



transforming the way the world works



# Oceania geodetic infrastructure tools and direction: An industry perspective from Trimble.

Paul Drummond

# Today's context

- **Applicable Trimble contribution**
  - **GNSS CORS; RTN software; DBO consulting**
    - To deliver GNSS augmentations & other GNSS CORS related data products;
    - Augmentations: Single base and network RTK incl. VRS, MAC, SparseVRS,
  - **Service delivery including RTX (RTK-PPP)**
    - TCP/IP (cellular) and L-Band available today
- **Discussion contributions from industry**

- **GNSS: Global Navigation Satellite Systems**
- **CORS: Continuously Operating Reference Station**
- **RTN Real-Time Network**
- **DBO: Design, Build, Operate**
- **RTK: Real-Time Kinematic**

- **VRS: Virtual Reference Station**
- **MAC: Master Auxiliary Concept**
- **RTX: Real-Time Extended**
- **PPP: Precise Point Positioning**

# transforming

## THE WAY THE WORLD WORKS



Agriculture



Construction



Geospatial



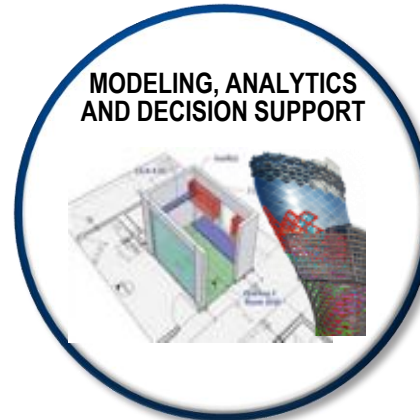
Natural Resources, Utilities & Government



Transport & Logistics

**FY 2013 :**  
**Revenue: US\$2.3 Bn**  
**Staff: 7,000**

**Facilities in 35 countries**  
**Partners in 125 countries**  
**Customers in 150**



**Global R & D :**  
**36 Sites**  
**11 Countries**  
**12 Time Zones**  
**11-12% of Revenue**  
**invested in R&D**

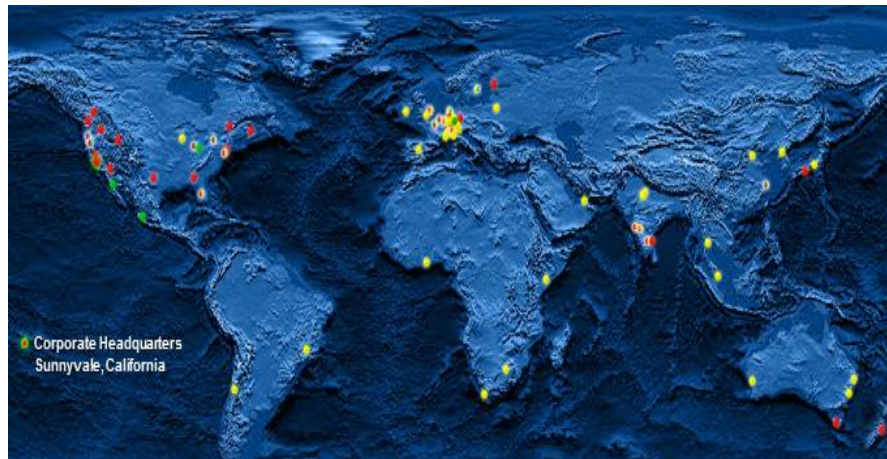
**1,000**  
**Trimble Patents Issued**

**Over**  
**60%**  
**of Technical Personnel**  
**in Software**



# Trimble and NZ/AU

- **Trimble in Oceania**
  - Development centre in Chch 250 staff
  - Another 100 staff in other NZ locations
  - 136 employees in Australia
  - ~200 additional staff in distribution offices (UPG/HLGS/Geosystems/Sypos/Sitech)



# Trimble Industry Focus



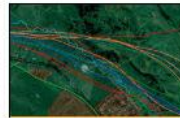
3D Laser Scanning



Aerial Sensor Systems



Agriculture



Alignment Planning



Local Government



Mapping and GIS



Marine Construction



Military - Defense



Automotive - Embedded Systems



Building Design, Construction and Engineering



Cadastral and Boundary Surveying



Civil and Site Construction and Engineering



Mining



Mobile Computing



Mobile Surveying and Mapping



Monitoring



Construction Logistics



Construction Tools



DGNS Navigation Infrastructure



GNSS Infrastructure



Oil, Gas and Chemical



Outdoor Enthusiasts



Positioning Services



Precision GNSS and Inertial



Environmental Solutions



Field Service Management



Fleet and Asset Management for Heavy Civil Projects



Forestry



Public Safety



Rail



RFID



Survey and Engineering



Electric Utilities



Indoor Mobile Mapping



Land Administration



Land Seismic



Telco and Cable



Time and Frequency



Transportation and Logistics



Unmanned Aircraft Systems



# Division: Mission Statement

*“To leverage our innovative infrastructure solutions to reliably provide accurate positional information to measure locations and rate of change to make informed decisions, as well as providing safe navigation on a global basis.”*



