

MODERNISATION WITH CURRENT CAPABILITY & CAPACITY

Tonga's Positioning Operation

Geodetic Survey Services
Ministry of Lands & Natural Resources
Government of Tonga



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Content

- Tonga Strategy
- Current capacity
- Monthly operation
- Challenges
- Way Forward
- Conclusion



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Accurate Positioning Tonga Strategy

- Aligning with Tonga Strategic Development Framework II

 TONGA STRATEGIC DEVELOPMENT FRAMEWORK II	NATIONAL IMPACTS	A PROGRESSIVE TONGA SUPPORTING A HIGHER QUALITY OF LIFE FOR ALL PEOPLE							
	NATIONAL OUTCOMES	More inclusive, sustainable and dynamic, knowledge based economy		More inclusive, sustainable and balanced urban & rural development across island groups			More inclusive, sustainable and effective land & environment management and resilience to climate & risk		
	ORGANISATIONAL OUTCOMES	1.4. Improved public enterprise performance	2.7. Better care & support for vulnerable people in particular the disabled	4.2. More reliable, safe and affordable transport services	4.4. More affordable buildings and other structures	4.5. Improve the use of research & development focussing on priority needs.	6.1. Improved land use planning & management for private & public spaces	6.2. Improved use of natural resources for long term flow of benefits	6.3. Improved resilience to natural disasters and impact of climate change
ACCURATELY POSITIONING TONGA STRATEGY	STRATEGIC PRIORITIES	1. MODERN GEODETIC REFERENCE FRAME ALIGNED TO THE GLOBAL GEODETIC REFERENCE FRAME		2. MODERN HEIGHT REFERENCE FRAME		3. NATIONAL CORS NETWORK FOR TONGA		4. LEGAL AND POLICY FRAMEWORK FOR GEODETIC INFRASTRUCTURE	



Accurate Positioning Tonga Strategy

- Aligning with Regional and Global Plans



Geodetic Survey Current Capacity

- Staffs
 - 4 graduate
 - 1 Chief Geodetic Surveyor
 - 1 Bachelor of Science
 - 1 BSC of mathematics
 - 1 current BSC of mathematics and physics
 - 5 Supporting staff
- Age
 - 2 is in his forties
 - 7 is in their twenties
- Equipment
 - 5 GNSS (sea level project & GA)
 - 1 Level
 - 1 Total Station
- Software
 - Trimble Business Centre (TBC)
 - QGIS
 - Magnet Office



OPERATIONAL MONTHLY PLAN

CADASTRAL CONTROL

- Locate existing primary cadastral controls
- Update Station diagrams
- Mark protections
- Observe with GNSS

GEODETIC NETWORK

- Locate & update station diagrams
- Carry out GNSS Campaign
- Carry out GNSS observation on geodetic marks, trig stations.

