



Tonga's Geodetic Infrastructure

Current Status, Infrastructure, and the Plan

Viliami Folau

Geodetic Survey Services

Ministry of Lands and Natural Resources

Tonga

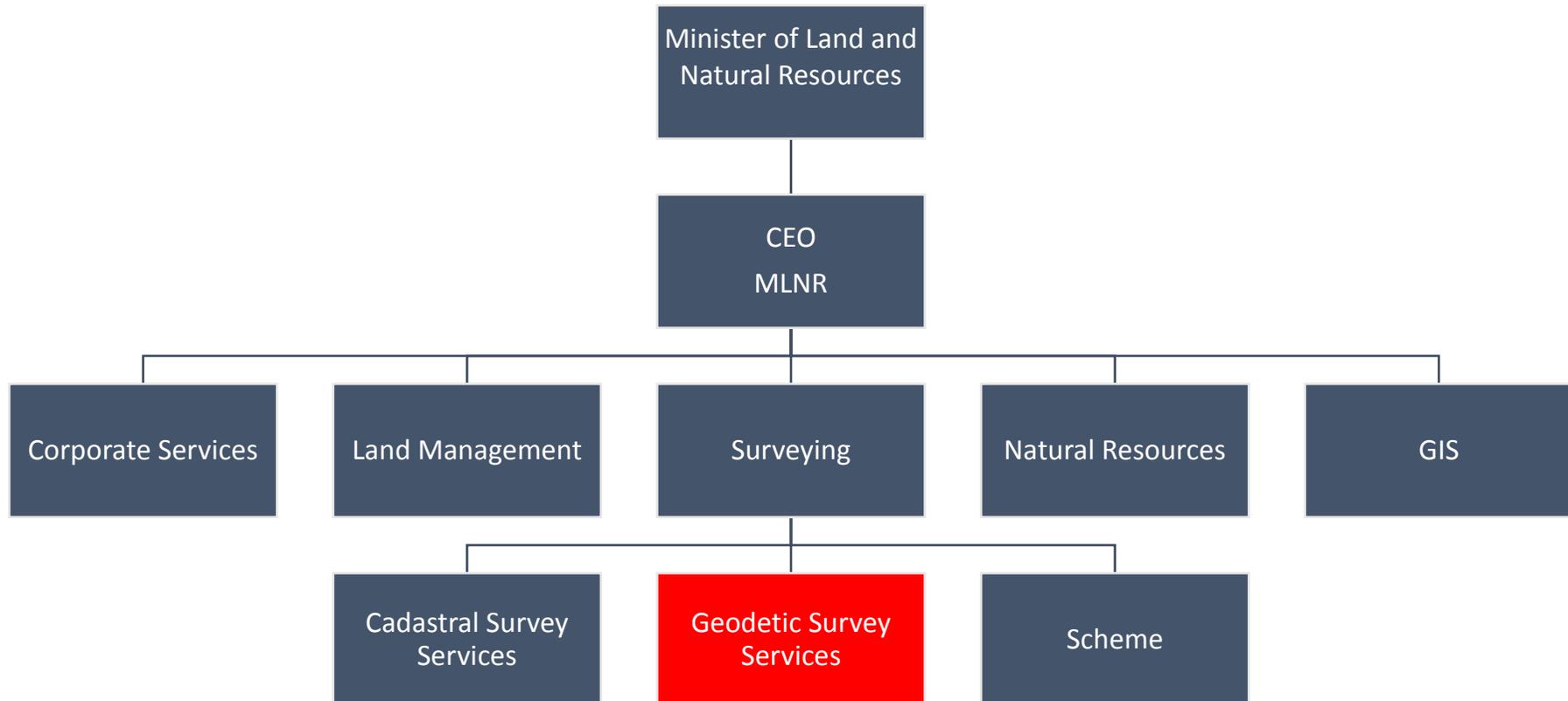
Focus of the Presentation

- Tonga Geodetic Services
- Tonga's Old Datum
- Tonga New Geodetic Datum
- Tonga Map Grid
- Existing Vertical Network
- Pacific Sea Level Monitoring Project
- Sea Level Rise & Natural Disasters
- Issues with a Fully Modernised Geodetic Infrastructure
- Plans
- Conclusion

Kingdom of Tonga



Tonga Geodetic Services



Tonga Cadastral Grid Survey Datum 1957/1961 & Tonga Cadastral Survey Grid 1961

Aim is to determining Primary Control for the Cadastral Survey of the Kingdom of Tonga.