# Who are we today?

- **Infrastructure Business Segments**



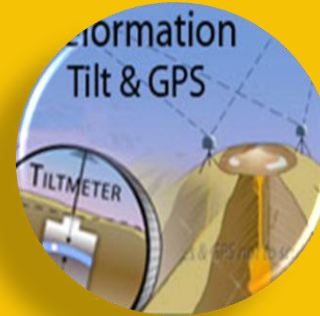
Real Time  
Networks

RTN



Navigation  
Infrastructure

NavInfra



Monitoring

MON



Earth  
Systems

ES



**Infrastructure Focus Area**

# Who are we today?

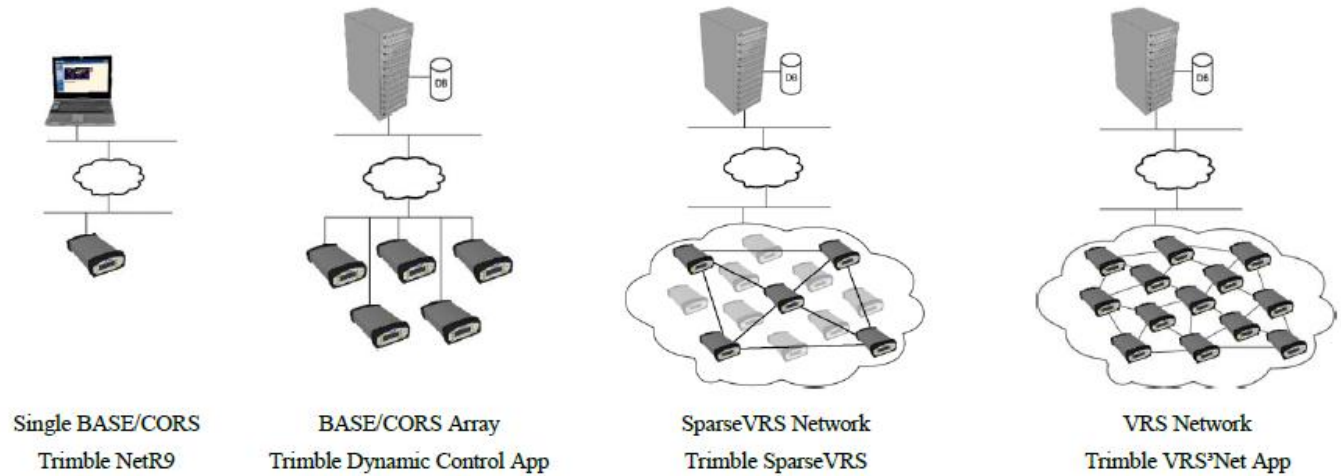
- Real Time Networks

*To provide accurate scalable positioning solutions to enable productivity and efficiency*



RTN

## Scalable Approach





# Who are we today?

## ■ Navigation Infrastructure

*To provide precise and reliable aids to navigation (AtoN)  
to ensure safety in demanding environments*

- Safety of Life at Sea (SOLAS)
- Modern Lighthouse
- Harbor approach



Navigation  
Infrastructure

# Who are we today?

## ■ Monitoring

*To provide critical decision making data to ensure safety of public, infrastructure and resources*

