

International GNSS Service

2021+ **Strategic Plan**

SCTB00ATA- IGS station, operated by GNS Science Te Pu Ao on behalf of Toitū Te Whenua Land Information New Zealand and New Zealand Earthquake Commission as part of the GeoNet programme
Scott Base (Antarctica)
Photo Courtesy of P. Gentle (LINZ)

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IGS INTERNATIONAL
GNSS SERVICE

The International GNSS Service (IGS) ensures open access, high-quality GNSS data products that enable access to the definitive global reference frame for scientific, educational, and commercial applications.

The IGS is a service of Global Geodetic Observing System International Association of Geodesy International Union of Geodesy and Geophysics

IGS is a Network Member of International Council for Science - World Data System

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Table of Contents

2	Acknowledgements
4	Mission, Vision, Values
5	Executive Summary
6	IGS at a Glance
8	Strategic Plan Development + Process
10	IGS Strategy for 2021 & Beyond
12	Goals & Objectives
26	Implementation
27	Looking Forward



Vision

A better understanding of the Earth through the application of GNSS

Mission

The International GNSS Service provides, on an openly available basis, the highest-quality GNSS data, products and services in support of the terrestrial reference frame, Earth observation and research; positioning, navigation and timing; and other applications that benefit science and society.

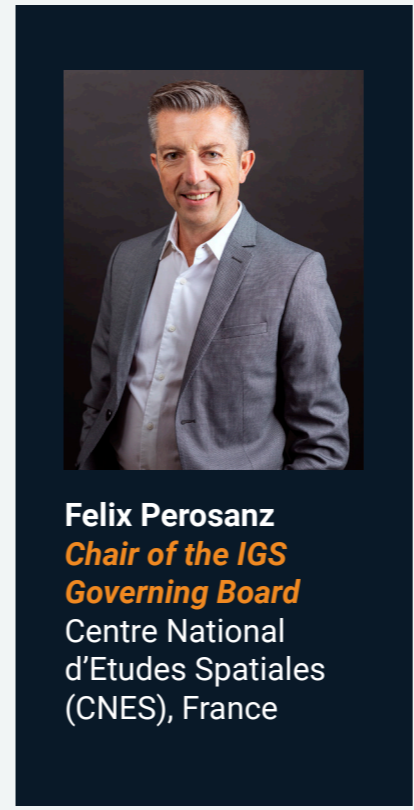
Organizational Values

Fundamental to the IGS are key values that are shared across the organization, these are:

- Advocacy of an open data policy, with data and products openly available,
- Welcome contributions from and participation with all organizations,
- Effective reliability through the redundancy of IGS components,
- Technical evolution through “friendly competition”,
- Dedicated engagement with policy entities to raise mutual awareness of IGS and geodesy in general.

BAKE00CAN
Baker Lake, Canada
Photo Courtesy of CDDIS

Message from the IGS Governing Board Chair



Felix Perosanz
Chair of the IGS Governing Board
Centre National d'Etudes Spatiales (CNES), France

Dear IGS Community Members,

For over twenty-five years, the International GNSS Service (IGS, where GNSS stands for Global Navigation Satellite Systems) has carried out its mission to advocate for and provide freely and openly available high-precision GNSS data and products. In 2020, despite a global pandemic and interruptions on our life and work schedules, the IGS continued to sustain our community's needs. While delivery of the IGS reference frame, orbit, clock and atmospheric products continues to drive the core activities, the IGS transformation to a multi-GNSS service is of highest priority, and is reflected both directly and indirectly throughout the 2021+ Strategic Plan.

The IGS continues to coordinate a collaborative research infrastructure and provide operations at the global scale, operating as a service of the International Association of Geodesy (IAG), and a contributor to the Global Geodetic Observing System (GGOS). Accordingly, the IGS is also represented in IAG and GGOS governance, bureaus, commissions and working groups, ensuring the IGS retains its strong level of international significance and sustainability. A number of IGS community leaders also participate in the United Nations Global Geospatial Information Management (UN GGIM) efforts on Geodesy, which aims to enhance the sustainability of the global geodetic reference frame and infrastructure through intergovernmental advocacy for geodesy.

