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International GNSS Service

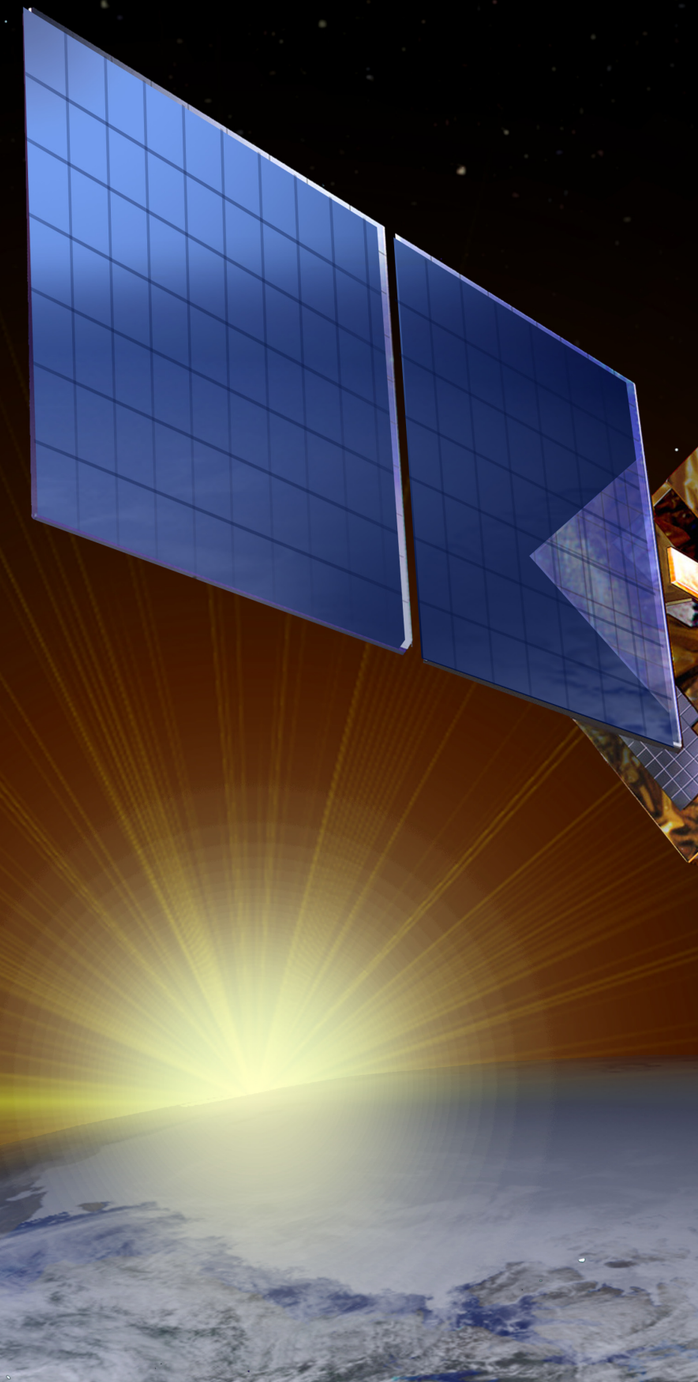
International Association of Geodesy
International Union of Geodesy
and Geophysics

JPL 400-1376 04/09

INTERNATIONAL
GNSS SERVICE

Strategic Plan

2008 – 2012



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GNSS SERVICE

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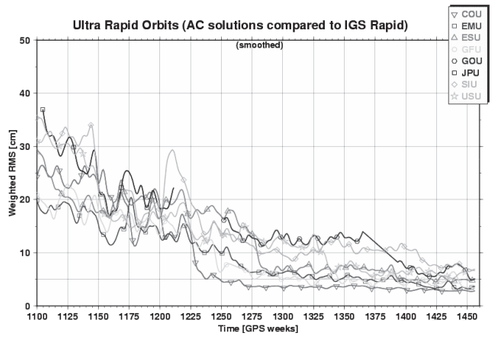
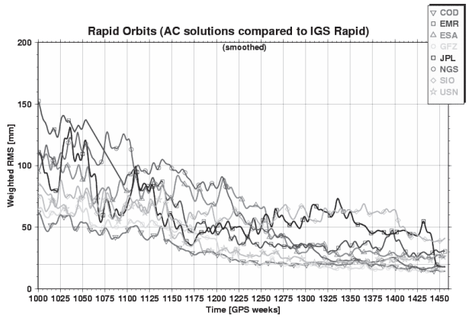
Preface

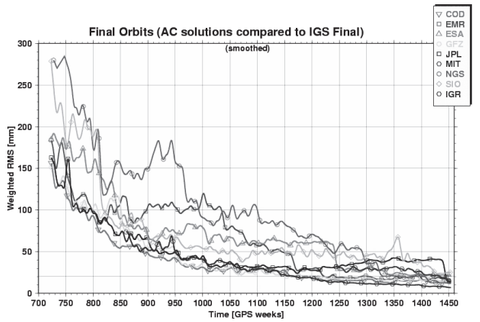
The International GNSS Service (IGS) is an organization of more than 200 worldwide agencies and institutions that pool resources and expertise to provide the highest-quality Global Navigation Satellite Systems (GNSS) data, products, and services to support high-precision applications of GNSS. It is a service of the International Association of Geodesy (IAG), one of the associations of the International Union of Geodesy and Geophysics (IUGG). The IGS operates as a voluntary federation that is self-governed by its participants through an elected Governing Board. Each participating organization contributes its own resources: there is no central source of funding.

