolved due Angelyn's keen attention to detail and advocating compliance to IGS standards. Significant progress in this area is summarized in the Network report and referenced in the companion volume, the IGS Technical Report.

One key accomplishment coordinated by the CB was the formal development of an IGS tutorial for the venue of the GPS '99 Symposium in Tsukuba Japan (See Kato, this volume). This four-hour tutorial covers aspects from the basics of GPS, the organization of the IGS, the network and data center descriptions, IGS product quality and availability, reference frame details and user issues. The CB was fortunate to have the assistance of Dr. Jan Kouba, former Analysis Center Coordinator (1993-1998) of NRCAN; Carey Noll, Manager of the Crustal Dynamics Data Information System, (CDDIS) at GSFC, an IGS Global Data Center; Remi Ferland, IGS Reference Frame Coordinator also at NRCAN, and assistance from other Governing Board members Mike Bevis, University of Hawaii; Tim Springer, GS Analysis Center Coordinator, University of Bern; and Markus Rothacher Technical University of Munich. This tutorial is now updated and expanded as necessary and is available at the IGS website as a powerpoint document. This is a first step towards greater outreach to users and we anticipate a web-based/CD interactive tutorial development over the next years and better user interface, dependent on available resources.

GPS 99 International Symposium

This International Symposium on GPS was convened as a multiple sponsored Commission on Space Techniques for Geodesy (CSTG), IAG, IGS symposia in Tsukuba, Japan in October. Former IGS Governing Board member, Prof. Teruyuki Kato, of the Earthquake Research Institute of Japan was the Secretariat of the Conference for the Local Organizing Committee was. This was an excellent venue providing great opportunity to meet with colleagues from all over the world, and especially from neighboring Asian countries. The IGS commends the organizers of this symposia for its great success. Please refer to Kato in this volume. A web site with session summaries is available at:

<http://www.soc.nacsis.ac.jp/geod-soc/gpssymp/index.html>

CB Outreach for IGS

In April, Angelyn Moore represented the IGS at the AIAA International Workshop titled 'International Space Cooperation: Solving Global Problems' in Bermuda. Over 80 experts from around the world were invited to participate in this workshop, which was divided into five working groups, with the IGS joining a working group on 'Global Navigation Satellite Systems (GNSS): Fostering International Cooperation and Benefits to Worldwide Users'. This working group generated a number of recommendations and findings based on the satellite navigation systems and the role of international cooperation

in current and future GNSS systems, very timely given the synergies between the GPS and the proposed Galileo system. The final report is available from the AIAA, <http://www.aiaa.org>. This workshop was a preparatory activity for the UNISPACE III Conference, a United Nations convened conference on “Space Benefits for Humanity in the Twenty-First Century”.

Low Earth Orbiter Workshop

Early in 1999 the Central Bureau was deeply involved in the organization of the Workshop ‘Low Earth Orbiter Missions: Developing and Integrating Ground and Space Systems for GPS Applications’ held in Potsdam, Germany, March 9-11 at the GeoForschungsZentrum (GFZ). This was a workshop jointly organized by IGS, GFZ and JPL bringing together GPS experts, mission representatives and the science community intent on the application of Low Earth Orbiter (LEO) GPS flight instruments to provide data for precise orbit determination (POD), atmospheric occultation, gravity, and ionospheric studies. It is evident from the attendance and the lively discussions that there is a positive synergy and great potential benefit between IGS and the LEO missions. There are more than a dozen such LEO missions over the next decade that will carry on-board GPS receivers, which can all potentially benefit from a common ground-based GPS/GNSS infrastructure. See the accompanying IGS Technical Report 1999 for more detailed information on the workshop.

IGEX-98

The International GLONASS experiment 1998 IGEX-98 successfully concluded the experimental phase on April 19, 1999. This was a unique experiment that demonstrated the IGS flexibility to incorporate and process other satellite navigation system data in a precise and meaningful manner. This was the first time that GLONASS orbits were computed at the 20-50 cm level, and a valid reference system transformation between the Russians PZ-90 systems, WGS 84 and the ITRF was achieved. In September, a workshop was convened by Jim Slater and Carey Noll in conjunction with and jointly sponsored by the Institute of Navigation (ION) at its annual GPS meeting in Nashville, GPS99. The proceedings are available at the IGS website or through the Central Bureau. Based on the success of the project, a proposal was presented to the IGS Governing Board in December to continue as a pilot service within the IGS, named the International GLONASS Service Pilot Project (IGLOSS-PP), after some modifications, this was approved by the GB. The project is chaired by Jim Slater, NIMA. See the GLONASS report in this and future volumes.

Of Note

The IGS supported an experiment during the total eclipse of the sun on August 11, 1999. High-rate GPS data was collection at a number of sites, mostly a selected subset of the

IGS network and regional stations within the affected area of Europe. This was largely organized by the Ionospheric Working Group, chaired by Joachim Feltens of ESA/ESOC. Data is archived at the CDDIS.

1999 IGS Workshops, External Meeting Participation and Activities supported by the CB

IGS LEO Workshop – ‘Low Earth Orbiter Missions: Developing and Integrating Ground and Space Systems for GPS Applications’, March 9-11, GeoForschungsZentrum, Potsdam, Germany

Civil GPS Service Interface Committee (CGSIC), March 15-18, Washington DC, USA

International Space Cooperation: Solving Global Problems, April 12-15, American Institute of Aeronautics and Astronautics, Bermuda

European Geophysical Society, April 19-23, Den Hague, Netherlands

Global Sea Level Observing System Meeting (GLOSS GE6), Intergovernmental Oceanographic Commission (IOC), United National Educational, Scientific and cultural organization (UNESCO) and Project, May 10-13, Toulouse, France

IGS Analysis Center Workshop: ‘Real-Time Applications and Long-Term Accuracy’, June 8-10, Scripps Institution of Oceanography, La Jolla, California, USA

XXII General Assembly, International Union Of Geodesy and Geophysics (IUGG), July 19-30, University of Birmingham, UK.

International GLONASS Experiment 1998, (IGEX-98), Concluding Workshop, September 13-14, Institute of Navigation, GPS ’99, Nashville, Tennessee, USA

US-China GPS Workshop, September 29-30, National Science Foundation, US Geological Survey, Palm Springs, CA USA

International Symposium on GPS, Application to Earth Sciences and Interaction with Other Space Geodetic Techniques GPS ’99, October 18-22, Tsukuba, Japan

American Geophysical Union Fall Meeting ,San Francisco, CA December.

Publications of the Central Bureau in 1999

IGS 1998 Annual Report

IGS 1998 Technical Report

IGS Network Workshop Proceedings

IGS Directory 1999

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