This plan was developed by the IGS Governing Board with the help and support of the Central Bureau, and guided by extensive community feedback and discussions. It presents a forward-looking strategy addressing the role of IGS as facilitator, incubator, coordinator, and advocate working towards three major goals in service to our community and beyond. The plan focuses on how the IGS maintains and enhances its leadership role within the broader GNSS community as societal demands for GNSS products and services continues to grow. Central to the goals and objectives are the complementary roles of the IGS as a collaborative research program, as well as an operational service. The plan seeks to maintain appropriate balance of the two roles to ensure ongoing support from associate members and collaborating organizations.

The IGS 2021+ Strategic Plan has been balanced to address both internal and external factors driving IGS organizational growth towards multi-GNSS technical excellence. Looking forward, implementation of this plan will include ensuring sustainable and resilient contributions to the IGS community and its work, as it is the breadth and number of contributors to the IGS as well as their high levels of commitment that have ensured the high level of performance and reliability of product generation and delivery thus far. The plan continues in the spirit of previous strategic plans in that it is intended to guide our service to the community, and is not intended to be restrictive. It is our hope that the guidance in this plan will ensure the best possible IGS for the ever-growing community of users relying upon its openly available high-quality GNSS data and products.

Felix Perosanz

IGS At A Glance

The International GNSS Service (IGS, where GNSS stands for Global Navigation Satellite Systems) is the world's largest GNSS organization, with an over twenty-five years of history of advocating for and providing freely and openly available high-precision GNSS data and products. The IGS consists of over 300 Associate Members (AM), representing over 45 countries and over 200 contributing organizations.

As of early 2021, the IGS consists of over 300 Associate Members, representing over 45 countries. The 36-member IGS Governing Board guides the coordination of over 142 contributing organizations participating within IGS, including 108 operators of GNSS network tracking stations, 6 global Data Centers, 13 Analysis Centers, and 4 product coordinators, 21 Associate Analysis Centers, 23 regional/project Data Centers, 14 technical Working Groups, two active pilot projects (i.e., Multi-GNSS and Real-time), and the Central Bureau.

IGS is a voluntary federation of self-funded agencies, universities, and research institutions all over the world, working together to provide the highest precision GNSS satellite orbits in the world. Access to very high precision products is provided freely and openly for scientific advancement and public benefit. IGS data and analysis products support a wide variety of applications that touch millions of users in virtually all segments of the global economy.

IGS products support access to and realization of the International Terrestrial Reference Frame, providing support for geodetic research and scholarly applications. Furthermore, IGS Working Groups and Pilot Projects work for the continuous development of new and improved applications and products. As a technical service of the International Association of Geodesy, IGS functions as a component of the IAG Global Geodetic Observing System (GGOS) and a network member of the International Science Council's World Data System.

1,428 IGS MAIL SUBSCRIBERS 

500+ Worldwide Reference Stations in over **100** countries 

300+ Associate Members  | **142** Contributing Organizations 

Providing Data & Products from over **145** Satellites in **4** Global  & **2** Regional  Constellations 

108  Agencies operating GNSS Network Tracking Stations

23  Regional/Project Data Centers |  **21** Associate Analysis Centers

14 Technical Working Groups  | **13** Analysis Centers

 **11 TB (135 million files)** over the last 5 years |  **6** Global Data Centers

DUNDOONZ- IGS station, operated by GNS Science Te Pu Ao on behalf of Toitū Te Whenua Land Information New Zealand and New Zealand Earthquake Commission as part of the GeoNet programme
Dunedin (New Zealand)
Photo Courtesy of Paul Aichholze

Strategic Plan Development Process

The IGS Governing Board and Associate Members participated in a comprehensive, thoughtful, and transformative strategic planning process facilitated by the IGS Central Bureau.

The strategic plan, covering the period 2021 and beyond, was created over a two-year period. The following activities took place in an over-arching and multi-modal community engagement and plan development process:

- Convening a Strategic Planning Task Force working session to co-plan and oversee the planning process
- Series of dedicated Central Bureau working sessions
- Open meetings at various conferences with Associate Members and stakeholders
- Facilitated dedicated workshop with Governing Board Members to address key issues faced by the IGS, the GNSS community, the membership, and considered history, current environment, and future opportunities in developing the future direction
- Research, analysis, and updating of our understanding of economic, social, and cultural external environmental changes
- Creation of a Vision 2021+ document to serve as a launching pad
- Development of an environmental scan and analysis of strengths, weaknesses, opportunities, and threats
- Online membership survey with nearly 100 completed surveys
- Review of internal organizational documents, including the 2017 Strategic Plan, organizational structure information, conference materials, and other organizational materials
- Development of a framework of organizational goals, strategies, and recommendations
- Preparation of an implementation plan for the strategic plan
- Board review, approval, and adoption of the full strategic plan