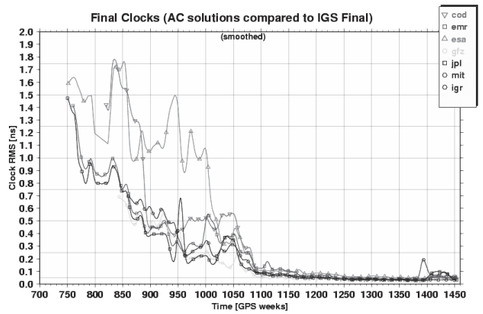
The IGS operates a global network of GNSS ground stations, data centers, and data analysis centers to provide data and derived data products that are essential for Earth science research; multi-disciplinary positioning, navigation, and timing (PNT) applications; and education. The IGS products include GNSS satellite ephemerides, Earth rotation parameters, global tracking station coordinates and velocities, satellite and tracking station clock information, zenith tropospheric path delay estimates, and global ionospheric maps. These products support Earth science and other activities, such as improving and extending the International Terrestrial Reference Frame (ITRF) maintained by the International Earth Rotation and Reference Systems Service (IERS), monitoring deformation of the Earth, monitoring Earth rotation, monitoring the troposphere and ionosphere, determining orbits of scientific satellites, and other diverse applications.

The quality and consistency of all IGS products has continued to improve over the past five years. The continued refinement of techniques and methodologies, and intensive collaboration between participants, has resulted in realization of the principal goals of the 2002–2007 Strategic Plan.

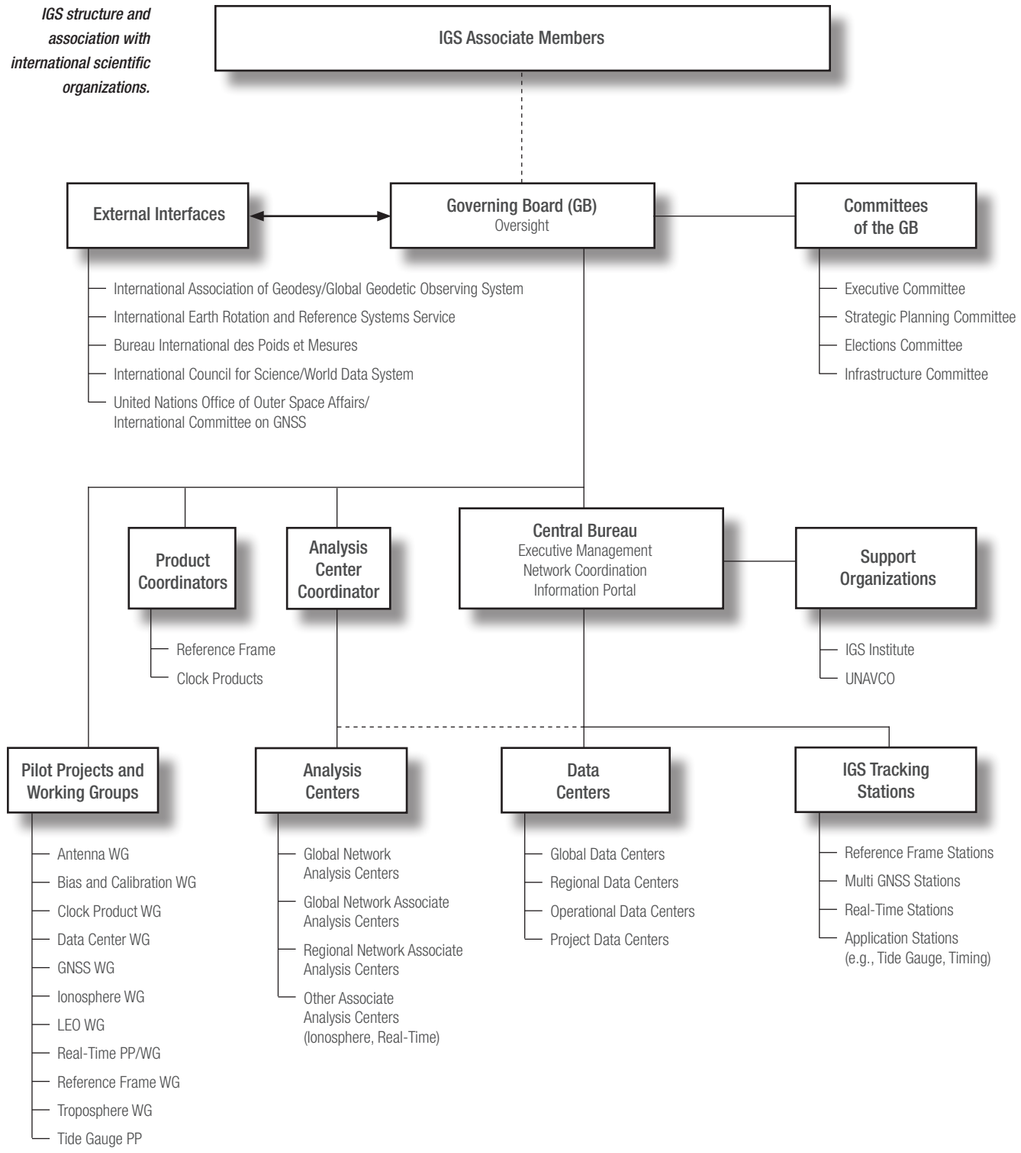








IGS structure and association with international scientific organizations.



