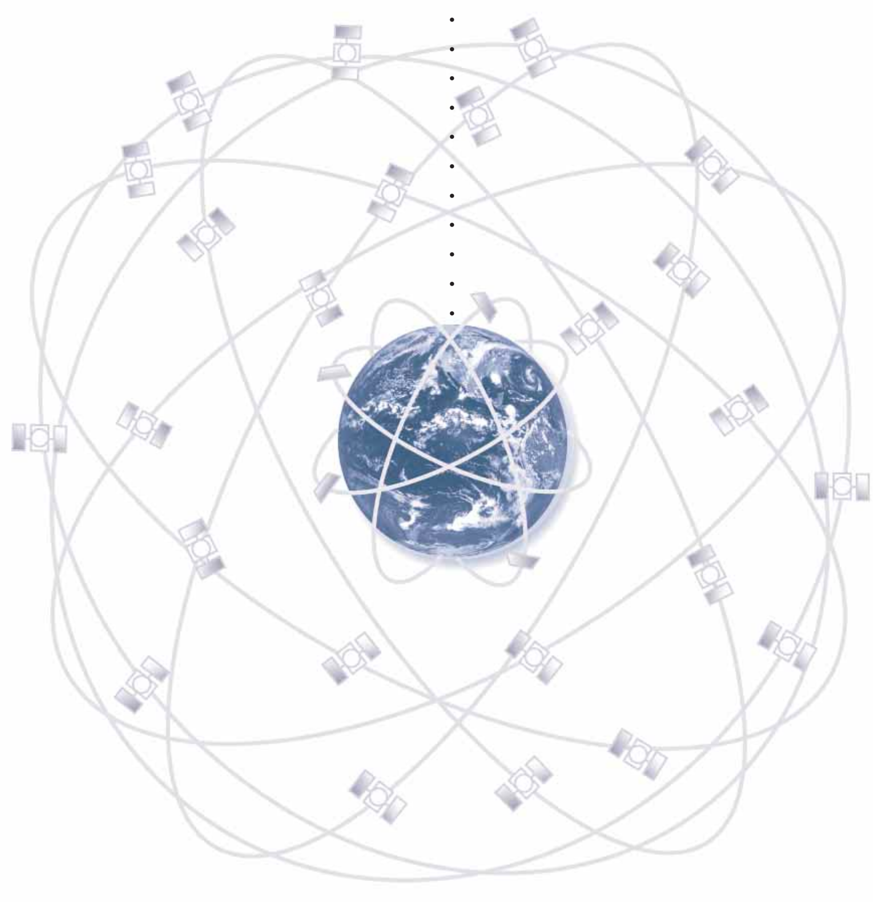
2002-2007

Strategic Plan

INTERNATIONAL

GPS

SERVICE



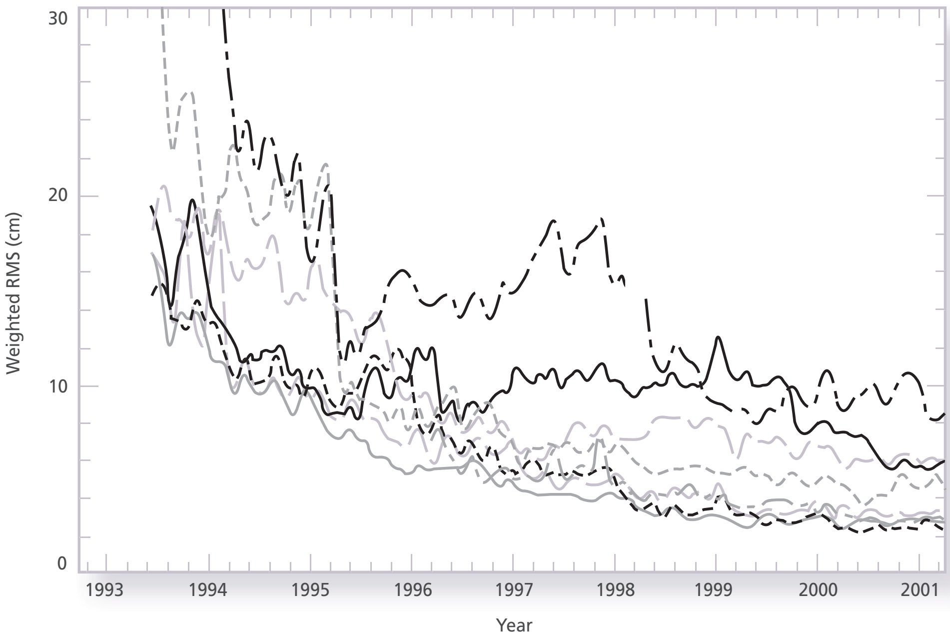
Executive Summary

The International GPS Service (IGS) has been in existence since January 1994. During these eight years, the accomplishments of the IGS have met and often exceeded the expectations of even the most optimistic of its founders and the most demanding of its users. The IGS now comprises more than 200 contributing organizations in more than 75 countries. Through these organizations, its associate members, hundreds of participating scientists and engineers, and the many respective sponsoring agencies, the IGS operates a global network of GPS stations that has produced the best satellite-based, globally accessible, three-dimensional geocentric reference frame in existence. The global network, together with IGS Analysis Centers, Data Centers, projects, and working groups, have provided geodetic reference data and related products that have been of enormous benefit to solid-Earth science research and to the operational effectiveness of a variety of satellite missions. It is impressive that the IGS has accomplished so much as a fully voluntary, globally decentralized organization, self-governed by its members, and without any central source of funding. Financial support is provided through the various member organizations and the agencies around the world that sponsor them.

Building upon its record of achievement, and in recognition of emerging technological and scientific trends, it is timely for the IGS to examine its future roles and functions and to establish goals and objectives consonant with the technological and scientific changes taking place. Technological advances include GPS modernization, transitioning to GPS III, GLONASS integration, and the development of other next-generation global navigation satellite systems (GNSS), such as Galileo. For science and research, a host of new low Earth orbiting (LEO) missions are emerging driven by a broad range of scientific objectives, including weather forecasting, climate monitoring, upper-atmosphere research, space weather prediction, and interdisciplinary Earth science studies such as the relationships between ultrasensitive gravity measurements in space and hydrological parameters at the Earth's surface.