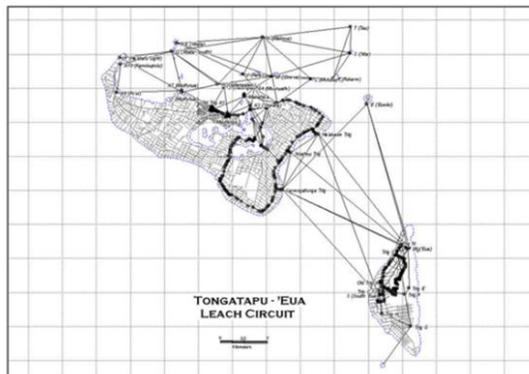
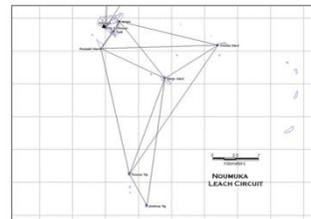
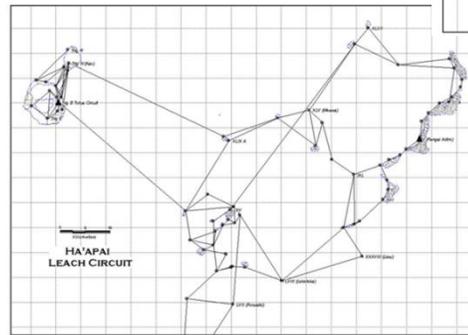
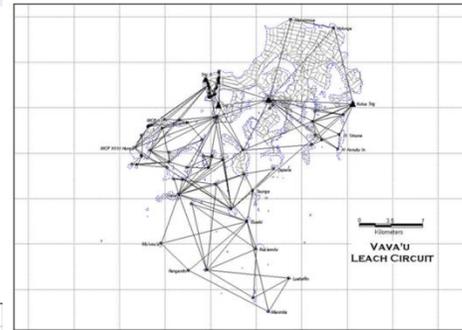
The TCG Control Network is based on Astronomical Observation determined independently at 4 islands groups.

1. Tongatapu-'Eua Circuit 1957 - 1959
2. Nomuka Circuit 1959
3. Vava'u Circuit 1959 - 1960
4. Ha'apai Circuit 1961

This was Done by Leach and Browne, Registered and Chartered Surveyors from New Zealand

“Instructions for the Cadastral Survey of The Kingdom of Tonga”, 1958,
by Leach & Browne, Registered and Chartered Surveyors, Jupiter House,
Milford, Auckland, NZ.

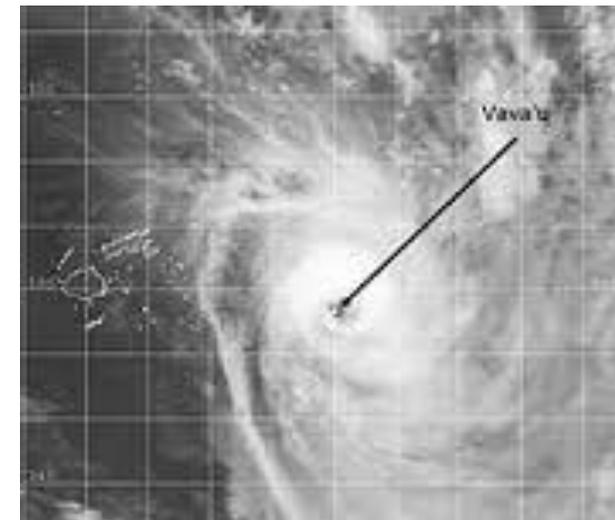
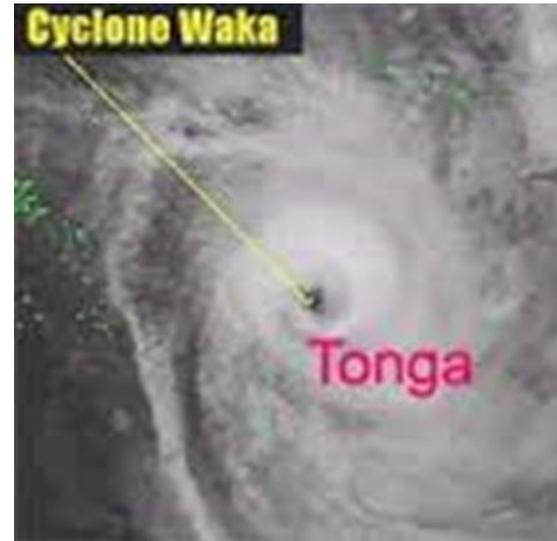
Tonga Cadastral Grid Survey Datum 1957/1961 & Tonga Cadastral Survey Grid 1961