Executive Summary

The IGS, continuing a dynamic period of growth and transition through the 2002–2007 time frame, is pleased to present this new Strategic Plan for the period of 2008–2012. The IGS Governing Board anticipates that this upcoming period will be an era of significant changes, as new uses and corresponding increased demands develop for the IGS's suite of data and data products. This Strategic Plan outlines key points of the IGS's fundamental strategy and its anticipated path forward.

Since the IGS Governing Board adopted its previous Strategic Plan, a number of developments have taken place inside and outside the IGS that make it imperative to update the plan. While much of the Strategic Plan 2002–2007 remains valid, this new plan is developed for 2008–2012. Three key strategies are formulated:

- Deliver world-standard quality GNSS data and products to all users globally with leading-edge expertise and resources.
- Develop, integrate, and participate with new and changing GNSS systems and user needs to continuously improve IGS services and to provide value to a broad range of users.
- Continuously improve the effectiveness of IGS management and governance to support future growth.

The broad strategic lines remain as before, but a significant number of the derived actions are new, as described in this plan.

The IGS strategic planning process is an ongoing effort. The Board completed a systematic update of the IGS Terms of Reference (TOR) and associated charters for Analysis Centers and Data Centers, adopting the new version in March 2005, the first revision since 1999. Significant modifications included: a change of the organization's name from "International GPS Service" to "International GNSS Service"; changes to the composition of the Governing Board, including Coordinators for Timing, Reference Frame and Network; and establishment of an IGS Executive Committee.

In parallel with these IGS internal developments, the IGS has been working with the International Association of Geodesy (IAG) and its other scientific services and commissions on the concept of a Global Geodetic Observing System (GGOS), which is federating the activities and products of the IAG scientific services and commissions and providing the contribution of geodesy to the Global Earth Observing System of Systems (GEOSS). GEOSS is an activity of the intergovernmental ad hoc Group on Earth Observations (GEO) (see http://www.earthobservations.org/). A central issue of the GGOS initiative is the International Terrestrial Reference Frame (ITRF), its future development, and its correct and consistent use. The IGS, with its prime concern for high precision, accuracy, and reliable processing of the signals of the GNSS constellations, and as the provider of the consolidated inputs of the GNSS contribution to the ITRF, necessarily plays a key role in GGOS and in the broader activities, e.g., the building of GEOSS.

A further new development is the establishment of the International Committee on GNSS (ICG — see www.icgsecretariat.org). The ICG was officially established through the United Nations Office for Outer Space Affairs (UNOOSA) in December 2005, following extensive preparatory meetings and actions over several years, in which the IGS played an active role. IGC members are GNSS providers; also included in the ICG are associate members — consisting mainly of intergovernmental and nongovernmental organizations who are users of GNSS — and observers.

As the foregoing discussion reflects, the IGS is playing an even more active role in the international GNSS arena. The field itself is changing rapidly, with the modernization of the GPS system (i.e., the deployment of the GPS IIRM, GPS IIF, GPS III satellites, and new ground segments), the revival of the Russian GLONASS (likely to be re-established soon as a complete constellation, with additional system developments on the horizon, including a possible move to CDMA signals), the planned European Galileo system of 30 satellites, and global or regional systems being developed by China, Japan, and India, among others. High on the international agenda is achieving interoperability of these systems to the greatest extent possible, and as a minimum, intersystem compatibility where possible. The IGS will continue to take a leading role in monitoring these systems and their developments, and in making readily available the results of its experience and expertise, in particular high-level research and applications using the GNSS signals.

The work of the IGS and its constituent elements has become even more relevant and timely, as major global issues like climate change, sea-level rise, disaster prediction, monitoring and mitigation (specifically, of earthquakes, tsunamis, and volcanic activity) gain greater prominence in advancing efforts to better understand, predict and protect the environment in which we live.

The purpose of this updated Strategic Plan is to place the IGS in a position to take advantage of ongoing and expected changes and to maximize its potential and utility in serving the scientific community and society. The implementation of this Plan will be aided by the formulation and execution of annual implementation plans, in which the principal targets for the various elements and projects will be defined for each calendar year.

IGS Governing Board Members 2008

John Dow (EC), Chairman
ESA/European Space Operations Centre, Germany

Ruth Neilan (EC), Secretariat
IGS Central Bureau, Jet Propulsion Laboratory, USA

Felicitas Arias
Bureau International des Poids et Mesures, France

Yoaz Bar-Sever
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Norman Beck
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Paris Observatory, France

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University Consortium for Atmospheric Research, USA

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NASA Goddard Space Flight Center, USA

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Deutsches GeoForschungsZentrum Potsdam, Germany

Ken Senior
US Naval Research Laboratory, USA

Tim Springer
ESA/European Space Operations Centre, Germany

Robert Weber
Vienna University of Technology, Austria

Richard Wonnacott
Chief Directorate Surveys and Mapping, South Africa

EC = Executive Committee Member

IGS Mission

The International GNSS Service provides the highest-quality GNSS data, products, and services in support of the terrestrial reference frame; Earth observations and research; Positioning, Navigation, and Timing (PNT); and other applications that benefit the scientific community and society.