- Tectonics
- Objects (Dams, Bridges, ...)
- Slope Stability
- Mines



Monitoring

# Who are we today?

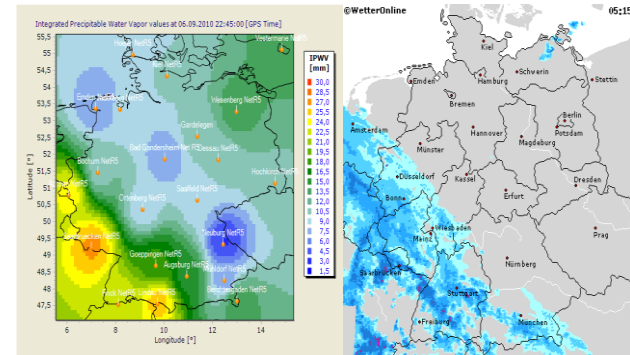
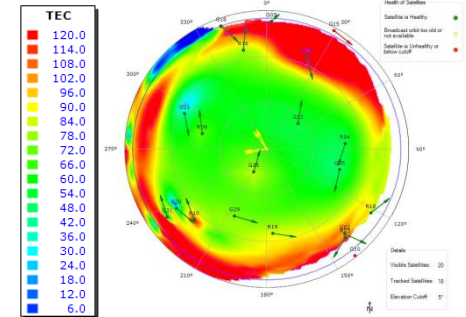
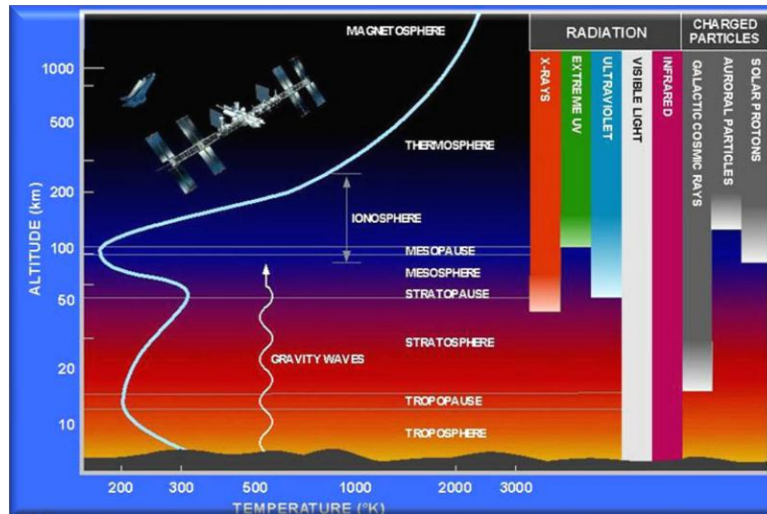
- Earth Systems

*To provide solutions to better understand interactions within the earth as a system*