Cyclone Recovery and Emergency Management Project (CREMP)

- **CREMP** was developed after Cyclone Waka visited Tonga in 2001 leaving US\$48 million cost of damages
- One of the project components, Land Hazards and Information Management was established to **improve the land information resources for preparedness and emergency response capability** for the Government of Tonga.
- A new geodetic datum and map projection had to be designed adopting international standards and specifications.

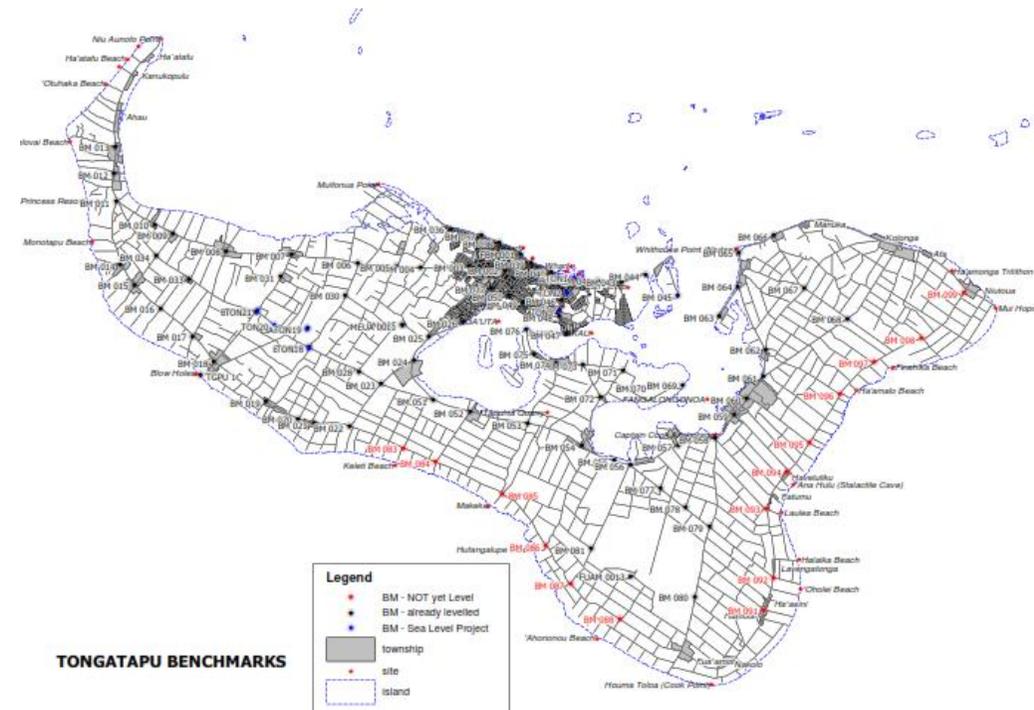
Cyclone Waka



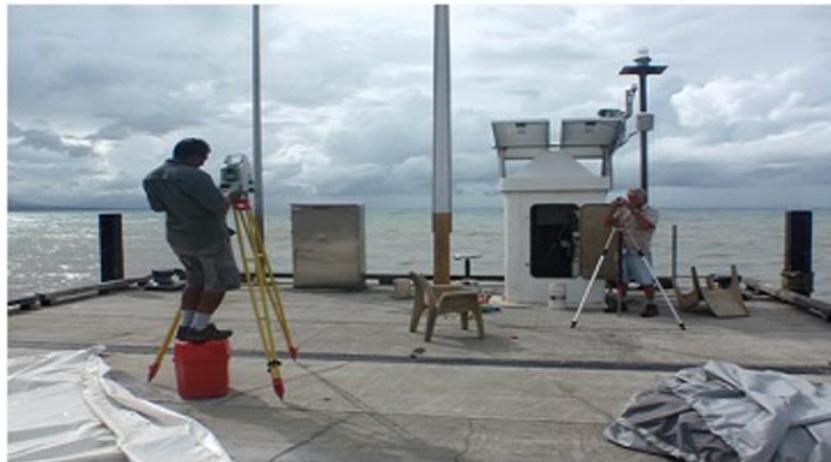
- A new, national geodetic datum has been created called the Tonga Geodetic Datum (TGD2005), based on international geodetic standards.
 - Geocentric origin
 - GRS80 ellipsoid (= WGS84)
 - Static datum based on ITRF2000 as at 1 Jan 2005
- A new , national map projection has been created called the Tonga Map Grid (TMG), based on international mapping standards.
 - Transverse Mercator
 - Reference spheroid = GRS80
 - Meridian of origin = 177W
 - Latitude of origin = The Equator
 - Central meridian scale factor = 0.9996
 - False origin = 1,500,000E 5,000,000N
- New topographical maps and international land boundaries will be based on the Tonga Map Grid

Vertical Network

- MSL 1990
- Only on the main island but not complete
- Pacific Sea Level Monitoring Project, PSLMP-tide gauge and BM precisely levelled every year.
- The rest of the islands-no levelling network
- Need a modern reference frame to cover the whole of Tonga-***especially the most vulnerable islands***