Serving the global community with 3 strategic priorities

As scientific and other GNSS applications proliferate, the work of the IGS and its constituent elements continues to increase in relevance. The role of IGS has been elevated as applications that essentially rely on the IGS data and products have greatly expanded both within and outside of the sciences. The IGS Governing Board works in support of continuous

improvement of the IGS suite of data and data products, made possible by the efforts of many dedicated contributors to the IGS. This Strategic Plan, produced with the assistance of the Central Bureau and built upon the feedback of many IGS community members, outlines key points of the IGS goals and the anticipated path to meet its objectives in 2021 and beyond.



GOAL

1

Achieve Multi-GNSS Technical Excellence

Increase organizational capability by identifying barriers to multi-GNSS success throughout the IGS, supporting solutions to key challenges, and reinforcing the importance of continuous technical evolution.



GOAL

2

Strengthen Outreach and Engagement

Advocate for open access geodetic and GNSS data and products that facilitate collaborations, standardization, and inclusivity.



GOAL

3

Build Sustainability and Resilience

Foster a resilient, sustainable, and effective organization to support an expanding and evolving IGS community.

IGS 2021+ Strategic Plan Matrix

		 Facilitation	 Coordination	 Incubation	 Advocacy
GOAL 1	 Multi-GNSS Technical Excellence	Identify impediments to multi-GNSS in each working group and infrastructural component, and facilitate solutions to these blockages	Coordinating (and tracking progress) the various multi-GNSS contributions (achievements) across all Working Groups and Infrastructural components	Identify and incubate aspects of IGS component work that are in need of special attention to make a strong step toward multi-GNSS	Advocate the benefit and critical need of Multi-GNSS through case studies, leadership, and demonstration
GOAL 2	 Outreach and Engagement	Facilitating collaborations with stakeholder organizations and groups to diversify and increase participation of IGS users and contributors	Coordinating outreach to relevant agencies & institutions, to attract and promote IGS scientific and user applications	Incubating the next generation of IGS community members through Inclusion campaigns targeted at organizations and early-career scientists	Advocating for standardization and interoperability essential to organizational sustainability and user community engagement
GOAL 3	 Sustainability and Resilience	Facilitating integration and evolution as both a collaborative research program and operational service	Coordinating technological and geographical infrastructural innovation and diversity	Incubating organizational sustainability and resilience through personnel redundancy and modularity	Advocating for open access geodetic and multi-GNSS data, products, and metadata via alignments with major United Nations frameworks and national/regional agendas




GOAL 1

Achieve Multi-GNSS Technical Excellence

Increase organizational capability by identifying barriers to multi-GNSS success throughout the IGS, supporting solutions to key challenges, and reinforcing the importance of continuous technical evolution.

Goal 1 aims for IGS to become the premier source for high-quality multi-GNSS data, products, standards, and expertise in the world, with these resources made openly available to all user communities. The IGS will continue to support the current core scientific user's needs to build and sustain a viable global multi-GNSS infrastructure and to reliably produce high-quality benchmarked products to advance knowledge and use of Earth systems and observations. Concurrently, the IGS will strive to work with emerging users who have the potential to shape the future direction of the IGS.

The evolution of products to include all GNSS constellations is an ongoing challenge for the IGS. Product enhancements often trigger discussions around the purpose and scope of the IGS, resulting in a review of data and product release policies. At the time of this writing, a review of the policies as they relate to real time multi-GNSS combined products is underway, in anticipation of such a product.



MAS100ESP
Gran Canaria, Spain
Photo Courtesy of ESA/ESOC



Objective 1.1 – Identify impediments to multi-GNSS in each working group and infrastructural component, and facilitate solutions to these blockages being available in the future.

The IGS recognizes that to meet ongoing changes and challenges associated with Earth-observing activities, it must offer a high-quality service, and enhance service performance and capabilities whenever possible. To accomplish this, the IGS strives to maintain all components to the highest levels of quality and accuracy; advocates for multi-GNSS compatible improvements in IGS infrastructure, network and analysis; and continues to monitor and improve site-related data quality.

IGS components will conduct self-assessments to determine what impedes progress toward multi-GNSS capabilities in their work, and report these issues to the Governing Board for intervention and action.



