International Fédération of Surveyors
Fédération Internationale des Géomètres
Internationale Vereinigung der Vermessungsingenieure

Asia Pacific Capacity Development Network

Report
Applications of Global Navigation Satellite Systems Workshop
Suva - Fiji, 24-28 June 2019

FIG Asia Pacific Capacity Development Network (AP CDN) and Commission 5 – Position and Measurement members, along with representatives from sister organisations, such as the UN GGIM for Asia and the Pacific (UN-GGIM-AP) Working Group 1 Geodetic Reference Frames, UN Sub-Committee on Geodesy Education Training Capcity Building (SCoG ETCB), and the International GNSS Service (IGS) actively participated in the "Workshop on the Applications of Global Navigation Satellite Systems" held in Suva, Fiji, 24-28 June 2019. This event was organized by the University of the South Pacific (USP) and co-sponsored by the United Nations Office for Outer Space Affairs (UN OOSA) and the International Committee on Global Navigation Satellite Systems (ICG).

Over 100 delegates from 26 countries attended the workshop that utilized various buildings and facilities within the USP campus. There were over 60 presentations covering the topics of –

- Status and future trends of GNSS systems
- GNSS based applications
- Case studies or projects from national agencies on GNSS applications
- GNSS spectrum protection, interference detection and mitigation
- Geodetic reference networks
- Sustainability and modernisation of GNSS CORS and geospatial infrastructure though capacity development
- Standards and interoperability of precise point positioning services
- Capacity building and international / national experiences in the use and implementation of GNSS technologies

To review and download the presentations please refer to the UN OOSA ICG website – http://www.unoosa.org/oosa/en/ourwork/psa/schedule/2019/2019-workshop-on-global-navigation-satellite-systems_-presentations.html

There were many highlight presentations and key messages pertinent to the various work-plans of FIG Commissions and Networks. The main points to note were -

- The GNSS modernisation program is ongoing, despite the economic and political challenges being faced by most operators of systems such as GPS, GLONASS, Galileo, QZSS, and BeiDou.

- It was evident that maintenance on existing GNSS infrastructure and enhancement programs for the next generation GNSS systems to broadcast multi GNSS signals and improving their integrity is prevalent.
- Likewise, research and development into this area, is being driven by the increasing mass market need for accurate and reliable real time positioning via portable or mobile devices.
- The GNSS related activity in applications, geoscience and industry that is currently influencing organisational policy and resource investment are - satellite based augmented systems (SBAS), precise point positioning (PPP) performance, safety of life, emergency warning systems, building disaster resilience, asset / infrastructure/ environmental management, collection and analysis of geospatial information imagery and remote sensing techniques, and geospatial / geodetic infrastructure and systems
- Governments and providers of positioning services must engage with their national spectrum regulators and the International Communication Union (ITU) to ensure "users and stakeholders" understand the issues and importance of GNSS signal protection; its vulnerabilities; impact and detection of GNSS interference; and methods to protect GNSS signals and mitigate the impact from interference.
- Low cost GNSS positioning devices are now becoming a realistic option for users and for organisations who are searching for cost effective technology to geo-reference information and / or to implement a "fit purpose" approach to defining land tenure for good land administration and governance.

Note, the ICG will release a statement on the workshop, which will contain a summary, conclusions and determinations for further action. This ICG statement will soon be available at the website location - http://www.unoosa.org/oosa/en/ourwork/psa/gnss/workshops.html .

From an Asia Pacific Capacity Development Network perspective this workshop provided several opportunities to further its' work plan in the Pacific with respect to -

(a) actions as outlined in the "Resolution - Operational Aspects of GNSS CORS - Reference Frame in Practice Seminar" that was prepared by participants in Suva, Fiji, last September 2018. To review this resolution please refer to website – http://www.fig.net/news/news_2018/09_rfip_fiji/resolution.pdf
(b) Provision of advice on the importance of strategic and operational planning to develop geodetic and geospatial capabilities
(c) Advocating the role and value of geodetic and geospatial information to resolving and managing the impacts of climate change / sea level rise; and natural disasters such as cyclones, earthquakes and tsunamis.
(d) Promoting that collaboration is the key to sustainable development.

To achieve the above the FIG AP CDN convened two sessions, focusing on the why, how and what of organisational planning for the development of GNSS CORS infrastructure capability and geodetic datum modernisation. A summary of the sessions is as follows -