Vertical Network

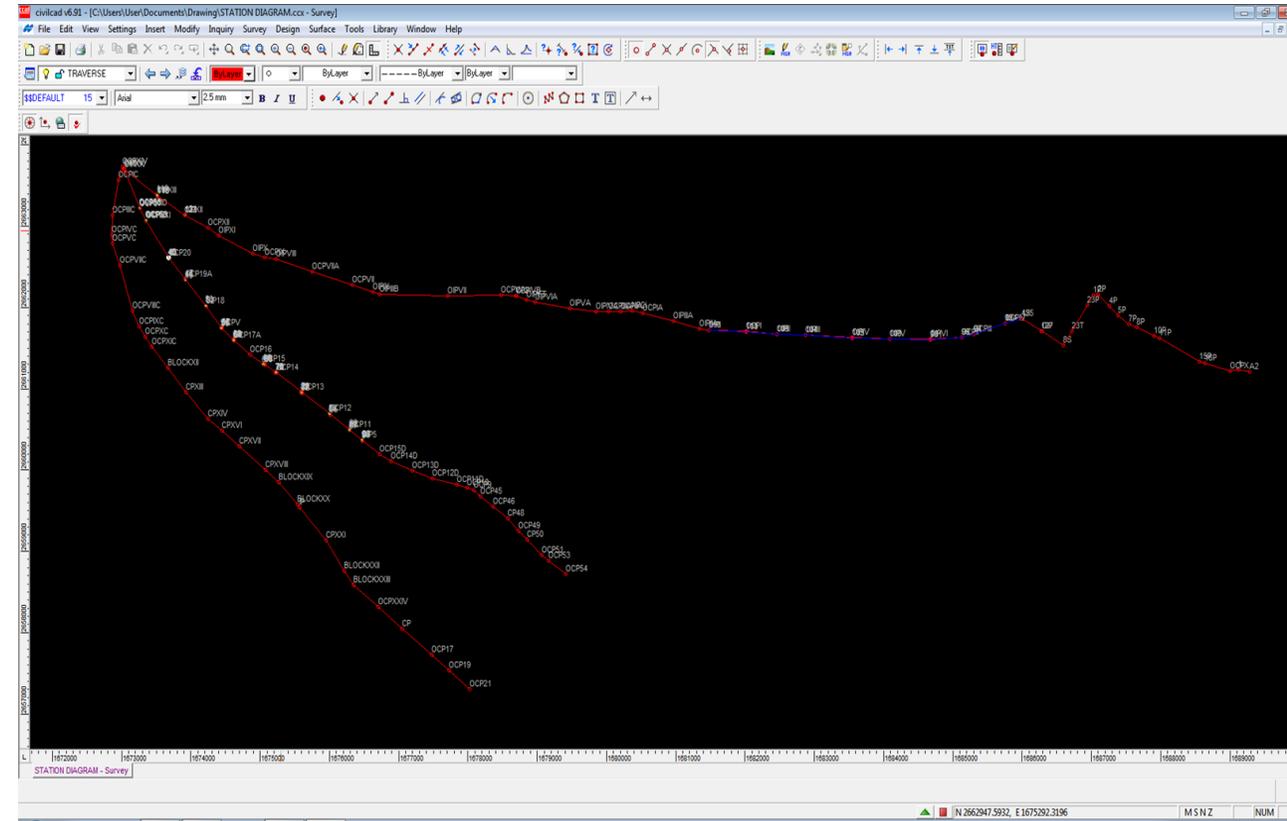
- Complete levelling of BMs in Tongatapu for MSL height
- Complete levelling in Tongatapu
- Determine ellipsoidal height of BMs

OTHER PROJECTS

- Tonga Renewable Energy Project
- Climate Resilience Sector Project
- New navigational chart for Tonga

CADASTRAL CONTROL

- 60% of Tongatapu Cadastral control has been Locate update Station diagrams
- Observe with GNSS