Objective 1.2 – Coordinate and monitor progress of the various multi-GNSS contributions and achievements across all working groups and Infrastructural components

The IGS must continue to optimize its use of multi-GNSS technology to increase service performance. New resources must be regularly developed to reflect the changing needs of IGS product users, and existing resources must evolve to keep pace with demand. For broadest impact, it is essential for all available GNSS signals to be integrated within the IGS portfolio of data and products.

With the ever-evolving nature of multi-GNSS technological and application developments, coordination of efforts across IGS technical working groups, as well as infrastructural components such as analysis centers and data centers, will be essential. Monitoring of each component's progress toward multi-GNSS excellence will be documented in the IGS Annual Technical Report and presented at year-end Governing Board meetings.



Objective 1.3 – Identify and incubate aspects of IGS component work that are in need of special attention in order to make a strong step toward multi-GNSS

The IGS is a strong, collaborative community that must continue to enable the resolution of technological or capacity weaknesses. By conducting a gap analysis and needs assessment within each component, areas of multi-GNSS capability in need of special attention will be identified, reported to the Governing Board for intervention, and supported by sessions at community workshops and other events. Those aspects of the multi-GNSS capability in need of greatest attention will be prioritized and incubated across the IGS scope of work.



Objective 1.4 – Advocate the benefit and critical need of multi-GNSS through case studies, leadership, and demonstration.

By participating on the United Nations Committee of Experts on Global Geospatial Information Management Subcommittee on Geodesy, the IGS is a key advocate of policy for countries around the world to cooperate in extending the Global Geodetic Reference Frame as a basis for mapping and geodetic measurement.

The IGS is also active through its role as an IAG service with the United Nations International Committee on GNSS, which coordinates among multiple GNSS providers on important policy matters relating to interoperability and performance of the various global navigation satellite systems. The IGS is a key committee member that advises ICG on scientific and policy matters. These and other efforts benefit from the broad advocacy efforts in which the IGS participates.



GOAL 2

Strengthen Outreach and Engagement

Advocate for open access geodetic and GNSS data and products that facilitate collaborations, standardization, and inclusivity.

In order to support the advancement of knowledge and innovations derived from Earth observations, the IGS advocates for openly available GNSS data and products. This enables innovative and cost-effective research projects, as well as a variety of other applications to be undertaken. Significant societal benefit arises from the IGS products, and subsequently these benefits will be communicated to a wide variety of potential users, especially those in regions currently under-represented in IGS components and governance.

Goal 2 is supported by objectives that seek to maintain or increase diverse personnel expertise to influence GNSS policy and to advocate the value and impact of open access GNSS data and products. It encourages the IGS to engage, communicate and educate where it can positively influence the open access of GNSS and geodetic data products. It supports the development of complementary communications, education, and outreach to organizations whose principles and interests may be aligned with those of IGS in promoting open data for public benefit.



Attendees at East Lake (Donghu) International Conference Center for the 2018 IGS Workshop in Wuhan, China
Photo Courtesy of Wuhan University



Objective 2.1 – Facilitate collaborations with stakeholder organizations and groups to diversify and increase participation of IGS users and contributors

The IGS recognizes that global access to expertise and trustworthy data is vital to the success of the organization. Maintaining organizational connections to global expertise and other resources requires a deliberate, long term objective that the IGS must continue to pursue. A multi-channel approach will be maintained by IGS to connect and engage the IGS community with leading experts, and expert organizations, in disciplines that are stakeholders to the IGS. The outcome of this objective will be a comprehensive network of expertise to enable the success of the IGS community as well as geodesy in general.



Objective 2.2 – Coordinate outreach to relevant agencies and institutions, in order to attract and promote IGS scientific and user applications

The efficient and ongoing integration of IGS products and services into existing global Earth-observing and navigation systems is of great mutual importance to the IGS and its diverse pool of collaborators.

Actively seeking out new avenues for engagement and cooperation with Earth scientific organizations will broaden the IGS user community, and ultimately produce a finely networked web of product and organizational integration within and around the IGS. This will ensure the optimal use of organizational and technological resources, and broaden the general user community while integrating it internally.