- An overview of Geodesy, its applications, and how it can influence and impact the social and economic objectives of a nation were presented by John Dawson of Geoscience Australia, representing the UN-GGIM-AP regional group. Highlights included the new Australian SBAS, Data Cube, Australia's National Positioning Infrastructure initiative, and Australian leadership in regional and UN entities.
- An introduction to GNSS-stakeholder international and multilateral cooperative organizations, as well as tools for capacity development funding, communications and linkages to United Nations initiatives – such as the Integrated Geospatial Information Framework, Sendai Disaster Management Framework and the Global Geodetic Reference Frame was presented by Allison Craddock of the NASA Jet Propulsion Laboratory, representing the IGS and the UN SCoG ETCB.
- An overview of the United Nations Capacity Development program, FIG AP CDN perspectives on capacity building planning, and discussions in support of strategic regional capacity building in the Pacific, including proposed solutions and paths forward, were presented by Rob Sarib, Chair FIG AP CDN.
- A regional case study of the development, implementation, and activities of the Pacific Geospatial Surveying Council's regional strategy "Position the Pacific for the Future" was presented by Andrick Lal (Fiji) representing, Pacific Geospatial Surveying Council (PGSC) and the Pacific Community.
- Case studies of national or country based capacity development planning and progress with respect to modernizing their geodetic datum and the establishment of GNSS CORS, as well as identifying gaps to success and areas of critical need, were presented by Sosefo Kaitapu (Tonga) and Sanjesh Kumar (Fiji).

From L to R – Sanjesh, Andrick, Rob, Sharafat, Allison, John, Viliami, and Sosefo.

- Following the presentations, moderators Allison Craddock, John Dawson, and Rob Sarib led discussions and engaged the participants on the key challenges / issues presented and prompted for key initiatives and actions to move capacity development in this region forward. As a consequence, the outcomes of this dialogue included:

- There is a need for a regional framework to develop and ratify standards and practices (procedures) for surveying and mapping in the Pacific Island Countries Territories (PICTs).
    - FIG AP CDN recommend - PGSC and Pacific Community investigate and commence consultation with PICTs.
- There is an immediate need for documented standards and practices that are "fit for purpose", including consolidated "checklists" that will serve to ensure consistent and sustainable use of GNSS, and related activities in the region.
    - FIG AP CDN recommend – PGSC on behalf of the PICTs request assistance from "development partners" to use their relevant standards and practices.
- It was noted that Australian and New Zealand surveying and mapping agency documentation (through the Intergovernmental Committee on Surveying and Mapping – ICSM) are available as foundations for the development of standards and practices for the PICTs
    - FIG AP CDN recommend – PGSC (with assistance from the Pacific Community) on behalf of the PICTs request assistance from ICSM to use their relevant standards and practices.
- A request for assistance to develop and prepare relevant legislation and polices with respect to GNSS, remote sensing and other measuring devices (DRONES / UAVs, tide gauges, LiDAR etc.) for the measurement and monitoring of sea level rise.
    - FIG AP CDN recommend – PGSC (with assistance from the Pacific Community) on behalf of the PICTs request assistance from "development partners" to convene a workshop on this matter
- Implementation plans developed by PICTs should be based on a "shared template" that highlights interoperability and applicability to key UN initiatives, including the joint UN GGIM - World Bank IGIF, as well as Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction. Furthermore the focus should be on regional issues such as sea level rise due to climate change, and disaster resilience management – before, during and after.
    - FIG AP CDN recommend – PGSC (with assistance from the Pacific Community) on behalf of the PICTs request assistance from "development partners" to convene a workshop on this matter
- It was noted that several PICTs which have developed both strategic and operational and implementation plans are willing to share such documents for the development of a template
    - FIG AP CDN recommend – PGSC (with assistance from the Pacific Community) contact the relevant PICTs who are willing to share documentation and provide a suitable accessible mechanism
- A communication framework for sharing of training opportunities should be developed, enabling economically efficient use of in-person training provided by industry and academia.
- A framework for sharing resources is needed, in order to ensure discoverability and interoperability. This would also serve as a collection point for community and PICTs

contributions, so that multiple entities may contribute elements as soon as available/possible and then facilitate a combined document.
    - With respect to last two points, FIG AP CDN recommend - PGSC and Pacific Community investigate and commence consultation with PICTs on how this should be managed.
- More engagement with the private (commercial) sector, especially for training and data processing, is encouraged.
    - FIG AP CDN recommend – each PICTs need to identify the development partners from the private sector and priority training. This information should be consolidated through the PGSC and Pacific Community to plan and manage implementation.
- PICTs organisations need to identify and prioritize areas of specialized training need with respect to GNSS and geodetic surveying. Furthermore, a centralized source for training and capacity development resources should be established, with these resources appropriately modularized and tagged so as to optimize interoperability, usability, and applicability to current and future needs.
- It was noted that training needs to be appropriate to the available equipment and infrastructure in a particular country or region; it should be appropriately scaled and directed to identify problems and capability levels in a given PICTs.
- When seeking training resources, it will be important to identify the current state of capabilities, as well as articulate needs for accomplishing a justified goal state. Follow-up training for sustainably maintaining core competencies as well as continuing education should also be emphasized.
- Collaboration with existing regional entities, such as the Pacific Meteorological Council, for the purpose of developing guidelines for mentorship and internship programs based on established regional successes was discussed.
    - For the above, see previous FIG AP CDN recommendations on training matters. In short to create a "pool" of shared resources and knowledge, and to avoid duplication it is critical the PICTs utilize a collaborate framework such as the PGSC and Pacific Community.
- It was noted that Tonga expressed the development of geodetic capabilities to unify and establish a vertical reference frame (height system) was priority. This priority was also agreed to by representatives from Fiji, Tuvalu, and Kiribati
    - FIG AP CDN recommend – for immediate action, Tonga and other PICTs to seek advice initially from development partners such as Geoscience Australia, Land Information New Zealand, PGSC and Pacific Community
- It was reinforced that engagement with local educational and academic institutions was critical to developing capacity, in particular the core geodetic competencies. It was further confirmed by participants that the USP, Fiji University the PGSC and other potential stakeholders such as Royal Melbourne Institute of Technology (RMIT) would need to collaborate on future training curricula and opportunities.