Earth Systems

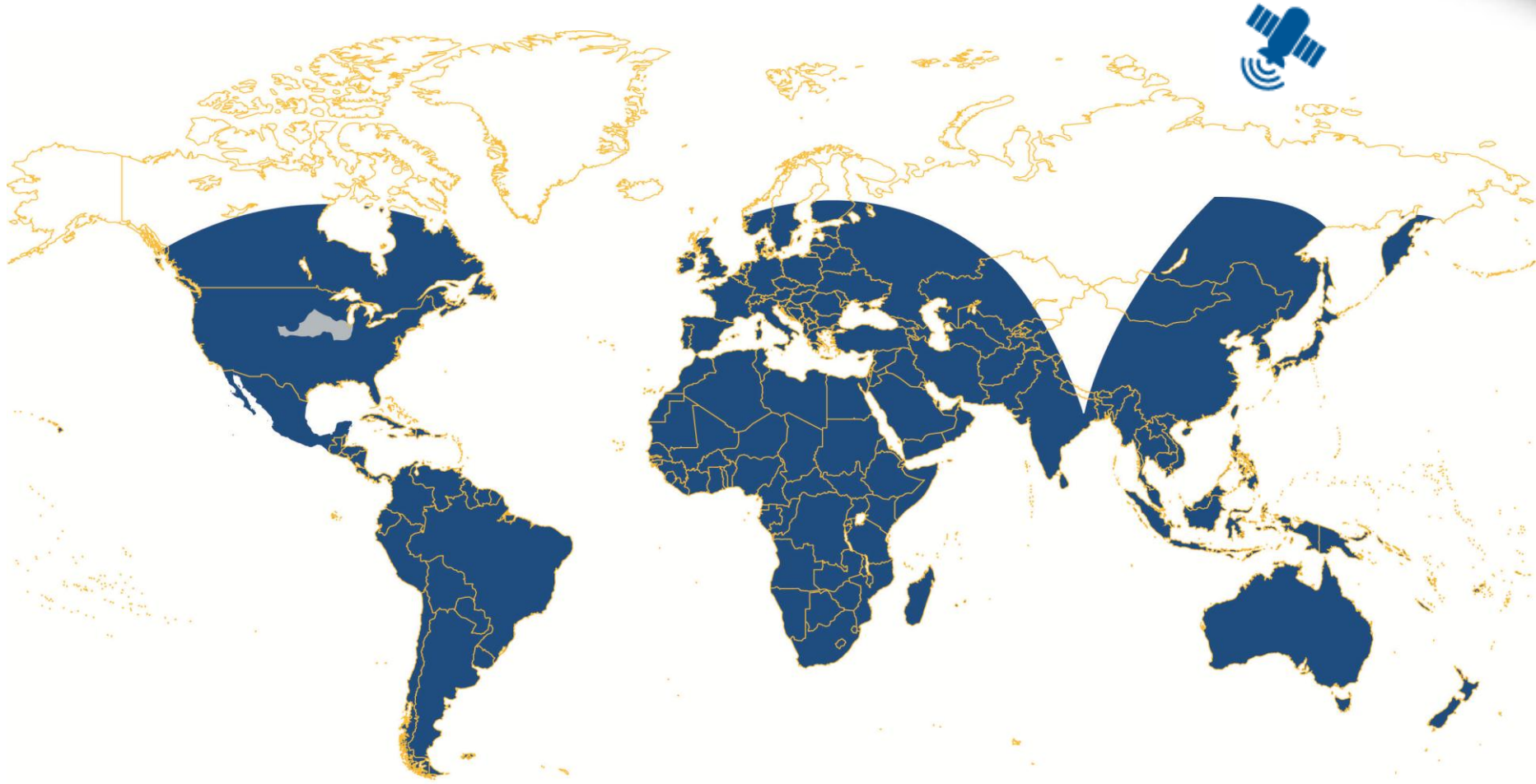
- Atmosphere
- Tectonics





# ALSO - CenterPoint RTX Coverage

## L-Band corrections from 6 GEO-satellite services



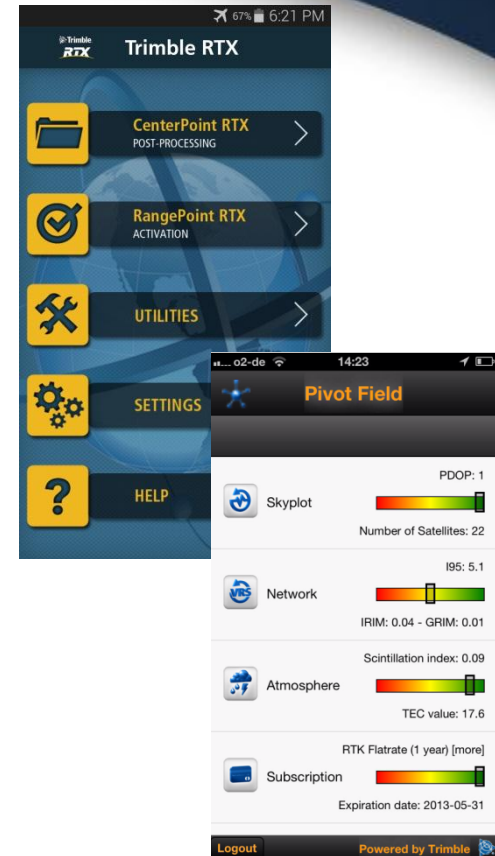
\* TCP/IP delivery available everywhere via cellular data since 2011

# Trimble CenterPoint RTX

Provides ambiguity fixing for all systems:  
GPS, GLONASS, BeiDou, Galileo and QZSS

RTX service introduced mid-2011  
RTX-PP for all GNSS users since Nov 2012  
Android App Oct 2013

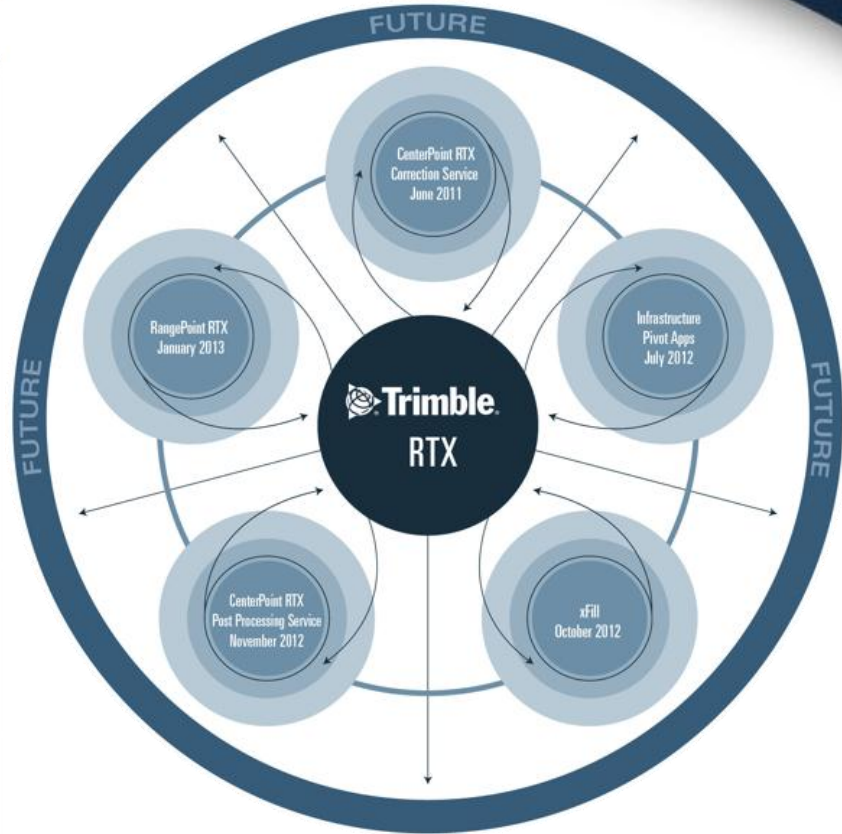
Latest release (Feb 2014) added BeiDou to  
all services, Galileo pending IOC