Long-Term Goals

To accomplish this mission, the IGS has set six long-term goals. These goals are to:

1. **Serve as the premier source of the highest-quality GNSS data, products and related standards and conventions, openly available to all user communities.**
2. **Attract leading-edge expertise to pursue challenging, innovative projects in a collegial, collaborative, inclusive and creative culture.**
3. **Incorporate and integrate new systems, technologies, applications, and ever-changing user needs into IGS products and services.**
4. **Facilitate the integration of IGS into the Global Geodetic Observing System (GGOS) and other more broadly based Earth-observing and global navigation systems and services.**
5. **Maintain an international federation with committed contributions from its members, and with effective leadership, management, and governance.**
6. **Promote the value and benefits of IGS to society, the broader scientific community, and in particular to policy makers and funding entities.**

In order to accomplish its mission and achieve its goals, the IGS has adopted three key strategies and associated specific actions required to move the IGS toward its long-term goals and to realize its mission.

Strategies and Actions

Strategy 1

Deliver world-standard quality GNSS data and products to all users globally with leading-edge expertise and resources. (See Goals 1 and 2)

The actions needed to fulfill this strategy are:

Quality

Ensuring highest quality of GNSS data, products, and services is the cornerstone of IGS philosophy, therefore the IGS will strive to:

- Maintain all IGS components at the highest levels of quality and accuracy.
- Compare, combine, and validate IGS products from the various Analysis Centers (ACs).
- Regularly reanalyze existing IGS tracking data using the most up-to-date models and standards to generate homogenous and highest-quality time series of products.
- Determine, publish, and implement improvements required in the IGS infrastructure, network, hardware, software, analysis techniques, and product dissemination.
- Assess, monitor, and improve site-related data quality and access to the ITRF.
- Engage with station operators, ACs, researchers, and equipment manufacturers to help design standards and conventions, and to train/assist future system builders.
- Review the performance and effectiveness of the overall service through IGS workshops, reviews of the IGS components, and by other means as necessary.
- Obtain user feedback on the quality of services provided and report the results.
- Audit and report on areas requiring changes and implement changes where improvements are necessary.

World Standard

The IGS has served as the de facto world standard for high-precision GNSS applications and must retain this position in order to best serve its existing and future constituencies. The IGS will evolve and incorporate new and varied data sets. In continuing as the world standard, the IGS will:

- Support participating organizations in developing and meeting standards for the transition to a multi-system, multi-GNSS tracking network.
- Provide open access to data and products to meet the needs of IGS user communities.
- Identify and pursue innovative projects, and incorporate new technologies and systems.
- Promote the IGS as the world standard via forums, workshops, education, and brochures.

The IGS will incorporate new systems, signals, and technologies into IGS capabilities.

- Determine user requirements, benefits received, and future needs through special sessions, user workshops, literature search, and university connections; and respond with documentation for sponsors and users.
- Incorporate these user needs into the IGS through improved processes, products, and services.
- Develop and distribute open-source, standard software tools for IGS users.
- Encourage researchers to cite the IGS in journal publications, and apprise editors of IGS citations, including data publishing.
- Outreach and expand to new user communities and GNSS.
- Build partnerships and participation with governmental, educational, and commercial entities.

Leading-Edge Expertise

The IGS is fortunate to have the dedication of many of the best minds in the GNSS-relevant fields of science and application with demonstrated technical and scientific leadership. In order to continue to draw the best people with an increasingly diverse breadth of expertise, the IGS will:

- Attract talented and new researchers by involving them in challenging science and innovative projects, and engaging with IAG commissions.
- Publicize involvement in innovative areas, working groups, and projects.
- Pursue and engage new participants in different geographic areas, scientific disciplines, and application areas by including them in meetings and workshops, and through focused presentations.
- Create a “Welcome” package highlighting key aspects of the IGS culture, including examples of IGS spirit of collegiality and collaboration.
- Utilize university members to serve as “Ambassadors for IGS” within their universities to attract the interest of multi-disciplinary centers.

Strategy 2

Develop, integrate, and participate with new and changing GNSS systems, and understand user needs to continuously improve the IGS to provide value to a broad range of users. **(See Goals 3 and 4)**

The actions needed to fulfill this strategy are:

New Systems and User Needs

New GNSS, the modernization of existing systems and an increasing number of users and applications will provide new opportunities; therefore, the IGS will:

- Incorporate new systems, signals, and technologies into IGS capabilities.
- Build relationships and implement plans for including modernized GPS, modernized GLONASS, Galileo, and other emerging systems and augmentations.
- Initiate a Galileo Pilot Project once feasible and study the Galileo signals and formats through the GNSS Working Group, working in cooperation with ACs.
- Establish strategic alliances and maintain a continuing dialogue to ensure IGS will be integrated into broadly based Earth observation and GNSS organizations such as the Global Geodetic Observing System (GGOS), the International Committee on GNSS (ICG), the Global Earth Observation System of Systems (GEOSS), the developing project Unification of African Reference Frames (AFREF), and others.
- Feed IGS inputs into the Group on Earth Observations (GEO) work plan via GGOS; interrogate the list of GEO tasks, which could lead to new innovative multi-disciplinary projects.
- Define the IGS role in GGOS and formalize and promote interactions with IAG Services through GGOS, and with other scientific services as appropriate.
- Be a prime source of GNSS multi-system monitoring supported by corresponding system products.
- Study and recommend a minimum set of GNSS signals required for scientific data processes.
- Encourage Data Centers and ACs to store, distribute, and analyze additional “evaluation sites.”
- Increase IGS processing capacities to include new signals and more frequent delivery of products.
- Develop new classes of products needed by IGS users, such as products to support real-time tsunami warning systems, Earth and space weather forecasting, precise timing, climate change research, etc.
- Build broader global participation with nations and regions not actively involved with IGS.