The IGS will continue to participate in GGOS. Noting the important connection to GNSS applications in land surveying, IGS will maintain a relationship with the International Federation of Surveyors. Through IAG and GGOS, IGS will participate in relevant activities of the Group on Earth Observations (GEO) as well as the committee on Earth Observation Satellites (CEOS). As part of its obligation as a service of the IAG, the IGS will continue to participate in relevant United Nations committees, such as the Committee of Experts on Global Geospatial Information Management and the International Committee on GNSS (ICG). By working with these organizations, the IGS seeks to build a broader global awareness and participation with nations and regions not currently active within the Service.



Objective 2.3 – Incubate the next generation of IGS community members through Inclusion campaigns targeted at organizations and early-career scientists

Leveraging on its network of experts, the IGS will continue to engage as a community through a number of channels. Principally, the IGS workshops, held biannually in locations around the world, are a principal avenue for connecting the entire IGS community of participants, users and stakeholders.

Technical workshops involving subject matter experts addressing highly specialized topics are held more frequently, as are interactions within the IGS working groups, committees, and projects. To promote awareness, inclusion, and transparency within IGS, the IGS Governing Board, Associate Members and other interested parties engage in an annual open meeting, which was successfully initiated in 2016.

The IGS will also expand its engagement to reach an even broader audience through virtual meetings and workshops. The IGS community of experts will be encouraged to contribute knowledge and information, which will be publicly available on the IGS website. Similar avenues for interaction will be introduced at IGS Workshops, including clinics for the latest technology, special plenary presentations, and other designated events for discussion and education across areas of interest.



Objective 2.4 – Advocate for standardization and interoperability essential to organizational sustainability and user community engagement

The IGS will promote standards to encourage open availability of multi-GNSS data and products for societal benefit. It will support the principal organizations involved with GNSS standards to positively influence the development of relevant standards. The IGS will advocate for open access to data and products complying to these standards. In this regard, a key and unique attribute of IGS as a self-supported federation is its impartiality and independence of financial influence in developing its products and promoting open standards. Such standards will serve to propagate availability of open GNSS data and products to maximize their benefits and impacts.



2016 IGS Workshop Poster Session
Photo Courtesy of IGS Central Bureau



2017 IGS Workshop participants
Photo Courtesy of IGN/Xavier Della Chiesa

WGTN00NZL- IGS station, operated by GNS Science Te Pu Ao on behalf of Toitū Te Whenua Land Information New Zealand and New Zealand Earthquake Commission as part of the GeoNet programme
Wellington (New Zealand)
Photo Courtesy of Brendon Glendinning



GOAL 3

Build Sustainability and Resilience

Foster a resilient, sustainable, and effective organization to support an expanding and evolving IGS community.

Goal 3 calls for IGS to vigilantly maintain effective organizational resilience and sustainability. Objectives relate to strengthening governance and related practices, as well as strengthening and

developing diverse contributions to the IGS. The desired outcome is a well-managed and supported organization with a diverse user base, and a well-defined vision and means for the future.



Objective 3.1 - Facilitate integration and evolution as both a collaborative research program and operational service

As the IGS matures, it takes on two critical tasks in service to the community; fostering collaboration and advances in GNSS research, as well as providing an essential foundation for scientific innovations via a high-quality operational GNSS data and product service. In order to achieve the organizational vision of “a better understanding of the Earth through the application of GNSS” the IGS must continue to ensure support for operations and research, as they are inextricably linked.



Objective 3.2 – Coordinate innovation and diversity in technological and geographical infrastructure

This objective seeks to support the IGS self-funded participant model, as well as to increase contributions to IGS through diverse sources. By helping the IGS participants to succinctly articulate the IGS value proposition, the IGS may positively impact participant funding over the long term. Sponsors must be convinced that by supporting the IGS, their investments are leveraged multifold by the benefits of IGS participation. Growth may be realized as new opportunities are pursued that may lead to more diverse participation within IGS.

By developing a better understanding of its users and impacts, the IGS can help its participants justify their involvement, and hence funding for IGS. The overall output of this objective will be a stable organization of diverse participants who are stably funded over the long term to support IGS activities.