Located marks along Hihifo Rd, Loto Rd and Liku Rd



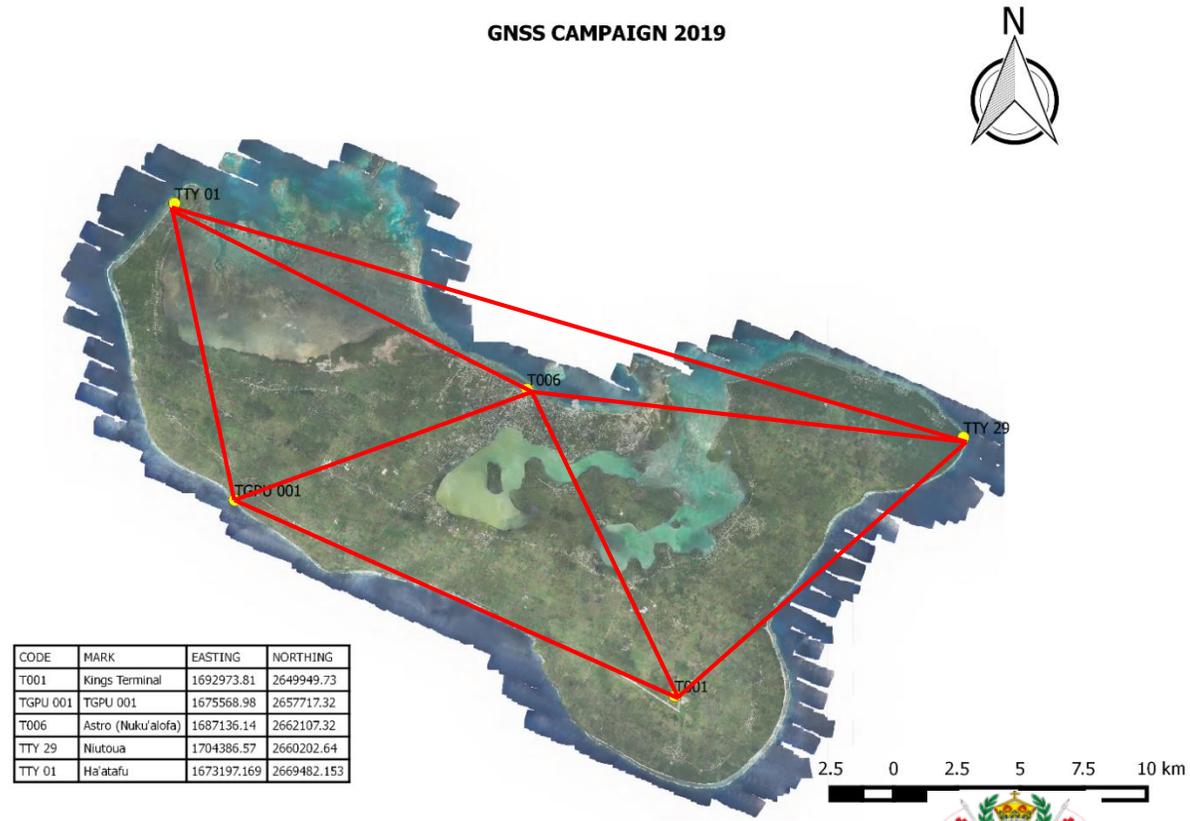
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GEODETIC NETWORK

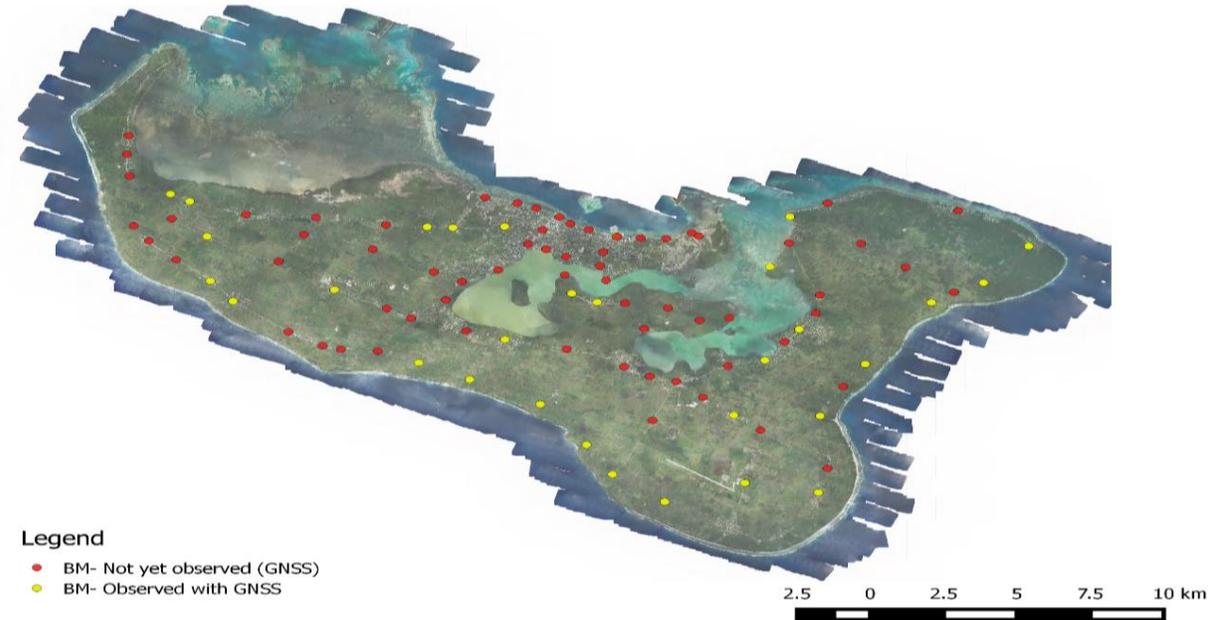
- 100% of Tongatapu geodetic trig stations has been relocated and observe with GNSS
- Annual weekly GNSS campaign its correlated with ASIA PACIFIC REGIONAL GEODETIC PROJECTED (APRGP GNSS campaign)