The IGS will promote the value of the IGS as a primary source of high-precision GNSS information.

- Conduct joint projects with other services, user groups, or organizations.
- Promote participation in the IGS real-time activities and encourage upgrade of IGS station capabilities to provide data in real time; encourage the use of real-time products for emerging applications; engage with GNSS equipment manufacturers to develop highly capable products; and proactively develop relevant standards.

Development and Funding

Maintaining the current level of productivity while being responsive to a more complex range of opportunities and services will require additional resources. Therefore, the IGS will:

- Promote the value of the IGS as a primary source of high-precision GNSS information, articulate the IGS benefits, identify activities that are of value to policy and decision makers, and provide justification to gain support for ongoing funding of participants.
- Broadly promote this Strategic Plan through personal communications, newsletters, annual reports, educational forums, workshops, special sessions at meetings, or workshops and correspondence.
- Identify funding sources and decision makers and invite them to participate in IGS events.
- Identify multi-year funding opportunities from sponsors; promote IGS benefits and integrate with global initiatives such as GGOS and ICG to strengthen justification for funding commitments.
- Raise funds for specific initiatives and activities, such as reference frame development and training in developing countries.
- Seek additional voluntary commitments from IGS participants.

Strategy 3

Continuously improve the effectiveness of the IGS governance and management to support growth of the service. **(see Goals 5 and 6)**

The actions needed to fulfill this strategy are:

Governing Board

The principal roles of the Governing Board (GB) are to set policy and to exercise broad oversight of all IGS functions and components. In developing the strategy to achieve the IGS goals, the GB will strive to:

- Balance GB meetings between strategic direction and technical issues.
- Improve mechanisms for taking technical and administrative actions required to improve the service.
- Continue its policy of transparency and openness of GB discussions and decisions.
- Ensure diversity of the GB with respect to geographical distribution, expertise, and applications.

Strategic Plan

For effective and guided growth to achieve the IGS mission according to the strategies laid out in this plan, the IGS will:

- Establish a process to implement the Strategic Plan and monitor progress.
- Establish annual implementation plans with assigned accountability.

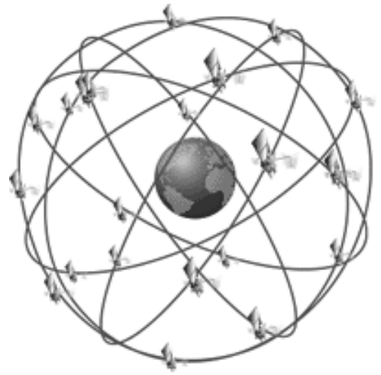
Central Bureau

The Central Bureau (CB) is the executive arm of the IGS, which is responsible for the general management, coordination, and day-to-day operation of the IGS consistent with directives, policies, and priorities set by the Governing Board. In order to keep up with growing demands that are arising from an expanding IGS organization and service, the CB will:

- Develop sources for new and expanded funding to strengthen the CB office.
- Distribute defined functions to other IGS participants and/or make use of visitors where feasible to expand the capabilities of the CB.
- Work with the GB and IGS components to develop priorities and actions for improving the overall effectiveness of the IGS.

- Facilitate the establishment of a permanent Infrastructure Committee to advise the Governing Board on matters related to the IGS infrastructure components and to coordinate activities for improving the overall service.
- Establish a legal entity as a model through which the IGS can conduct business with international organizations, industry, and the general public.
- Assist the GB in implementing elements of the Strategic Plan, administering the Strategic Plan, and monitoring progress on action items.

History of the International GNSS Service



The International GNSS Service (IGS) was established in January 1994 as a service of the International Association of Geodesy (IAG). The IGS was originally named the International GPS Service for Geodynamics. In 1999, the name was shortened to International GPS Service as the applications of GPS within the scientific community were extending well beyond geodynamics. The current designation was officially adopted in 2005, to reflect the fact that, while the United States Global Positioning System (GPS) is the foundation of the IGS, other GNSS will significantly contribute to and expand the work of the IGS (Russian GLONASS, European Galileo, Chinese Compass).

A number of key factors led to the formation of the IGS. By the late 1980s, many geodynamic and geodetic organizations recognized the potential of the GPS. As the then-new GPS began to be used for research and science applications, many organizations recognized the economical and unprecedented level of positioning achievable with this technology. The motivating goal for the solid-Earth sciences was millimeter-level positioning in support of science anywhere in the world. However, it soon became apparent that no single entity could (nor should) assume the capital investment and recurring operations costs for such a global system. It was at this point that key international players first considered joint partnerships to define cooperative approaches and set standards, to ensure that this endeavor would be successfully developed and ultimately driven by quality of science.