The use of GPS technology is expanding rapidly and is playing an increasing role in many arenas, including transportation, navigation, agriculture, and geographical information systems. Multidisciplinary applications across society have a need for increasingly accurate, reliable, and timely GPS data and products from existing and, in some cases, specialized networks. The IGS, with its breadth of expertise and geographic diversity, is well positioned to serve these users. The IGS will respond to these needs and opportunities by broadening its range of service to science and will seek to serve society better through establishing appropriate strategic alliances and collaborations.

It is within this context that the IGS has established the following goals and objectives for the next five years:



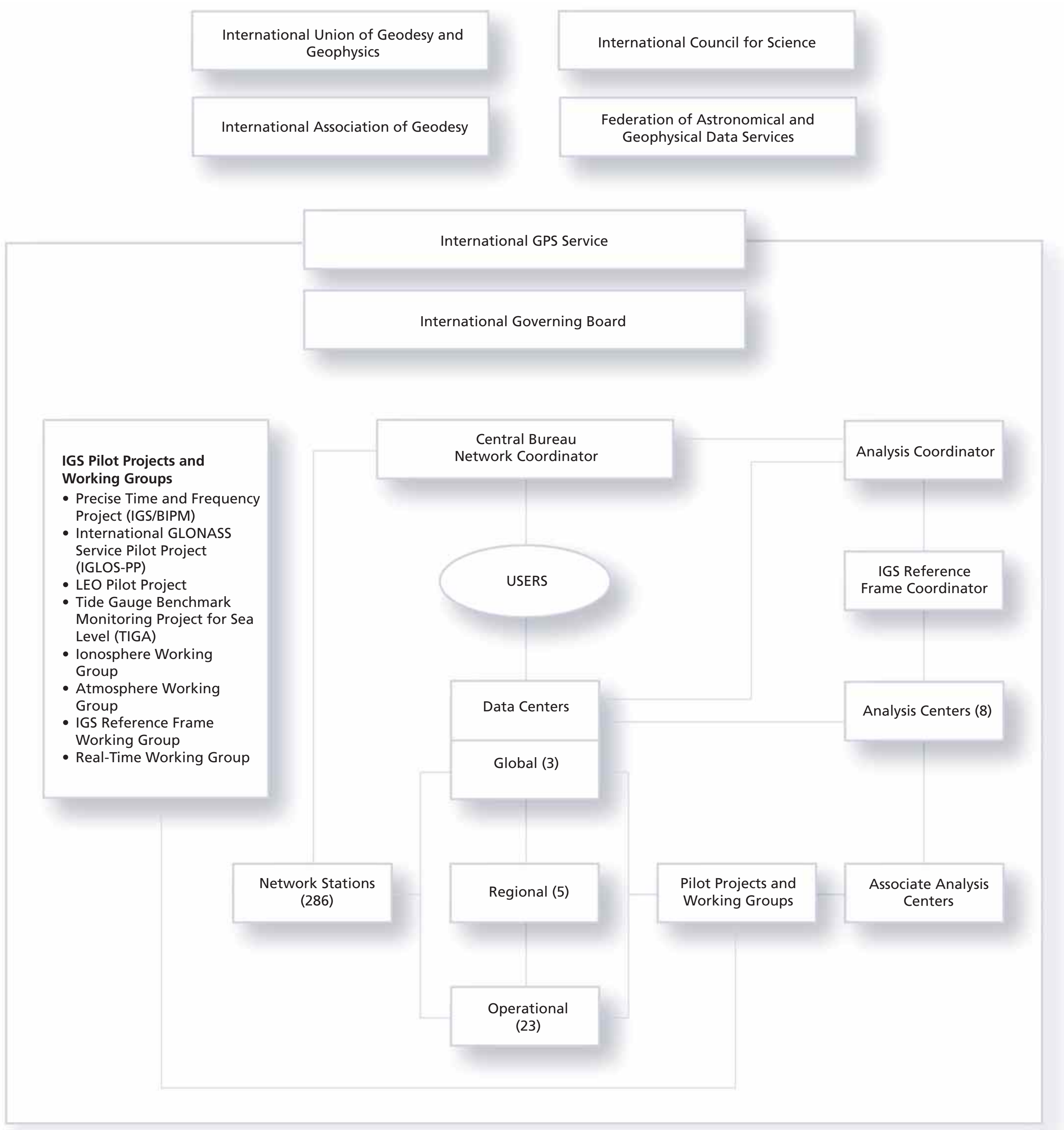
An order of magnitude improvement in IGS orbit determination over eight years; the traces are the weighted RMS of each Analysis Center's performance, and of the IGS Rapid Orbit, with respect to the IGS Final Orbit.

1. The principal goal of the IGS is to continue to provide a service to the international scientific community. However, IGS will seek to support a broader range of the Earth sciences by reaching out to non-solid-Earth scientific communities, including the atmospheric and ocean sciences. In addition, the recently enhanced recognition of the IGS as a key service of the International Association of Geodesy (IAG) will assist in establishing the interdisciplinary links.

2. As a secondary goal, the IGS will actively seek to serve society better by strengthening existing alliances and establishing new alliances and collaborations worldwide. In general, IGS will add value to its services and maintain the IGS products as the world standard. Through these new partnerships and potential new sponsorships, the IGS constituents hope to obtain additional resources to maintain the IGS infrastructure and services and to support other emerging applications.

3. To help accomplish the above, IGS will enhance flexibility and agility by delegating additional decision-making authority to its Central Bureau. In addition, an Executive Director position within the Central Bureau will be established to increase the functionality of the office, and seek multiagency/internationally based funding and resources for the Central Bureau. Further, the interdependent nature of the IGS requires stability, support, and appropriate allocation of resources for each component. Essential key roles and responsibilities must be vigilantly fulfilled for the continued success and improvements of the IGS — no part can function without the others. Thus, the Central Bureau, Analysis Centers, Data Centers, Network Operations, Working Groups and Pilot Projects, and the Coordinators — Analysis, Network, and Reference Frame — must have full support for their dedicated and vital tasks.