# Our data services enable applications

Convergence Time	Service	Horizontal Accuracy
< 1 min	OMNISTAR VBS	20" / 50cm
1-5 min	RANGEPOINT™ RTX™	20" / 50cm
3 min	VRS NOW™ EXTENDED COVERAGE	4" / 10cm
45 min	OMNISTAR XP/G2/GNSS	4" / 10cm
45 min	OMNISTAR HP	2" / 5cm
10-30 min	CENTERPOINT™ RTX™	1.5" / 4cm
Instant	OMNISTAR CORS	1" / 2cm
Instant	VRS NOW™	1" / 2cm

1 min in a few locations



A Range of Services

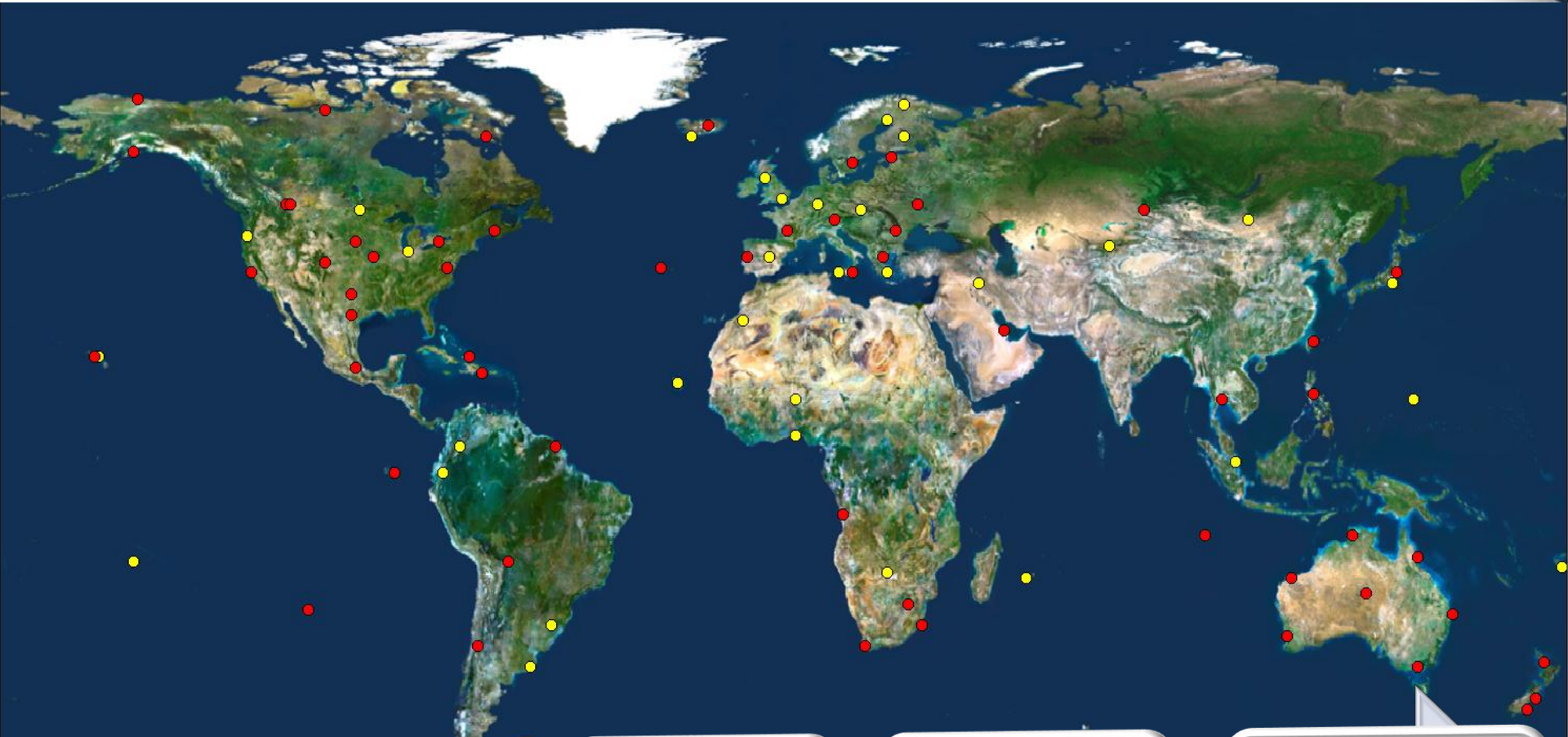
A Choice of Delivery Mechanisms

**RTX:** Carrier Phase Positioning with Resolved Ambiguities, Global <4cm

**FAST:** Proven 3.8cm PPP in <1 min



# From Pillars to Global PPP



Pillars & Monuments

GPS and 1<sup>st</sup> RTK