The idea for an international GPS service began to crystallize at the 1989 International Association of Geodesy (IAG) Scientific Assembly meeting in Edinburgh, United Kingdom. There, it was recognized that a standardized civilian system for using GPS would be beneficial to all. Subsequently, a planning committee was established within the IAG.

In 1991, a Call for Participation was organized by this IAG Planning Committee, seeking participants and contributors who would develop a “proof of concept” of an international service. It requested interested groups to assume the role of station operations, networks, data centers, analysis centers, and a Central Bureau for coordination of the activity. The response was overwhelming and the International GPS Service Oversight Committee was formed at the International Union of Geodesy and Geophysics (IUGG)/IAG General Assembly meeting in Vienna in 1991. The Committee organized a pilot project to demonstrate the potential of an international service based on the GPS. The pilot activity took place from June to September 1992 and was highly successful. The IGS was determined to be clearly viable. The IGS Pilot Project continued without interruption through 1993, while a proposal was prepared to the IAG seeking approval for the IGS as an IAG international service. Approval was received at the IAG Scientific Assembly in Beijing in 1993, and IGS was officially established on January 1, 1994. Recognition of

The IGS has become the global framework for virtually all regional applications and networks.

the value of IGS was reinforced with membership in the Federation of Astronomical and Geophysical Data Services (FAGS), initiated in 1996.

The IGS, as a completely voluntary organization, continues to operate its global civilian GPS tracking system for science and research. Since the pilot project in 1992, the network has grown from approximately 30 permanent GPS stations to more than 400; and the accuracy of the IGS orbits has improved by more than an order of magnitude, from 50 cm to better than 5 cm. The IGS continues developing and improving traditional products such as orbits, clocks, station positions and velocities, as well as fostering projects and working groups that produce additional data products, such as precipitable water vapor (PWV) and total electron content (TEC). These IGS projects and working groups are dependent upon the infrastructure of the IGS for science applications. The projects and working groups include the Ionosphere Working Group, Troposphere Working Group, IGS Reference Frame Working Group, Data Center Working Group, Antenna Working Group, Bias and Calibration Working Group, Clock Products Working Group, Low Earth Orbiter (LEO) Working Group, Tide Gauge Benchmark Monitoring Project for Sea-Level Studies (TIGA), the GNSS Working Group, and the Real-Time Pilot Project/Working Group. Projects that have been completed and are now incorporated into IGS routine processes include the Precise Time and Frequency Project — jointly with the Bureau International des Poids et Mesures (BIPM) — and the International GLONASS Pilot Project (IGLOS-PP).

It is the infrastructure of the IGS and innovative efforts of the IGS Analysis Centers that have driven the evolution and improvements of the IGS that in turn support these science-driven applications. Through the ACs and these working groups, the IGS continues to evolve and improve. The IGS has become the primary source for general access to and continuous development of the precise reference frame of the International Earth Rotation and Reference Systems Service (IERS): the International Terrestrial Reference Frame (ITRF). The IGS provides the global framework for virtually all regional applications and networks, including the following: the United States Plate Boundary Observatory GPS Network (PBO), IAG Commission 1 Reference Frames, which incudes the Subcommission for Europe (EUREF), Sistema de Referencia Geocéntrico para América del Sur (SIRGAS, the South American continental reference system), Unification of African Reference Frames (AFREF), and others.

The history, development, and current status of the IGS are captured online and in the Annual and Technical Reports, and particularly in workshop proceedings, all maintained and available through the Central Bureau. See: http://igs.org/.

Components and Roles

Network of Tracking Stations

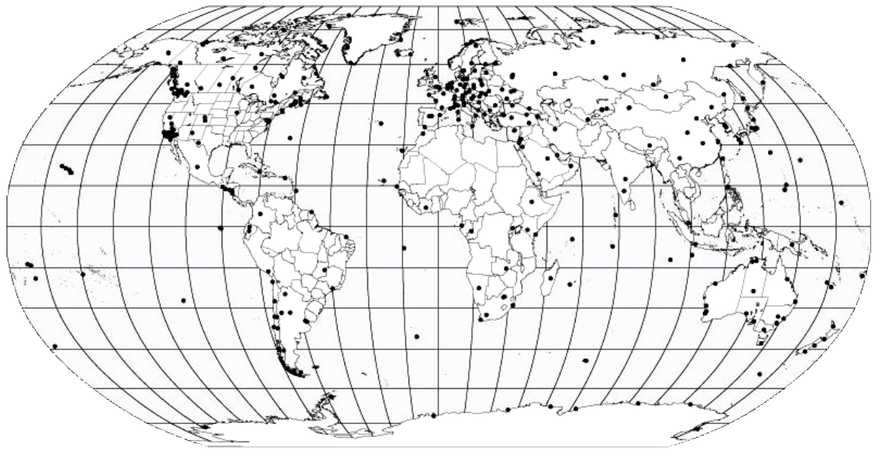
At the heart of the IGS is a network of GNSS tracking stations that are operated by participating agencies from around the world. There are too many to list here. For an up-to-date list of the IGS tracking stations and station operators, please refer to the IGS website at http://igs.org.

All components of the IGS are critically dependent on the global network of precise GNSS tracking stations. The IGS network includes over 400 stations that operate continuously, delivering data hourly or daily to the data centers. A subset of the network is providing real-time data streams within the IGS Real-Time Pilot Project. The IGS network today also includes nearly 100 GLONASS tracking stations. The operation of the IGS Network is conducted by more than 50 different organizations around the world, and is coordinated by the Central Bureau to assure that consistent, coordinated, and high-quality data are provided to the ACs and other users.