4. To facilitate and promote interactions, the IGS intends to establish a legal entity with the ability to accept multiagency resources with requisite accountability. The IGS will explore the establishment of a Business Office or function either as part of or independent of the organization. The purpose of this office will be to establish mutually beneficial relationships with public or industrial enterprises, to enhance support and services, and to facilitate contractual, business, and financial relationships.



IGS structure and association with international scientific organizations.

Mission

The International GPS Service is committed to providing the highest quality data and products as the standard for global navigation satellite systems (GNSS) in support of Earth science research, multidisciplinary applications, and education. These activities aim to advance scientific understanding of the Earth system components and their interactions, as well as to facilitate other applications benefiting society.

Long-Term Goals and Objectives

- Provide the highest quality, reliable GNSS data and products, openly and readily available to all user communities.
- Promote universal acceptance of IGS products and conventions as the world standard.
- Continuously innovate by attracting leading-edge expertise and pursuing challenging projects and ideas.
- Seek and implement new growth opportunities while responding to changing user needs.
- Sustain and nurture the IGS culture of collegiality, openness, inclusiveness, and cooperation.
- Maintain a voluntary organization with effective leadership, governance, and management.

Strategies of the IGS

To achieve the long-term goals and objectives of the IGS, three key strategies are identified:

Strategy 1: Ensure delivery of "world-standard" GPS (and other GNSS) data and products, providing the standards and specifications globally.

Strategy 2: Pursue new opportunities for growth to improve the services and serve a broader range of users.

Strategy 3: Continuously improve the effectiveness of the IGS organization.

Each of the strategies will be described in the following pages.

Strategy 1

Ensure delivery of "world-standard" GPS (and other GNSS) data and products, providing the standards and specifications globally.

The methods to fulfill this strategy are:

1. Maintain and improve accurate, robust, and reliable GPS/GNSS data, products, and delivery systems.
    - Continue to advocate an open data policy, providing data and products broadly and openly.
    - Evaluate and incorporate suitable new technologies into the IGS.

2. Promote IGS methods, data, and products to current and potential users as a world "standard," and broaden the IGS user community into other areas.
    - Develop broader outreach and education.
    - Devote attention to user needs and interfaces; develop and maintain comprehensive user guides.
    - Build partnerships — interdisciplinary, suppliers, commercial, intergovernmental, and sponsorships.
    - Expand participation.
    - Diversify the Governing Board to include other user communities.

3. Attract leading-edge talent for continuous innovation.
    - Embrace new and innovative project proposals.
    - Publicize IGS involvement in novel science, pilot projects, working groups, and other challenging activities.
    - Provide positive feedback to the sponsoring agencies.

Strategy 1 underscores the importance of providing and supporting the world standard for GPS and other GNSS. IGS has become the de facto world standard for many aspects related to GPS — the IGS products such as precise orbits, clocks, and coordinates (the best available anywhere) serve as globally consistent standards. IGS conventions include the standardized exchange formats for data and solutions (RINEX or Receiver-Independent Exchange Format; SP3 or Standard Product #3 Earth-centered/Earth-fixed Orbit File; and SINEX or Solution-Independent Exchange Format, now adopted by the International Earth Rotation Service [IERS], the International Laser Ranging Service [ILRS], and the International VLBI Service [IVS]), Antenna Phase Center Value (PCV) Tables, and standardized station information

The IGS must plan for broad access by diverse users.

forms. Adoption of these conventions facilitates the universal use of GPS for numerous applications in a straightforward manner.

Maintaining and improving accurate, robust, and reliable GPS/GNSS data, products, and delivery systems depends on two approaches:

a) Continue to provide data and products broadly and openly. The IGS advocates an open data policy and expects contributors and participating organizations to adhere to this policy. This is an important aspect as new data and products are generated for numerous applications.

b) As systems evolve, the IGS must be able to incorporate suitable technologies into its processing. A key example of this is the IGS incorporation of GLONASS (the Russian satellite system) into the routine GPS infrastructure. This demonstrates the unique capability of the IGS to adopt other satellite systems (GNSS), such as Galileo, in support of various applications.

In order for the IGS to be accepted as the world standard, it is necessary to promote the IGS to present and potential users and to be fully cognizant of advanced technology requirements. The IGS system, data products, and information, already well-known and used extensively in the geodetic community, should be promoted to numerous additional user communities in universities, nonprofit organizations, government, and the commercial sector.

The IGS must plan to facilitate broad access by diverse user communities through reassessment of user needs and how the users interface with the IGS to obtain the information or data products they require. It is also essential to involve the IGS working groups and projects more actively with the actual application communities. For example, IGS GPS expertise coupled with meteorological groups can facilitate a better understanding and methodology for GPS applications to weather forecasting and climate research.

In addition to paying keen attention to users' needs and interfaces, the IGS, in conjunction with the IAG, must engage in outreach and education activities and be fully involved in the future Integrated Global Geophysical Observing System (IGGOS). This is important to promote IGS products and plans broadly, which is being done but could be more far-reaching. A recent example is a new initiative to establish a continental reference system for Africa, termed AFREF. Continuing the development of tutorials, exhibits, user forums, and available literature can help to demonstrate the value of IGS, and reinforce IGS data and products as the geodetic world standard.

To ensure that IGS data and products are accepted as the world standard on a continuing basis, the organization must attract the kind of leading-edge talent to further innovation, foster collegial relationships, and demonstrate IGS involvement in novel and interesting science. This is extremely important to collaboration. Another element of this approach is to provide positive feedback to contributing agencies and their sponsors.

Strategy 2

Expand the IGS by pursuing new opportunities for growth.

Key emerging, demanding applications that the IGS must adapt to support include the low Earth orbiter (LEO) missions that carry onboard GPS flight receivers, and real-time (RT) applications. Supporting these leading-edge applications will help enhance the infrastructure to the benefit of both the IGS and the applications.

The methods to fulfill this strategy are:

1. Pursue and develop implementation plans in support of LEO satellite missions.
   - Provide standards and formats for mission-independent information.
   - Evaluate the impact of LEO data on IGS global products.
   - Evaluate creation of new IGS LEO Precise Orbit Determination (POD) products.