VERTICAL NETWORK

TONGATAPU BENCHMARKS

- 70% of Tongatapu BM has been relocated and Level.
- Leaving 30% of Tongatapu to be level.



MARK PROTECTION

- All BM were created on the 1990
- All of the most berried underground



Processing of GNSS Campaign Data

1. AUSPOS

- Online GPS processing service provided by Geoscience Australia.
- Static Observation Time; **2 hrs. to 6 days**

OBSERVATION



PROCESSING

- **1st Order Survey**- 6 Days
- **2nd Order Survey**- 24 Hours

- Convert raw data into RINEX
- Submit .19o to AUSPOS
- Coordinates are adjusted using CORS in the PSLGMP NETWORK



RESULT

- Coordinates are in
- ITRF 2014

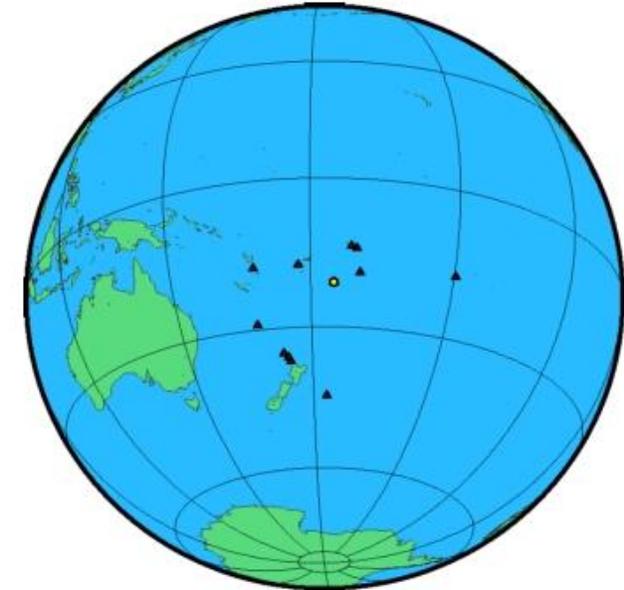


1 User Data

All antenna heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP).

Station (z)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
0468	04681480.19o	TRM57971.00 NONE	1.509	2019/05/28 20:43:30	2019/05/29 00:22:00
4244	42441481.19o	TRM55971.00 NONE	1.316	2019/05/28 22:05:00	2019/05/28 23:59:30