Data Centers

Since the inception of the IGS, the archives of the data centers have become increasingly important to a wide range of scientific and research applications. The distributed nature of the data flow supporting the IGS has been key to the successful archiving and availability of both IGS data and products. A hierarchy of data centers distributes data from the network of tracking stations, the Operational, Regional and Global Data Centers (DCs). This scheme provides for efficient access and storage of GPS and ancillary

Below: The IGS global network consists of over 400 continuously operating GNSS reference stations. Many IGS stations are collocated with other geodetic techniques such as VLBI, SLR, or DORIS to aid combination and intercomparison of results. The IGS objectives over the next five years will require that many of the IGS network stations be upgraded with multi-GNSS equipment.



data, thus reducing network traffic as well as providing a level of redundancy allowing for security of the data holdings. There are four Global DCs, six Regional DCs, and 16 Operational DCs.

Analysis Centers and Associate Analysis Centers

The ACs form the operational and scientific backbone that generates the IGS products. They provide, based on the available tracking data of the whole IGS network, a consistent set of high-quality products such as precise satellite orbits, station and satellite clock information, station coordinates, Earth rotation parameters, and atmospheric information. To fulfill the tasks of an IGS AC, all products have to meet the highest standards according to the IERS Conventions and, just as stringent, all submissions have to be made available on time and on a regular basis. Currently, the IGS ACs offer three types of solutions, which differ in accuracy and latency, to many kinds of scientific and engineering applications, specifically: ultra-rapid subdaily products, daily rapid products, and weekly final products. A prototype real-time product is under development. Besides their routine work, the ACs permanently concentrate on a variety of model improvements and these activities are the driving forces of the success of the IGS. There are currently 10 ACs. The ACs work with the Analysis Center Coordinator in developing the IGS combined products.

Associate Analysis Centers are organizations that produce specialized products, (e.g., ionospheric information or station coordinates and velocities for a global or regional subnetwork) and are generally linked to an IGS pilot project or working group. There are 20 of these Associate Analysis Centers.

Analysis Center Coordinator

The IGS Analysis Center Coordinator (ACC) has overall responsibility for generating the official IGS combined products. Specifically, the ACC assures quality control of the IGS products, evaluates performance, develops analysis standards, and assembles the Analysis Centers' output into a single set of official IGS products.

Working Groups and Pilot Projects

The work of supporting and developing the IGS components is carried out by Working Groups that may be tasked with the execution of various Pilot Projects. Working Groups focus on selected topics related to the IGS components according to goals and schedules specified in the working group's charter. Pilot Projects aim to develop particular IGS products or services that rely on the IGS infrastructure.

At present, the IGS Working Groups are:

- Antenna Working Group
- Bias and Calibration Working Group
- Clock Products Working Group
- Data Center Working Group
- GNSS Working Group
- Ionosphere Working Group
- Low Earth Orbiter Working Group
- Reference Frame Working Group
- Troposphere Working Group

The current IGS Pilot Projects are:

- Tide Gauge Benchmark Monitoring Project for Sea-Level Studies (TIGA)
- Real-Time Pilot Project

Previous Pilot Projects, which were concluded successfully and integrated into the mainstream IGS activities, were:

- Precise Time and Frequency Project, jointly with the Bureau International des Poids et Mesures (BIPM)
- International GLONASS Service Pilot Project (IGLOS-PP)

IGS Governing Board

The principal roles of the Governing Board are to set policy and to exercise broad oversight of all IGS functions and components. It also controls general activities of the Service, including restructuring, that would be appropriate to maintain efficiency and reliability, while taking full advantage of the advances in technology and theory.

Central Bureau

The Central Bureau is the executive arm of the IGS and as such is responsible for the general management and coordination of IGS activities and external affairs consistent with the directives, policies, and priorities set by the Governing Board. The CB coordinates with the IGS tracking station operators to assure consistent delivery of high-quality standardized data to

the ACs, and will facilitate the activities of the Infrastructure Committee in conducting critical assessments of the IGS infrastructure components and making recommendations to the GB to improve the overall service. The Central Bureau Information System (CBIS) is the main information portal for all of the IGS components and is operated by the CB. The CB is the primary outreach organization that communicates and coordinates the IGS activities with broader GNSS initiatives around the world.

See discussion in Strategy 3 above for additional information regarding the IGS Governing Board and Central Bureau.

The IGS Institute

One of the recommendations under Strategy 3 is to *"Establish a legal entity as a model through which the IGS can conduct business with international organizations, industry, and the general public."* Since completing the strategic planning process, and while this plan was being prepared for printing, a nonprofit public benefit corporation was established in September 2008. The IGS Institute, Inc., is located in California and is set up to conduct business as needed for the IGS.