2. Pursue and develop implementation plans related to real-time (RT) and near-real-time (NRT) applications.
   - Provide standards and formats for RT operations.
   - Form liaisons with existing regional RT networks; for example, with the meteorological community.
   - Broadcast IGS products for RT users.

In order to pursue new opportunities for growth, the IGS must remain abreast of and involved in cutting-edge applications. It has been recognized for the past few years that the IGS can play an important role in LEO missions. These LEO satellites carry onboard GPS receivers and therefore need the precisely defined orbit and clock products of the GPS satellites for a number of scientific applications. In the case of those LEOs performing atmospheric occultation observations, a reference station subset of the ground network will provide higher-rate tracking data. This is of great interest to the IGS and the community in general. Several of the agencies contributing to the IGS are involved in the deployment and operation of these LEOs (e.g., GeoForschungsZentrum Potsdam, Germany; National Aeronautics and Space Administration, USA); hence, there is a natural synergism for enhancing the IGS. Applications of occultation missions include weather forecasting, climate and space weather monitoring and ionospheric mapping. Occultation sensing exploits the refracted GPS signal observed by the LEO to derive temperature, pressure, water vapor, or electron density anywhere around the globe. Similarly, ground-based measurements of precipitable water vapor can be a valuable contribution to weather forecasting and climate research, a topic under study by the IGS Atmosphere Working Group.

Some important applications (e.g., weather prediction) require low-latency data and product delivery. Near-real-time or real-time operations of part of the IGS will soon be required. Hence the IGS will pursue and develop plans related to real-time applications — not just weather forecasting, but others as well. The Real-Time Working Group is chartered to investigate the IGS role in real-time applications and is also looking at forming liaisons with many of the existing regional networks, which currently operate in real time. The IGS can play a critical role in bringing together various real-time regional GPS networks and developing and promoting a standard by which real-time networks can operate and exchange data products on a global basis.

These areas point to growth of the IGS user community as outlined in Strategy 1.

Pursuit of growth opportunities can succeed only if a stable foundation exists. To continue delivering the best products as in Strategy 1 and to pursue new opportunities as outlined in Strategy 2, the IGS must focus on realizing a stable and mature organizational structure appropriate for the next decade, as described in Strategy 3.

Strategy 3

Continuously improve the effectiveness of the IGS organization.

1. Seek renewed commitment to the IGS mission, goals, and objectives with existing partners and potential new alliances.
   - Negotiate long-term multilateral agreements or conventions among IGS supporting agencies.
   - Obtain firm commitment from IGS components during 2002.
   - Offer international proposals to funding/sponsoring agencies for long-term commitments.
   - Consider industry or private sponsorships.

2. Review and restructure the organization as necessary to align with this Strategic Plan, with careful consideration of the future organization, stability, and functioning of key components, in particular the Central Bureau.
   - Pursue steps to establish IGS as a legal international entity.
   - Investigate other successful organizational models and strategies.
   - Update IGS Central Bureau organization; restructure and expand to ensure long-term stability and effectiveness.

3. Ensure appropriate long-term levels of resources and funding.

    - Determine and identify the funding/resources required to:

      —Sustain, enhance, and improve services to existing users

      —Serve the needs of new and diverse users in the future

      —Strengthen the IGS Central Bureau

    - Pursue opportunities to stabilize support and to increase funding and resources in order to accomplish the above.

    - Explore the establishment of a Business Office as part of the IGS Central Bureau or independent of it in order to establish mutually beneficial relationships with public or industrial partners.

4. IGS Governing Board actions:

    - Assign more responsibility and decision-making to the Central Bureau to enhance effective coordination of the service.

    - Evaluate the need for possible new members to broaden representation without compromising board effectiveness and key competence.

The IGS has experienced explosive growth over the last ten years. It is prudent now to re-evaluate and attempt to improve its effectiveness. This will take careful consideration. Clearly one of the successes of the IGS has been the federated nature of the organization — each agency brings to the table what it can offer. An organization commits to other partners that it will fulfill certain roles and responsibilities.

It is now vital to pursue a recommitment to the goals and objectives of the IGS as outlined in this Strategic Plan and solicit long-term member commitments, perhaps negotiating multilateral agreements with the IGS supporting agencies, or a convention that members adhere to. This will help to ensure viability of the IGS and its components through long-term commitments of support, funding sources, and resources. This commitment will reinforce and enhance proper functioning of the network, communications, redundant Data Centers, Analysis and Associate Analysis Centers, Coordinators, the Central Bureau, the Governing Board, and importantly, keep the IGS vital through the working groups and projects.

A strong IGS, able to achieve the goals described in this Strategic Plan, requires an effective IGS Central Bureau. The Central Bureau performs many tasks for the IGS:

Strengthening the Central Bureau is a top priority.

- The primary functions are day-to-day coordination of the service and acting as the executive arm of the Governing Board.
- The information system maintained by the Central Bureau is the key interface for outside users.
- The Network Coordination function as part of the Central Bureau is crucial for compliance to standards within the IGS.
- The Central Bureau attempts to support each working group or project within the IGS, and supports the Governing Board and its meetings.
- The Central Bureau produces IGS publications and promotes the IGS and contributing agencies at many venues through exhibits, tutorials, and user forums.
- The Central Bureau responds daily to communications from a broad range of contacts.

Since inception, the Central Bureau has been sponsored by NASA, a noteworthy contribution. Current staffing resources and functioning of the Central Bureau are inadequate for the new directions of the IGS. Strengthening the Central Bureau organization is therefore a top priority.

The organization of the Central Bureau must be restructured and expanded consonant with the goals of this plan, and the Governing Board must develop a shared vision of the evolution of the Central Bureau. The Central Bureau must be positioned to fulfill current responsibilities and expand to meet the stated objectives. To sustain and enhance an international organization, it is important to have an entity that can fairly represent the IGS to external organizations — governmental, public, and private.

The IGS will consider establishing an internationally based legal entity with the ability to accept multiagency resources with requisite accountability. This will enable the IGS to enter into contractual relationships that will broaden the range of services and funding base.

In terms of the effectiveness of the IGS organization, it is also important to look at the IGS Governing Board and how this Board interacts with the various components and the Central Bureau. More responsibility and decision-making authority can be delegated to the Central Bureau, given adequate resources and staff. The Governing Board should regularly evaluate the need for potential new members to broaden representation into the areas of multidisciplinary applications as noted in Strategies 1 and 2, in balance with the need for Board effectiveness.