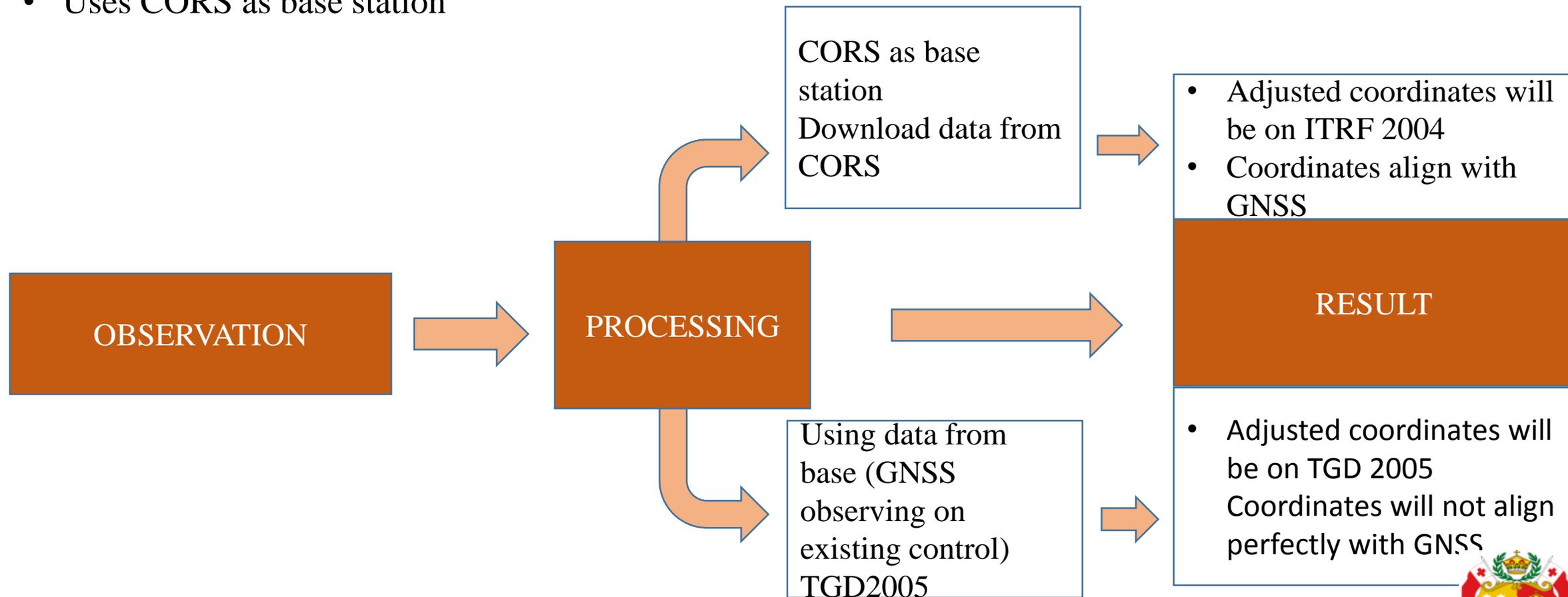
2 Processing Summary

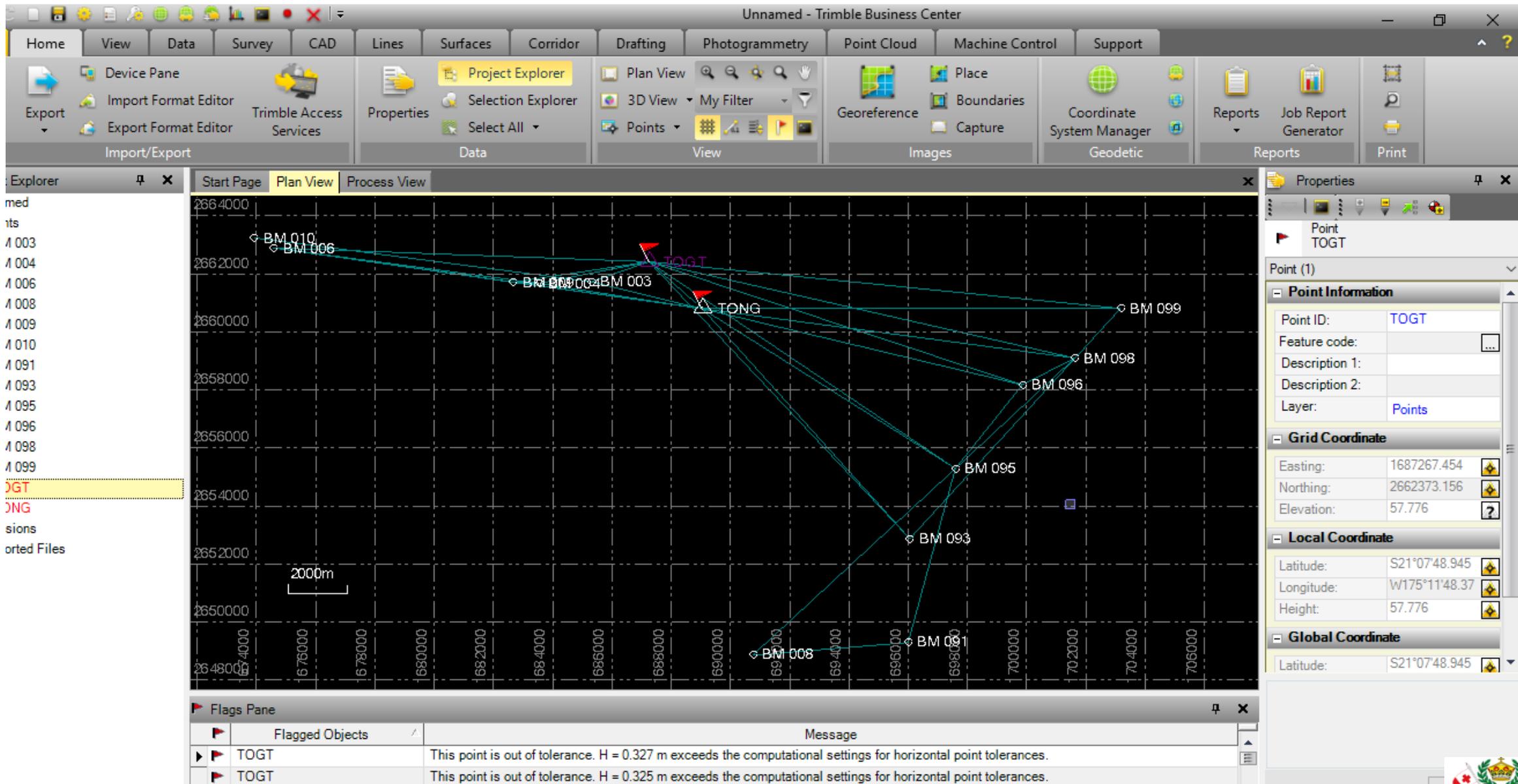


Date	User Stations	Reference Stations	Orbit Type
2019/05/28 22:05:00	0468 4244	ASPA AUCK CHTI FAAI KYIA LAUT NIUM NIUT NGRF PIVL SAMO TONG WHNG	IGS rapid

2. Trimble Business Centre TBC

- GNSS/GPS data processing software
- Uses CORS as base station

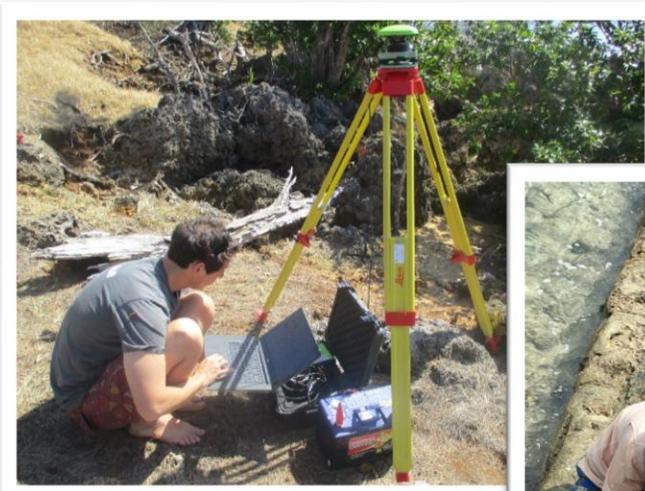




OTHER PROJECTS

Other requested tasks apart from the daily planned activities;

- Tonga Renewable Energy
- Climate Resilience Sector Project- Monitoring waves
- New Navigational Chart.



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CHALLENGES

- **Not enough qualified staff**
- **Need more equipment and resources**
- **Lack of expertise in specific areas**
 - **National adjustments**
 - **Need in depth understanding on GNSS receivers and antenna**
 - **Gravity measurements**
- **Lack of funding to cover outer islands**
- **Need proper office space-previous office was destroyed by TC GITA**



WAY FORWARD

- **Purchase new GNSS**
- **Purchase new digital level**
- **Trainings on SNAP for conducting national adjustment**
- **Send staff for further higher qualification in specialized areas in geodesy**

Complete Tonga's Positioning Strategy!



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Conclusion

- Good result with existing capacity
- Current operation is part of the strategies.
- The Key is:-
 - Need more observation.
 - Need more data.
 - A fully utilised what on hand