Supporting Organizations

Global Data Centers

- Crustal Dynamics Data Information System, NASA Goddard Space Flight Center, USA
- Institut Géographique National, France
- Korean Astronomy and Space Science Institute, South Korea
- Scripps Institution of Oceanography, USA

Analysis Centers

- Center for Orbit Determination in Europe, Astronomical Institute, University of Bern, Switzerland
- Deutsches GeoForschungsZentrum Potsdam, Germany
- European Space Operations Centre, European Space Agency, Germany
- Geodetic Observatory Pecny, Czech Republic
- Massachusetts Institute of Technology, USA
- NASA Jet Propulsion Laboratory, California Institute of Technology, USA
- National Geodetic Survey, National Oceanic and Atmospheric Administration, USA
- Natural Resources Canada
- Scripps Institution of Oceanography, USA
- US Naval Observatory, USA

Analysis Center Coordinator

- National Geodetic Survey, National Oceanic and Atmospheric Administration, USA

Reference Frame Coordinator

- Natural Resources Canada

Clock Products Coordinator

- US Naval Research Laboratory, USA

Infrastructure, Operations, and Network Coordinator

- IGS Central Bureau, NASA Jet Propulsion Laboratory, California Institute of Technology, USA

Central Bureau

- NASA Jet Propulsion Laboratory, California Institute of Technology, USA

Pilot Projects and Working Groups

- Pilot Projects
  - —Tide Gauge Benchmark Monitoring (TIGA), Deutsches GeoForschungsZentrum, Potsdam, Germany
  - —Real-Time Pilot Project, Natural Resources Canada
- Former Pilot Projects
  - —International GLONASS Service Pilot Project (IGLOS-PP), National Geospatial-Intelligence Agency, USA
  - —Precise Time and Frequency Project, US Naval Research Laboratory, USA; and Bureau International des Poids et Mesures, France
- Working Groups
  - —Antenna, Technische Universität München, Germany
  - —Bias and Calibration, Astronomical Institute, University of Bern, Switzerland
  - —Clock Products, US Naval Research Laboratory, USA
  - —Data Centers, NASA Goddard Space Flight Center, USA
  - —Global Navigation Satellite Systems (GNSS), Vienna University of Technology, Austria
  - —Ionosphere, University of Warmia and Mazury, Poland
  - —Low Earth Orbiters (LEO), European Space Agency, European Space Operations Centre, Germany
  - —Troposphere, NASA Jet Propulsion Laboratory, California Institute of Technology, USA
  - —Real-Time, Natural Resources Canada
  - —Reference Frame, Natural Resources Canada

Associate Analysis Centers

- Global Network Associate Analysis Centers (GNAACs) for the Densification of the Global Reference Frame
  - —University of Newcastle upon Tyne, UK
  - —Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, USA

Regional Network Associate Analysis Centers (RNAACs) for the Densification of the Terrestrial Reference Frame

- Deutsches GeoForschungsZentrum Potsdam, Germany
- EUREF European Reference System, Global and European Regional Geodetic Networks: Bundesamt für Landestopographie, Switzerland; Center for Orbit Determination in Europe, Switzerland; Geodetic Observatory Pecny, Czech Republic; Bundesamt für Kartographie und Geodäsie, Germany; International Commission for Global Geodesy of the Bavarian Academy of Sciences, Germany; Nordic Geodetic Commission, Scandinavia; Nuova Telespazio S.p.A., Space Geodesy Center, Italy; Observatory Lustbuehel Graz, Austria; Royal Observatory of Belgium; University of Padova, Italy; Warsaw University of Technology, Poland
- Geographical Survey Institute of Japan
- Geophysical Institute of the University of Alaska, USA Geoscience Australia
- Onsala Space Observatory, Sweden
- Pacific Geoscience Center, Canada
- SIRGAS — Sistema de Referencia Geocéntrico para las Américas (South American Geocentric Reference System), Deutsches Geodätisches Forschungsinstitut, Germany

Regional Data Centers

- Bundesamt für Kartographie und Geodäsie, Germany
- Geoscience Australia
- Hartebeesthoek Radio Astronomy Observatory, South Africa
- NASA Jet Propulsion Laboratory, California Institute of Technology, USA
- National Geodetic Survey, National Oceanic and Atmospheric Administration, USA
- Russian Data Analysis and Archive Center, Russia/Incorporated Research Institutions of Seismology, USA

Operational Data Centers for Networks

- Centre National d'Etudes Spatiales, France
- Delft University of Technology, Netherlands
- Deutsches GeoForschungsZentrum Potsdam, Germany
- European Space Agency, European Space Operations Centre, Germany
- Geodetic Survey of Canada, Natural Resources Canada
- Geographical Survey Institute, Japan
- Geological Survey of Canada, Natural Resources Canada
- Hartebeesthoek Radio Astronomy Observatory, South Africa
- Italian Space Agency
- Kort and Matrikelstyrelsen/National Survey and Cadastre, Denmark
- NASA Jet Propulsion Laboratory, California Institute of Technology, USA
- National Geodetic Data Centre, Geoscience Australia
- National Geodetic Survey, National Oceanic and Atmospheric Administration, USA
- Norwegian Mapping Authority
- Russian Data Analysis and Archive Center, Russia/Incorporated Research Institutions of Seismology, USA
- Scripps Orbit and Permanent Array Center, Scripps Institution of Oceanography, USA

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Acknowledgment: The IGS Governing Board thanks all members of the strategic planning committee for their thoughtful contributions to this strategic plan. The Governing Board also thanks all participants and supporters of the IGS. Without your dedicated participation and generous support, the IGS would not exist.

This document was edited by the IGS Central Bureau, which is hosted at the Jet Propulsion Laboratory, California Institute of Technology, with support from NASA.