History of the International GPS Service

What is the IGS

— why IGS?

A number of key factors led to the formation of the IGS. By the late 1980s, many geodynamics and geodetic organizations recognized the great potential of the Global Positioning System (GPS). As the new GPS was evaluated in research and science applications, many organizations recognized the economical, unprecedented level of positioning achievable with this technology. The motivating goal for solid-Earth sciences was millimeter-level positioning in support of science anywhere in the world. However, no single agency could (or should) assume the capital investment and recurring operations costs for the necessary global infrastructure. It was at this point that the international community considered joint partnerships to define cooperative approaches and set standards, to ensure that this endeavor would be successfully developed and ultimately be 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, UK. It was here that people recognized that a standardized civilian system for using GPS would be beneficial to all. Subsequently a planning committee was established within 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 this 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 a Campaign Oversight Committee was formed at the International Union of Geodesy and Geophysics (IUGG)/IAG General Assembly meeting in Vienna in 1991. This committee organized a pilot project to demonstrate the potential of an international service based on the GPS. This pilot activity took place from June to September 1992 and was highly successful. This project, designated International GPS Service for Geodynamics (IGS), was clearly viable. The IGS Pilot Project continued through 1993, while a proposal to the IAG was prepared seeking approval for the IGS as an IAG international service. This approval was received at the IAG Scientific Assembly in Beijing, China, in late 1993, and the official IGS was established on January 1, 1994. Recognition of the value of IGS was reinforced with membership in the Federation of Astronomical and Geophysical Data Services (FAGS) in 1996.

The IGS, as a completely voluntary organization, continues to operate the 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 nearly 300 and the accuracy of the IGS orbits has improved an order of magnitude, from 50 centimeters to 5 centimeters, with satellite and station clocks accurate at the sub-nanosecond level. Extensive development of the IGS infrastructure, along with the remarkable achievements and efforts of the IGS Analysis Centers, continues to drive the evolution of the traditional products such as orbits, clocks, station positions and velocities, and Earth orientation and rotation parameters. In turn, these support science-driven applications, which offer additional products such as tropospheric precipitable water vapor (PWV) and total electron content (TEC) of the ionosphere. The IGS fosters working groups and projects for developing new areas of investigation utilizing the IGS framework, including the Precise Time and Frequency Project, joint with the Bureau International des Poids et Mesures (BIPM); the Ionospheric Working Group; Troposphere Working Group; IGS Reference Frame Working Group; the International GLONASS Service Pilot Project (IGLOS-PP); the Low Earth Orbiter Pilot Project; the Tide Gauge Benchmark Monitoring Project for sea level studies (TIGA); and the Real-Time Working Group. It is through these working groups that the IGS continues to evolve and improve.

The scope of advantageous use of the IGS continues to expand. The IGS has become the primary source for general access to and continuous development of the precise reference frame of the International Earth Rotation Service (IERS), the International Terrestrial Reference Frame (ITRF). The use of GPS contributes to the significant adoption of ITRF in national and other coordinate systems that are central to commercial, civil, and government activities. Developments within the LEO Pilot Project similarly indicate that the IGS is becoming the fundamental source of precise reference frame for exciting international space missions carrying GPS flight receivers, such as the operational CHAMP, SAC-C, Jason-1, GRACE, and the future GOCE, ICESat, and FEDSat. The IGS provides the global framework for virtually all regional applications and networks — for example, the Southern California Integrated GPS Network (SCIGN), IAG Commission X-Global and Regional Geodetic Networks, Subcommission for Europe (EUREF), and Sistema de Referencia Geocéntrico para América del Sur (SIRGAS, the South American continental reference system).

Roles of IGS Components

The history, development, and current status of the IGS are captured in the Annual and Technical Reports, and workshop proceedings, all available through the Central Bureau. Key documents such as the IGS Terms of Reference, and including all publications, are held at the IGS information system at the Central Bureau, which can be accessed at *http://igscb.jpl.nasa.gov*.

The following paragraphs describe the IGS components.

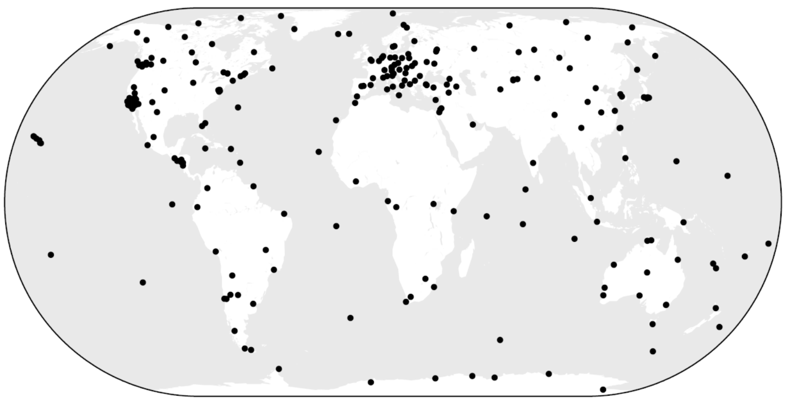
Network of Tracking Stations

All components of the IGS are critically dependent on the global network of precise GPS tracking stations. Recognizing the fundamental requirement for consistent, coordinated, and high-quality network operations, where different receivers are deployed and maintained by more than 50 organizations, the IGS Governing Board recommended in late 1997 that a Network Coordinator be established. This was realized in 1998 when a position was created within the Central Bureau. Since then an overall enhancement of the network processes has been realized. The IGS network includes nearly 300 stations that operate continuously delivering data hourly or daily to the data centers. Currently, the IGS network also includes more than 30 GLONASS tracking stations.

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 archive and availability of both IGS data and products. A hierarchy of data centers, Global, Regional, and Operational, collects and distributes data from the network of tracking stations.

Map of IGS network GPS stations in 2002.



This scheme provides for efficient access and storage of GPS and ancillary data, thus reducing network traffic as well as a level of redundancy allowing for security of the data holdings. There are three Global Data Centers, five Regional Data Centers, and 23 Operational Data Centers.