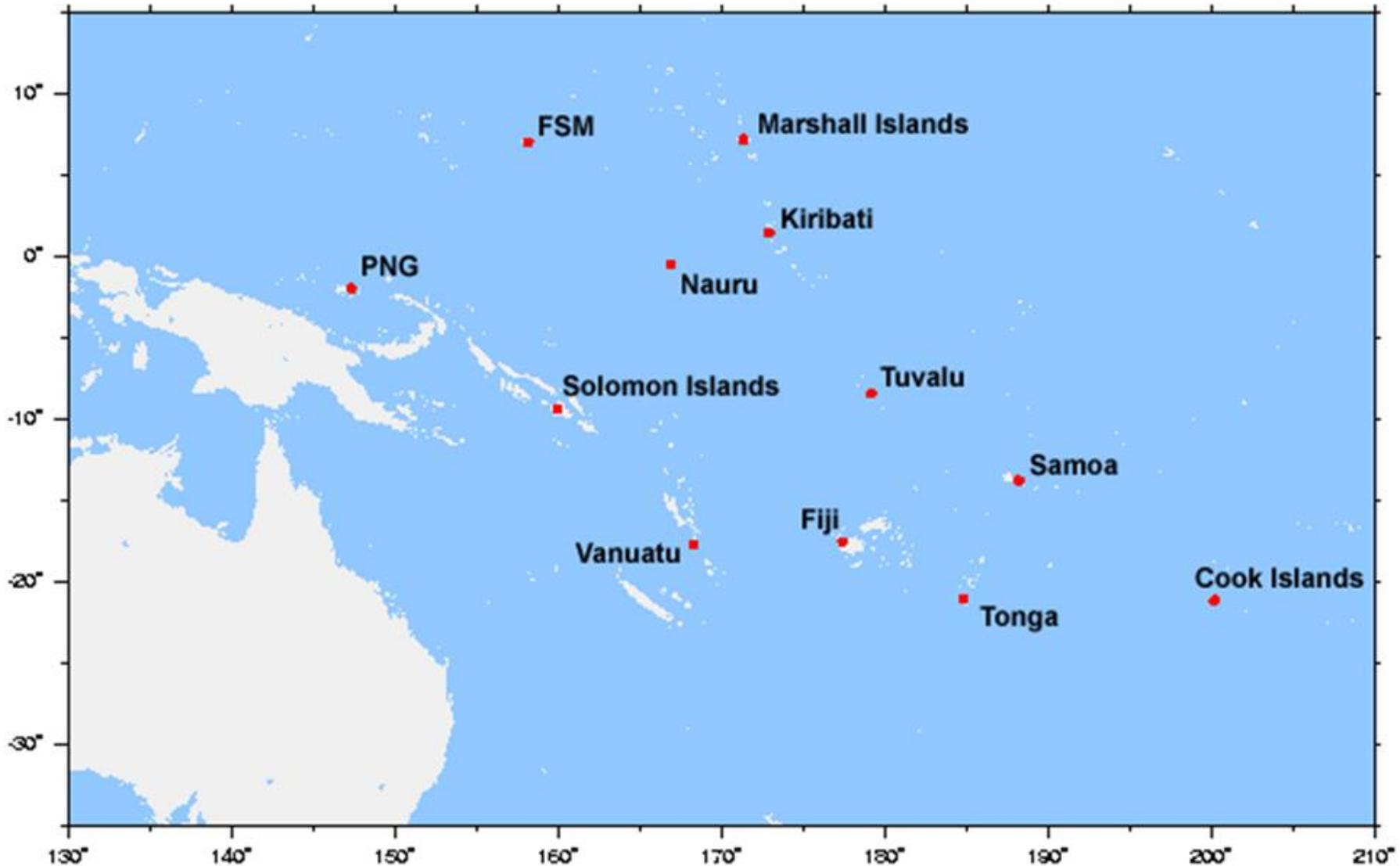
1. Tide Gauge



2. CORS



Tide Gauges and CORS in Pacific



Sea Level Rise & Natural Disasters

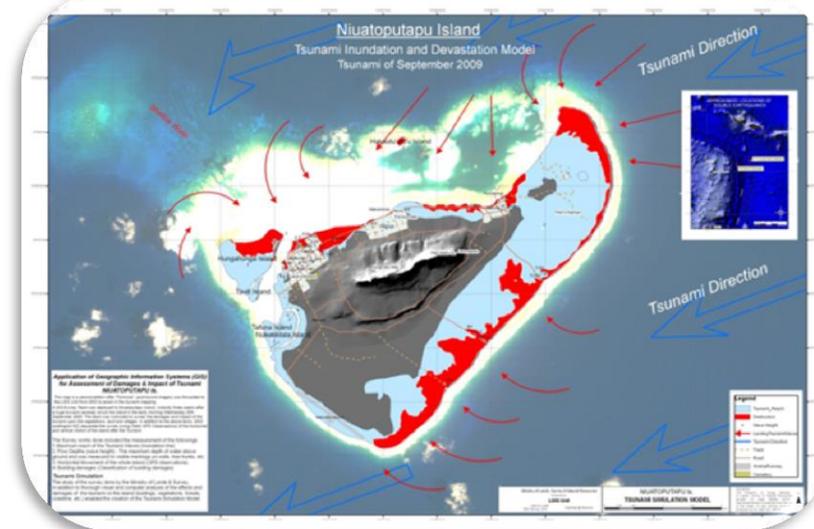


Tsunami 2009

Before



After



- Current legal and policy framework does not accommodate and facilitate modernising of geodetic infrastructures
- Effective plans not yet in place (short and long-term)
- Funding is always an issue
 - Right equipments
 - Trainings and support
 - Technical Assistant
 - Staffing
 - Field Survey

Geodetic Plan-next 12 months



- Ongoing...Survey Act-Plan to submit to Parliament this year
- Currently developing Geodetic 10 yrs Strategy-Plan to complete in 6-12months
- Compile and update all data both office and in the field:
 - For update geodetic network
 - For developing of a new vertical reference frame for Tonga

- Geodetic Strategy in place with funding
 - Densification and regular maintenance of geodetic network to cover the whole country especially the most vulnerable ones, also including cadastral network.
 - To have a modern vertical reference frame for Tonga distributing accurate heights to rest of the **country...accurate heights are vital!**
 - Role of geodesy in disaster preparedness and management eg Earthquakes etc.
 - Provide the foundation to enable accurate and reliable real-time positioning whenever and wherever it is required
 - Support all positioning needs in Tonga through a modernised and accessible the geodetic infrastructure.....**a fit-for-purpose positioning system**
 - Self-reliance geodetic services equipped with necessary expertise and resources

- Pacific Geospatial and Surveying Strategy-10 yrs-PGSC
- World Bank agree to fund the development of a geodetic strategy/work plan for Tonga...implementing nationally the regional strategy
- Recruiting of our first female surveying graduate (UNITECH-PNG) and also supporting staffs
- Partnership and collaboration: FIG-AP-CDN, UN-GGIM-AP, GA, NZIS, PGSC continues to play an active lead role in promoting a modern geodetic infrastructure not only for Tong but also the Pacific region...we need also the assistance of the IAG