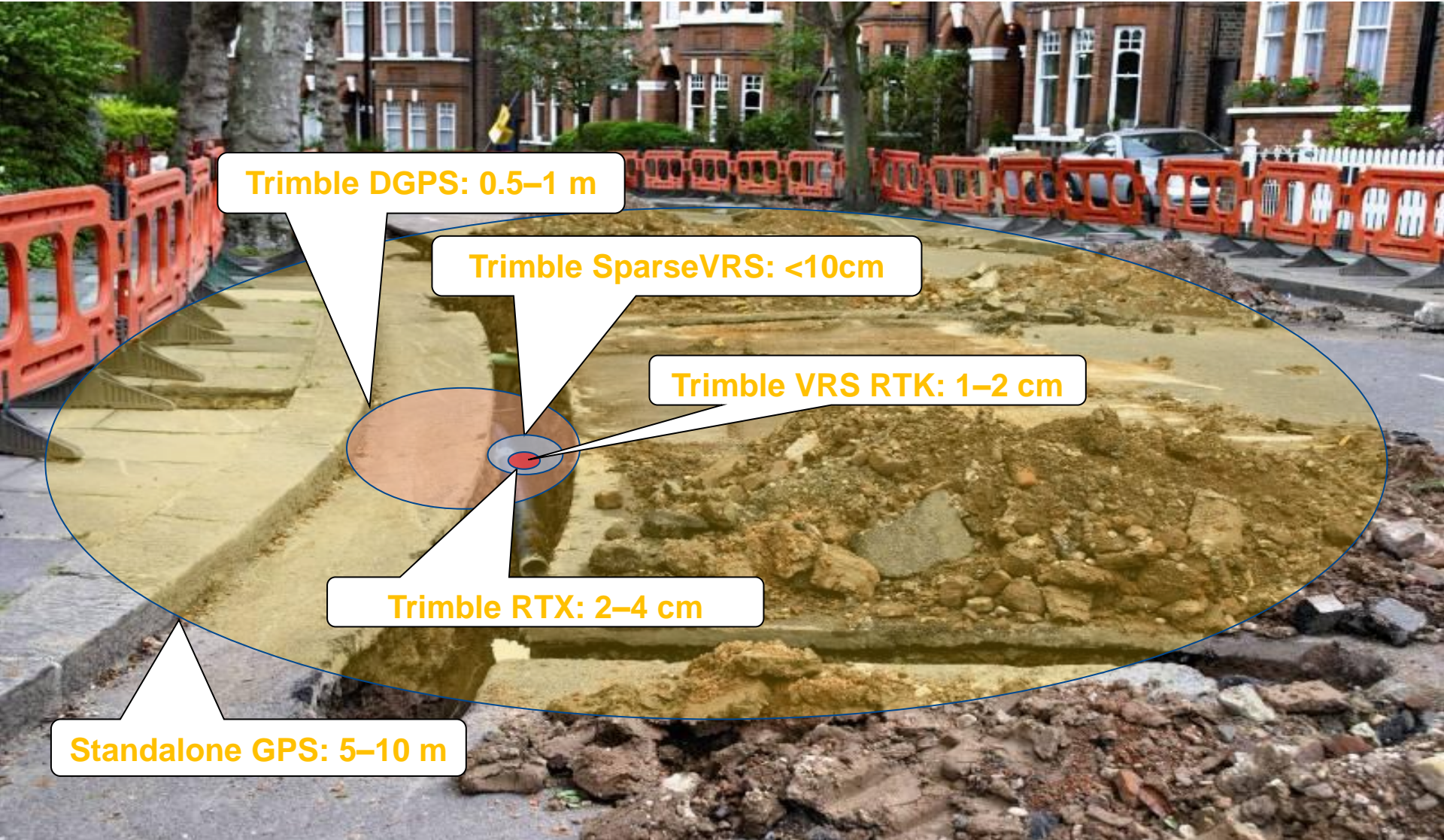
Active Control (CORS)

Virtual Ref Stations (VRS)

RTK from the Sky - RTX



# Application Accuracies



Trimble DGPS: 0.5–1 m

Trimble SparseVRS: <10cm

Trimble VRS RTK: 1–2 cm

Trimble RTX: 2–4 cm

Standalone GPS: 5–10 m

# RTN Portfolio

## GNSS Real Time Networks

A GNSS network is a common resource that helps users achieve a wide range of benefits while enabling cost-saving solutions in the fields of surveying, mapping and other high accuracy positioning work.

Whether you're building a new GNSS network or expanding an existing network, our proven solutions simplify the process, cost and complexity of deploying GNSS Infrastructure.