Objective 3.3 - Incubating organizational sustainability and resilience through personnel redundancy and modularity

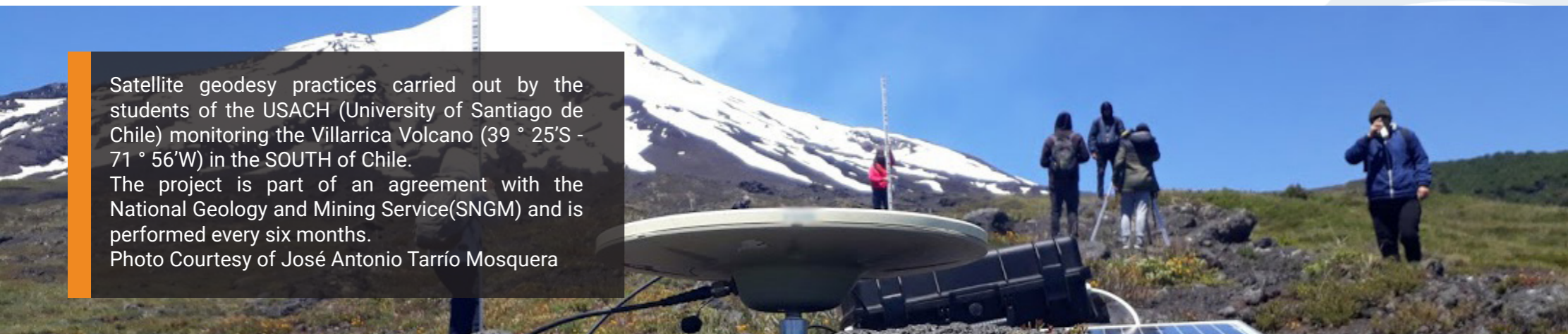
Above all else, it is the IGS community members – its people – who ensure the organization and its mission are successful. In order to ensure the long-term sustainability and success, as well as to facilitate additional diversity in participation, a practice of personnel redundancy will be put into action. All component leadership roles will be supported by an understudy, so that component leaders are able to better allocate their time, and to ensure that organizational knowledge is shared and passed on in the best possible manner.



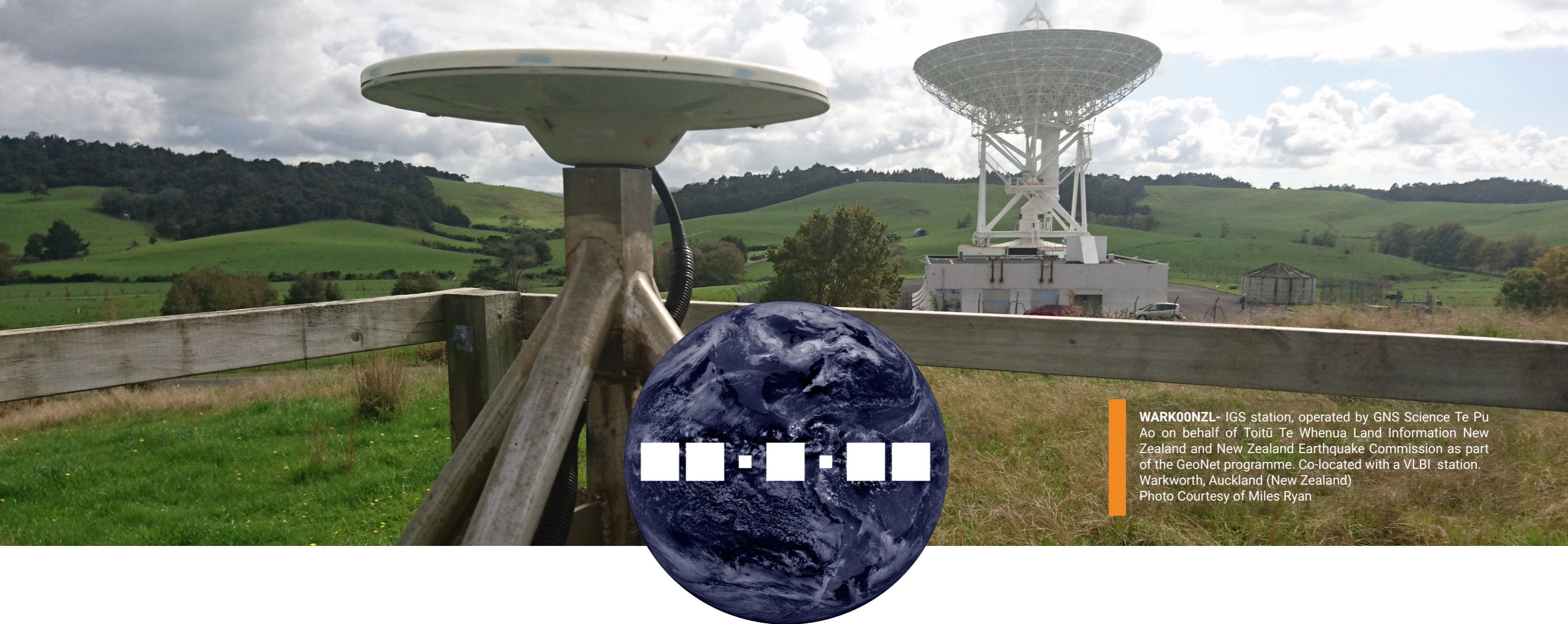
Objective 3.4 - Advocate for open access geodetic and multi-GNSS data, products, and metadata via alignments with major United Nations frameworks and national/regional agendas