Analysis Centers

Analysis Center Coordinator

Associate Analysis Centers

The Analysis Centers are the scientific backbone of the IGS. They provide, based on the available tracking data of the whole IGS network, a consistent set of high-quality products like precise satellite orbits, station and satellite clock information, station coordinates, Earth rotation parameters, and atmospheric information. To fulfill the tasks of an IGS Analysis Center, 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 Analysis Centers offer three types of solutions, which differ in accuracy and latency, to many kinds of geophysical and engineering applications. Besides their routine work, the Analysis Centers permanently concentrate on a variety of model improvements and these activities are the driving forces of the success of the IGS. There are currently eight Analysis Centers.

The Analysis Centers work with the Analysis Center Coordinator, who ensures that the IGS objectives are carried out. Specific responsibilities of the Analysis Center Coordinator include quality control, performance evaluation, and continued development of appropriate analysis standards. The Analysis Center Coordinator is also responsible for the appropriate combination of the Analysis Centers' products into a single set of products, the official IGS 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. The Associate Analysis Centers are generally linked to an IGS pilot project or working group. There are on the order of 20 of these associated centers.

Working Groups & Pilot Projects

Working groups focus on selected topics related to the IGS components according to the goals and schedule specified in the working group's charter. Pilot projects aim to develop particular IGS product(s) or service(s) relying on the IGS infrastructure. The current IGS working groups are:

- Ionosphere Working Group
- Atmosphere Working Group
- IGS Reference Frame Working Group
- Real-Time Working Group
- Network Working Group (pending)

The current IGS pilot projects are:

- Precise Time and Frequency Project, joint with the Bureau International des Poids et Mesures (BIPM)
- International GLONASS Service Pilot Project (IGLOS-PP)
- Low Earth Orbiter Pilot Project (based on CHAMP, SAC-C, GRACE, etc.)
- Tide Gauge Benchmark Monitoring Project for Sea-Level Studies (TIGA)

Central Bureau

The Central Bureau is the executive arm of the IGS Governing Board and as such is responsible for the general management and coordination of IGS activities and external affairs of the IGS consistent with the directives, policies, and priorities set by the Governing Board.

The history, development, and current status of the IGS are captured in the Annual and Technical Reports, and workshop proceedings, all available through the Central Bureau. Key documents, such as the IGS Terms of Reference, and other publications are held at the IGS information system at the Central Bureau (*http://igscb.jpl.nasa.gov*).

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.

Supporting Organizations of IGS Components

Global Data Centers

- Crustal Dynamics Data Information System, NASA Goddard Space Flight Center, USA
- Institut Géographique National, France
- Scripps Orbit and Permanent Array Center, Scripps Institution of Oceanography, USA

Analysis Centers

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

Analysis Center Coordinator

- Astronomical Institute University of Bern – Center for Orbit Determination in Europe, Switzerland (until January 2003)

Reference Frame Coordinator

- Natural Resources Canada

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

IGS Working Groups and Projects

Lead Organizations (many organizations contribute to each)

- IGS Reference Frame Densification — Natural Resources Canada

- Precise Time and Time Transfer — US Naval Observatory, USA; Bureau International des Poids et Mesures, France
- International GLONASS Service Pilot Project — National Imagery and Mapping Agency, USA
- Low Earth Orbiter Project — Analysis Coordination: European Space Agency/European Space Operations Center, Germany; NASA Jet Propulsion Laboratory, California Institute of Technology, USA; GeoForschungsZentrum Potsdam, Germany
- Ionosphere Working Group — European Space Agency/European Space Operations Center, Germany
- Atmosphere Working Group — GeoForschungsZentrum Potsdam, Germany
- Tide Gauge Benchmark Project for Sea Level Monitoring — GeoForschungsZentrum Potsdam, Germany
- Real-time Working Group — Natural Resources Canada; NASA Jet Propulsion Laboratory, California Institute of Technology, USA

Associate Analysis Centers

Global Network Associate 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

- Space Geodesy Analysis Center, Geoscience Australia National Mapping Division (Formerly AUSLIG)
- EUREF European Reference System, Global and European Regional Geodetic Networks, European Coordinating RNAAC:

  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 Commision, 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
- GeoForschungsZentrum Potsdam, Germany
- Geographical Survey Institute of Japan
- Geophysical Institute of the University of Alaska, USA
- Onsala Space Observatory, Sweden
- Pacific Geoscience Center, Canada

- Sistema de Referencia Geocéntrico para América del Sur, Deutsches Geodätisches ForschungsInstitut, Germany, Instituto Brasileiro de Geografia e Estatística (IBGE), Brazil

Regional Data Centers

- National Geodetic Data Center, Geoscience Australia National Mapping Division (Formerly AUSLIG)
- Bundesamt für Kartographie und Geodäsie, Germany
- National Geodetic Survey/National Oceanic and Atmospheric Administration, USA
- Hartebeesthoek Radio Astronomy Observatory, South Africa
- NASA Jet Propulsion Laboratory, California Institute of Technology, 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
- European Space Agency/European Space Operations Center, Germany
- Geodetic Survey, Geological Survey, Natural Resources Canada
- GeoForschungsZentrum Potsdam, Germany
- Geographical Survey Institute, Japan
- Hartebeesthoek Radio Astronomy Observatory, South Africa
- Italian Space Agency
- NASA Jet Propulsion Laboratory, California Institute of Technology, USA
- 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