### Solutions

#### Trimble NetR9 GNSS Reference Receiver

A full-feature, top-of-the-line GNSS reference receiver



[▶ Learn More](#)

#### Trimble Dynamic Control App

BASE/CORS Array administrative software for streamlined field operations and increased user productivity



[▶ Learn More](#)

#### Trimble VRS<sup>3</sup>Net App

VRS network management designed with the future in mind



[▶ Learn More](#)

#### Trimble Sparse VRS App

Sparse VRS network management enables users to configure and grow their network



[▶ Learn More](#)

#### Trimble Solar Cabinets

Versatile enclosures to power and protect sensitive electronic equipment

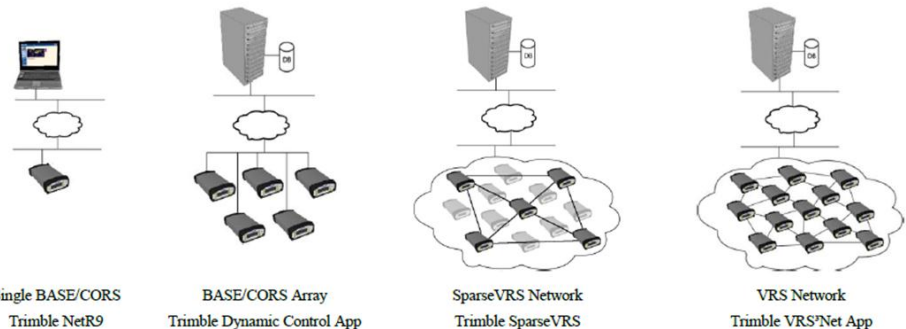


[▶ Learn More](#)

## Our Vision

*“provide accurate and scalable positioning solutions to enable productivity and efficiency”*

## Scalable Approach

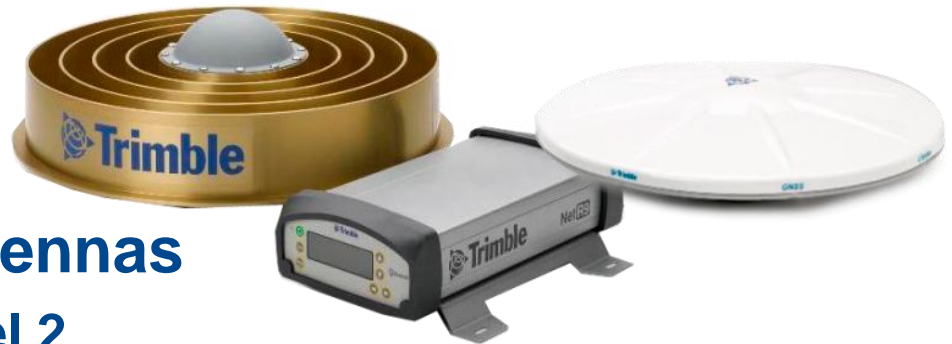




# RTN

## ■ Hardware

- Trimble NetR9 CORS
- Various Geodetic Antennas
  - Zephyr Geodetic Model 2
  - D/M Choke Ring
  - Ti-Choke Ring

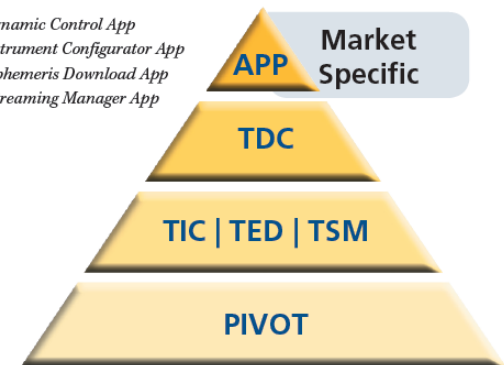


## ■ Software

- TDC, SparseVRS, VRS<sup>3</sup>Net Apps
- All based on new PIVOT platform

## ■ Typical RTN Applications

TDC - Trimble Dynamic Control App  
 TIC - Trimble Instrument Configurator App  
 TED - Trimble Ephemeris Download App  
 TSM - Trimble Streaming Manager App



*Hierarchical Apps layer structure*

# More than 20 Apps in Pivot ...

## ■ Highlights

- Manage multiple instruments at once; create GNSS augmentations incl. single base, sparse network and network RTK; automate PP or RTK-PP deformation data processing; derive tropo and iono products; track crews on web page; automate data download; transmit datum transformations via RTCM
- New at 11/2014 – Trimble Online Processing (TOP) online PP service



# Pivot Mobile Apps



## Trimble Pivot Admin

Provides the administrator easy access to the server system including a full overview on all servers and Trimble Pivot platform installations.

TRIMBLE PIVOT ADMIN
TECHNICAL NOTES

Trimble® Pivot™ Admin is a mobile app for administrators of a Trimble Pivot platform installation providing access and maintenance capabilities from a tablet or a smart phone at any time and from everywhere. Pivot Admin provides health status and system runtime information.

**PIVOT GOES MOBILE**

Trimble Pivot platform introduced the Trimble Mobile Com navigation App, which on older system administrator to open an invitation from their system to the mobile world through a link generated by Trimble Mobile device (such as tablet or smart phone) that supported by the Android or Apple iOS operating system, on new system administrator like health status, maintenance, and at length conditions. The mobile app is currently available.