- FIG AP CDN recommend – PGSC members Fiji, Tonga, Tuvalu, Kiribati, and Vanuatu, along with Pacific Community representatives, collaborate with the USP and Fiji University to develop relevant curricula and courses.
- FIG AP CDN recommend – PGSC (with assistance from Pacific Community) approach RMIT, University New South Wales, and University of Otago for advice on surveying curricula with respect to core surveying and mapping competencies.

» It was noted by the FIG AP CDN that future workshops in the Pacific will need to be at least 3-5 days, so as to develop the necessary capabilities to implement a practical, incremental and fit for purpose approach to subjects, such as –

- Integration of height systems and establishment of a vertical height datum.
- GNSS fundamentals and principles
- GNSS and reference frames
- GNSS measurement, processing and adjustment of observations for datums
- Transforming data
- Standards and Practices for GNSS measurements, processing and adjustments
- Legislative and policy matters with respect to GNSS and survey practice
- GNSS data management
- Importance and value of geospatial information

FIG's Working Group 5.4 – GNSS from Commission 5 Positioning and Measurement, convened two specialized workshops on PPP services. More specifically these sessions provided presentations that:

- Increased awareness of the system-provided PPP services, the user benefits, and opportunities to support point navigation and timing (PNT) applications in developing countries; and
- Encouraged standardization and interoperability of the system provided PPP services.

The PPP status update presentations were delivered by GNSS and RNSS (Regional Navigation Satellite Systems) providers from Russia (GLONASS), European Union (Galileo), Japan (QZSS), China (BeiDou) and Australia (Aus-SBAS); the IGS, and FIG. Interesting discussions with participants, initiated by Suelynn Choy, ensued each presentation, and as result the following was noted -

- Access to high accuracy positioning service provided by GNSS and RNSS will be an enabler for emerging mass-market high accuracy positioning applications such as in autonomous systems in transportation, construction, agriculture, and Location Based Service (LBS) applications
- PICTs and Small Island Developing States are able to benefit from free and open access to high accuracy positioning services provided via satellites and ground communication.
- There is interest by users in "harmonizing" the "system" provided PPP services, and therefore the topic of standardization and interoperability is worthy of further discussion in ICG and with the user community.

In addition to the workshop, FIG representatives Suelynn Choy, Matt Higgins and Rob Sarib participated in two local geospatial and surveying forums.

The first forum was held at the USP Facility of Science, Technology and Engineering Building, and involved the international speakers of the GNSS workshop, and representatives from USP, Fiji University, Pacific Community, industry leaders and the PGSC. The meeting was moderated by Sharafat Gadimova (UN OOSA) and Sushil Kumar (USP), and the discussions were focused on improving collaboration and co-operation on education and training for GNSS (and geodetic) related activities in the Pacific. After the exchanging of opinions and consideration of options, it was agreed by the local academic institutions and stakeholders that –

(a) More dialogue and engagement amongst stakeholders was necessary so as to establish the fundamental capabilities for an effective GNSS curriculum; and
(b) To re-evaluate the core capabilities of survey / geospatial qualifications needed by industry to meet the challenge of managing climate change and sea level rise.

It was also pleasing to hear that international organisations (both public and commercial), and neighboring academic institutions (non PICTSs) were willing and available to provide assistance to develop the necessary capabilities.

The second forum was convened by the Fiji Institute of Surveyors (FIS) at the Pacific Community Lotus Building in Nabua. The purpose of this forum was to primarily exchange information about the challenges being faced by the modern day land boundary surveyor, and the role of this surveyor in modernising the cadastral and geodetic framework. John Dawson (UN-GGIM-AP / Geoscience Australia) and Rob Sarib delivered presentations on this topic, and ensuing discussions were facilitated by FIS Executive Council members Andrick Lal and Paserio Samisoni. The outcome of these discussions was for FIS members to note the changing role of a cadastral surveyor and to actively participate in professional development that will build the capabilities required to address the future challenges.

In concluding, FIG and partners congratulate the local delegates for their active participation at this workshop, and contributions to related meetings and forums, both formal and informal. FIG and partners thank all presenters and GNSS providers for their cooperation and willingness to share information about their organisations geospatial / geodetic activities, infrastructure, systems and services, such as PPP. FIG and partners also thank the UN OOSA ICG and the USP community for their work and efforts in organizing and hosting this event, in particular Sharafat Gadimova and Sushil Kumar. Finally FIG and partners have appreciated and enjoyed the warm hospitality shown by our Fijian and PICTs friends and colleagues.