The IGS, as a technical service of the IAG, will be a strong supporter of the implementation of the United Nations Global Geodetic Reference Frame as the basis upon which all spatial data and positioning activities should be founded. IGS will work with the International Federation of Surveyors and IAG to encourage open sharing of geodetic data and information that contributes to the implementation of global, regional, and national reference frames, as well as the inter-relationships among these frames. Through participation in the UN GGIM Subcommittee on Geodesy, IGS will support advocacy for guidelines and standards to advance the interoperability of geodetic reference systems and data.

Major United Nations frameworks, including the Sustainable Development Goals (SDGs), Sendai Framework for Disaster Risk Reduction, UN Framework Convention on Climate Change, and the UN GGIM-World Bank Integrated Geospatial Information Framework, serve as key advocacy and communications tools for all geospatial information applications. IGS will work with the UN GGIM Subcommittee on Geodesy and UN International Committee on GNSS (ICG) to identify linkages to the aforementioned frameworks and encourage existing and emerging applications of GNSS that contribute to global sustainability and disaster risk reduction.



Satellite geodesy practices carried out by the students of the USACH (University of Santiago de Chile) monitoring the Villarrica Volcano (39 ° 25'S - 71 ° 56'W) in the SOUTH of Chile. The project is part of an agreement with the National Geology and Mining Service(SNGM) and is performed every six months. Photo Courtesy of José Antonio Tarrío Mosquera



WARKOONZL- IGS station, operated by GNS Science Te Pu Ao on behalf of Toitū Te Whenua Land Information New Zealand and New Zealand Earthquake Commission as part of the GeoNet programme. Co-located with a VLBI station. Warkworth, Auckland (New Zealand)
Photo Courtesy of Miles Ryan

Implementation

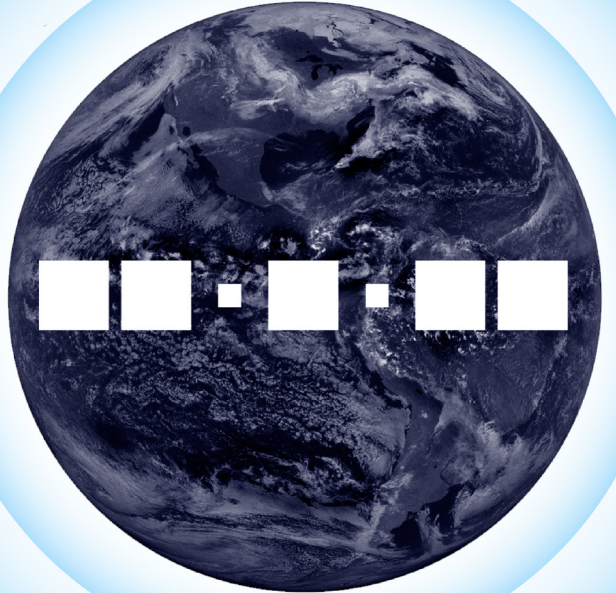
The IGS is developing a strategic implementation action plan in support of the Goals and Objectives stated above. This action plan will start with each component identifying achievable year 1 and 2 goals. Progress will be monitored by the Governing Board and recorded in the Annual Technical Report, where efforts

within each IGS component, as well as the organization overall, will be presented within the framework of the strategic plan. While implementation is an iterative and evolving process, the goals will serve as the key focal point for all IGS work moving forward.

Looking Forward

This Strategic Plan provides a clear direction for advancing IGS in 2021 and beyond. The IGS will remain committed to providing its world standard products to diverse users working on innovative applications. The IGS will continue to build a sustainable organization that pushes the

limits of technology to improve the overall effectiveness of the organization. We envision that, guided by this plan, IGS will emerge and continue to be an organization that is well positioned to take on its next set of challenges in the years ahead.



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