Participating Organizations

International Association of Geodesy (IAG)	
Federation of Astronomical and Geophysical Data Services (FAGS)	
International Earth Rotation Service	
Comisión Nacional de Actividades Espaciales (CONAE), Argentine Space Agency	Argentina
Estación Astronomica Rio Grande	Argentina
Facultao de Cs. Astronómicas y Geofísicas	Argentina
La Plata National University	Argentina
Universidad Salta Instituto Geonorte	Argentina
National Survey for Seismic Protection	Armenia
Australian Antarctic Division	Australia
ESA Perth Ground Station	Australia
Geoscience Australia, National Mapping Division (formerly AUSLIG)	Australia
Research School of Earth Sciences	Australia
Institute for Space Research Observatory Graz	Austria
University of Technology Vienna	Austria
Coastal Zone Management Unit	Barbados
Royal Observatory of Belgium (ROB)	Belgium
Bermuda Biological Station for Research	Bermuda
Instituto Brasileiro de Geografia e Estatística (IBGE)	Brazil
Instituto Nacional de Pesquisas Espaciais (INPE)/ATSME, Brazilian Space Agency	Brazil
University Federal de Parana	Brazil
Military Topographic Service of Bulgaria	Bulgaria
Geodetic Survey Division, Natural Resources Canada	Canada
Natural Resources Canada (NRCan)	Canada
Pacific Geoscience Center (PGC), Geological Survey of Canada, Natural Resources Canada	Canada
University of New Brunswick	Canada
Centro de Estudios Espaciales, Center for Space Studies	Chile
China Geo-informatics Center, Chinese Academy of Surveying and Mapping	China
China Seismological Bureau	China
Crustal Motion Observation Network of China	China
Kunming Astronomical Observatory	China
National Bureau of Surveying and Mapping	China
Shaanxi Observatory Chinese Academy of Science	China
Shanghai Observatory Chinese Academy of Science	China
Tibet Autonomous Regional Bureau of Surveying and Mapping	China
Wuhan Technical University of Surveying and Mapping	China

Yunnan Observatory	China
Instituto de Investigación e Información Geoscientifica, Minero-Ambiental y Nuclear (INGEOMINAS)	Colombia
Bureau National D'Etudes Techniques (BNETD)	Cote d'Ivorie
Research Institute of Geodesy	Czech Republic
Kort & Matrikelstyrelse, National Survey and Cadastre (KMS)	Denmark
Charles Darwin Research Station, Galápagos Islands	Ecuador
Instituto Geografico Militar (IGM)	Ecuador
Centro Nacional de Registros	El Salvador
National Environmnet Research Council (NERC) Space Geodesy Facility	England
Finnish Geodetic Institute	Finland
Bureau International des Poids et Mesures (BIPM)	France
Centre Littoral de Geophysique (CLDG), University La Rochelle	France
Centre National d'Etudes Spatiales (CNES)	France
Institut Geographique National (IGN)	France
Observatoire de la Côte d'Azur (OCA)	France
Territoire des Terres Australes et Antarctiques Francaises	France
ESA Station Diane	French Guyana
Universite des Sciences et Techniques de Masuku	Gabon
Alfred Wegener Institute for Polar and Marine Research	Germany
Bavarian Academy of Sciences	Germany
Bundesamt für Kartographie und Geodäsie	Germany
Deutsche Forschungsanstalt für Luft-und Raumfahrt e.V. (DLR)	Germany
Deutsches Geodätisches ForschungsInstitut (DGFI)	Germany
European Space Agency/European Space Operations Center (ESA/ESOC)	Germany
GeoForschungsZentrum Potsdam (GFZ Potsdam)	Germany
Physikalisch-Technische Bundesanstalt (PTB)	Germany
Technical University Munich	Germany
University of Bonn	Germany
University of the Bundeswehr	Germany
Technical University of Crete	Greece
SRI International	Greenland
Guam Seismic Observatory	Guam
Instituto Geografico Nacional	Guatemala
Instituto Geografico Nacional	Honduras
Satellite Geodetic Observatory, Penc	Hungary

Landmaelingar Islands, National Land Survey of Iceland	Iceland
Council of Scientific and Industrial Research (CSIR), Centre for Mathematical Modelling and Computer Simulation (CMMACS)	India
National Geophysical Research Institute	India
BAKOSURTANAL National Coordination Agency for Surveys and Mapping	Indonesia
Survey of Israel (SOI)	Israel
Tel-Aviv University (TAU)	Israel
Agenzia Spaziale Italiana (ASI), Italian Space Agency	Italy
Nuova Telespazio S.p.A.	Italy
Telespazio S.p.A	Italy
Time and Frequency Laboratory, Instituto Electtrotecnico Nazionale G. Ferraris	Italy
Ufficio Geodetico di Bolzano Regione Autonoma Trentino Alto Adige	Italy
University of Padova	Italy
Jamaica Meteorological Service	Jamaica
Communications Research Laboratory (CRL)	Japan
Earthquake Research Institute, University of Tokyo (ERI)	Japan
Geographical Survey Institute (GSI)	Japan
Radio Astronomy Applications Group	Japan
Usuda Deep Space Tracking Station	Japan
Western Pacific Integrated Network of GPS (WINGS)	Japan
Royal Jordanian Geographic Centre	Jordan
Scientific-Forecast Centre “Prognoz,” Emergency Agency of Kazakhstan	Kazakhstan
San Marco Telemetry Station	Kenya
Electromagnetic Field Expedition of the Institute of High Temperatures (IVTAN)	Kyrgyzstan
International Research Center — Geodynamic Proving Ground (IRC-GPG)	Kyrgyzstan
Maylasia Department of Surveying and Mapping	Maylasia
Centro de Investigación Cientifica y de Educación Superior de Ensenada (CICESE)	Mexico
Instituto Nacional de Estadistica Geografia e Informatica (INEGI)	Mexico
Research Centre of Astronomy and Geophysics	Mongolia
Delft Institute for Earth-Oriented Space Research (DEOS)	Netherlands
Delft University of Technology	Netherlands
Department of Land (DITTT/ST/BGN), Noumea	New Caledonia
Institute of Geological and Nuclear Sciences (GNS)	New Zealand
Land Information New Zealand (LINZ)	New Zealand
Instituto Nicaraguense de Estudios Territoriales	Nicaragua
Nordlysobservatoriet	Norway

Norwegian Mapping Authority, Geodetic Institute	Norway
Ny-Alesund Geodetiske Observatorium	Norway
Department of Surveying and Land Studies	Papua New Guinea
Manila Observatory	Phillipines
Astrogeodynamical Observatory, Space Research Centre, Polish Academy of Sciences	Poland
Institute of Geodesy and Geodetic Astronomy, Warsaw University of Technology	Poland
University of Warmia and Mazury in Olsztyn	Poland
University of Zagreb	Republic of Croatia
Department of Lands and Surveys, Survey Branch	Republic of Cyprus
Republica Geodetska Uprava	Republic of Macedonia
Technical University of Civil Engineering Faculty of Geodesy	Romania
Complex Magnetic-Ionospheric Station (CMIS)	Russia
Geophysical Observatory Arti	Russia
Geophysical Service, Russian Academy of Sciences	Russia
Institute for Metrology of Time and Space, GP VNIIFTRI	Russia
Institute of Applied Astronomy, Russian Academy of Sciences (IAA)	Russia
Institute of Astronomy, Russian Academy of Sciences (INASAN)	Russia
Institute of Geophysics, Siberian Branch of Russian Academy of Sciences	Russia
Institute of Marine Geology and Geophysics	Russia
Mission Control Center, Russian Space Agency (MCC)	Russia
OMSP Petropavlovsk	Russia
Russian Data Analysis and Archive Center (RDAAC)	Russia
Seismic Station Bilibino	Russia
Seismic Station Magadan	Russia
Seismic Station Tixi	Russia
Seismic Station Yakutsk	Russia
Technical University of Krasnoyarsk	Russia
The Institute of Metrology for Time and Space (IMVP) Russia	Russia
East-Siberian Research Institute for Physics, Technical and Radio-Technical Measurements (ES RIPRM), VS NIIFTRI	Russia
Seychelles National Oil Company	Seychelles
Nanyang Technological University	Singapore
Slovenian Environmental Agency	Slovenia
Chief Directorate Surveys and Mapping, Department of Land Affairs (CDSM)	South Africa
Council for Scientific and Industrial Research (CSIR)	South Africa
Hartebeesthoek Radio Astronomy Observatory (HartRAO)	South Africa

Korea Astronomy Observatory	South Korea
National Geography Institute	South Korea
ESA Villafranca Satellite Station	Spain
Institut Cartografic de Catalunya	Spain
Instituto Geografico Nacional	Spain
Instituto Nacional de Técnica Aeroespacial (INTA) / Estacion Espacial de Maspalomas	Spain
Real Instituto y Observatorio de la Armada (ROA)	Spain
Universitat Politécnica de Catalunya	Spain
ESA Kiruna Ground Station	Sweden
National Land Survey of Sweden	Sweden
Onsala Space Observatory	Sweden
Swedish National Testing and Research Institute	Sweden
Astronomical Institute University of Bern (AIUB)	Switzerland
Swiss Federal Office of Metrology and Accreditation (METAS)	Switzerland
Swiss Federal Office of Topography, Bundesamt für Landestopographie (L+T)	Switzerland
Université Française du Pacifique (UFP)	Tahiti
Universitié de la Polynésie Française	Tahiti
Institute of Earth Sciences, Academia Sinica	Taiwan
National Standard Time and Frequency, Telecommunication Laboratories, Chunghwa	Taiwan
Harita Genel Komutanligi General Command of Mapping	Turkey
Istanbul Technical University (ITU) Civil Engineering Faculty	Turkey
Karadeniz Teknik Universitesi	Turkey
TUBITAK Marmara Research Center Earth Sciences Research Institute	Turkey
Uganda Geological Survey and Mines Dept.	Uganda
Main Astronomical Observatory of National Academy of Sciences of Ukraine	Ukraine
National University Lviv Polytechnic	Ukraine
Poltava Gravimetric Observatory of the National Academy of Sciences of Ukraine	Ukraine
Science and Research Institute of Geodesy and Cartography	Ukraine
Space Research Laboratory of the Uzhgorod National University	Ukraine
British National Space Centre (BNSC)	United Kingdom
National Physical Laboratory	United Kingdom
Natural Environment Research Council (NERC), Space Geodesy Facility (NSGF)	United Kingdom
University of Newcastle on Tyne	United Kingdom
University of Nottingham	United Kingdom
Universidad de la Republica	Uruguay
National Radio Astronomy Observatory (NRAO)	US Virgin Islands

Allen Osborne Associates, Inc. (AOA)	USA
California County of Riverside	USA
Center for Earthquake Research and Information (CERI)	USA
Center for Space Research, University of Texas at Austin (CSR)	USA
County of Riverside, California	USA
Crustal Dynamics Data Information System (CDDIS – NASA Goddard Space Flight Center)	USA
Eastport Elementary School, Maine	USA
Incorporated Research Institutions for Seismology (IRIS)	USA
International Deployment of Accelerometers (IDA)	USA
Intuicom, Incorporated	USA
Jet Propulsion Laboratory (JPL), California Institute of Technology	USA
Long Valley Observatory	USA
Maine College of the Atlantic GIS Laboratory	USA
Massachusetts Institute of Technology (MIT) — Haystack Observatory	USA
MIT Department of Earth, Atmospheric, and Planetary Sciences	USA
NASA Goddard Space Flight Center (NASA/GSFC)	USA
National Aeronautics and Space Administration (NASA)	USA
National Center for Atmospheric Research (NCAR)	USA
National Geodetic Survey (NGS)	USA
National Imagery and Mapping Agency (NIMA)	USA
National Radio Astronomy Observatory (NRAO)	USA
National Science Foundation (NSF)	USA
NRAO Mauna Kea	USA
NRAO Pie Town	USA
Ohio State University — Laboratory for Space Geodesy and Remote Sensing	USA
Scripps Orbit and Permanent Array Center (SOPAC), Scripps Institution of Oceanography	USA
U.S. Naval Observatory (USNO)	USA
United States Geological Survey (USGS)	USA
University Consortium for Atmospheric Research (UCAR)	USA
University NAVSTAR Consortium (UNAVCO)	USA
University of Alaska — Geophysical Institute	USA
University of Colorado at Boulder	USA
University of Hawaii — School of Ocean and Earth Science and Technology, Pacific GPS Facility	USA
University of Nevada, Reno	USA
University of Texas, McDonald Observatory	USA
Ulugh Beg Astronomical Institute of the Uzbekistan Academy of Sciences	Uzbekistan
Marine Hydrometeorological Center	Vietnam

The IGS Strategic Plan 2002–2007 was developed by the Governing Board and officially approved in December 2001.

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International GPS Service

International Association of Geodesy

International Union of Geodesy and Geophysics

Federation of Astronomical and Geophysical Data Services

National Aeronautics and Space Administration

Jet Propulsion Laboratory
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