- Pivot Admin
- Pivot Field

**PIVOT ADMIN**

As the administrator of a Pivot server system, you would like to know at anytime and anywhere, whether your system is up and running without any problem or if problem occurs whether the problem was and its severity to decide whether an immediate intervention is necessary.

*Administration page for 100 servers*

The Pivot Admin mobile provides easy access to your server system and gives a full overview on all your server and Trimble Pivot platform installations. You can see status information of your system as well as health status of the various Pivot apps at one glance, which allow for immediate intervention.

**PIVOT ADMIN FEATURES**

- Facilitate overview on most important processes and overview on your server system
- Combined overview on all distributed system events in your server system
- Server and app health overview
- Control over Pivot services, as far as possible



## Trimble Pivot Field

Provides the field user various information on Atmosphere condition, satellite availability or subscription and session station.

TRIMBLE PIVOT FIELD
TECHNICAL NOTES

Trimble® Pivot™ Field is a mobile app for field users interested in status information from a CORS station network and in atmospheric conditions occurring within the region of the network. Session and subscription information for rovers are provided as well.

**PIVOT FIELD**

The ionosphere is the upper part of the atmosphere containing large number of ions and electrons. Depending on the solar activity an ionization of the upper atmosphere Signal traveling through the ionosphere can be influenced depending on ionization or disturbances in the ionosphere. Also known as scintillation. The performance of our GNSS applications like GPS / CORS measurements and phone signals are highly influenced by the ionosphere activity.

The Pivot Field mobile app provides status information on ionosphere activity based on a single station and network approach and provides that in graphical form. At your current position. The GNSS satellite availability is presented as well.

*Online availability for your location*

**MOBILE APPS DISTRIBUTION**

Pivot Admin and Pivot Field native mobile apps which can be downloaded free of charge from the Apple App store as well as from the Google Play store.

**MINIMUM SYSTEM REQUIREMENTS**

- Supported Operating systems

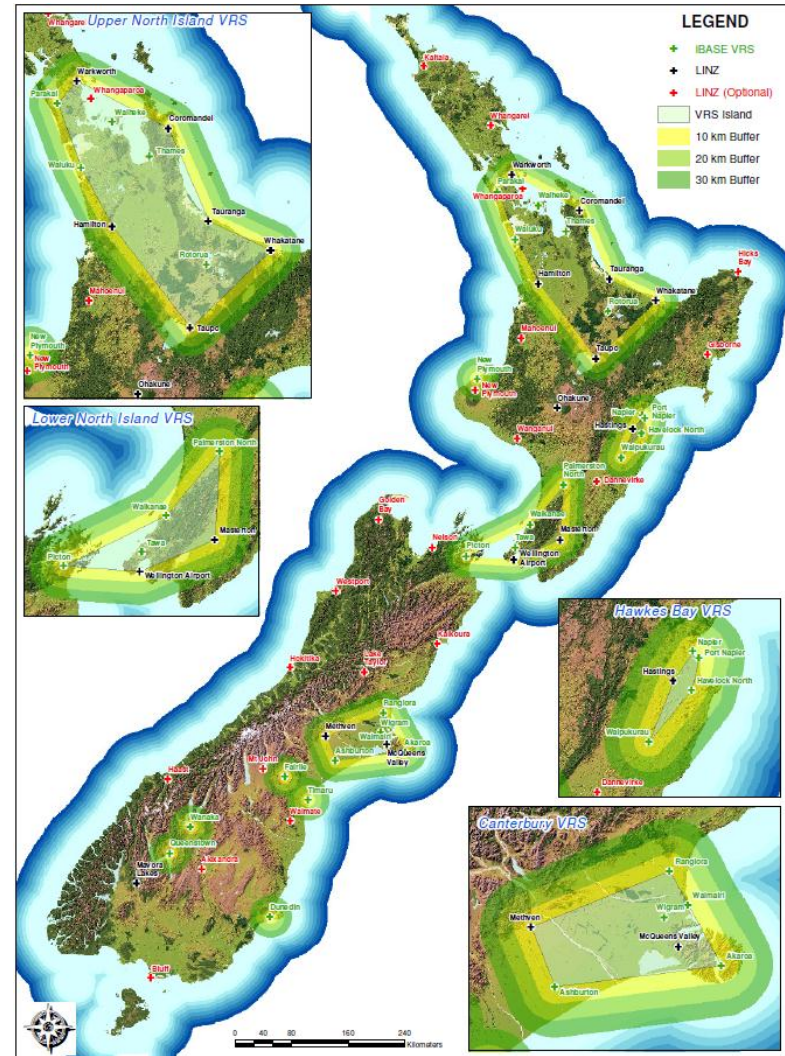


# Placeholder

- **Whiteboard discussion**

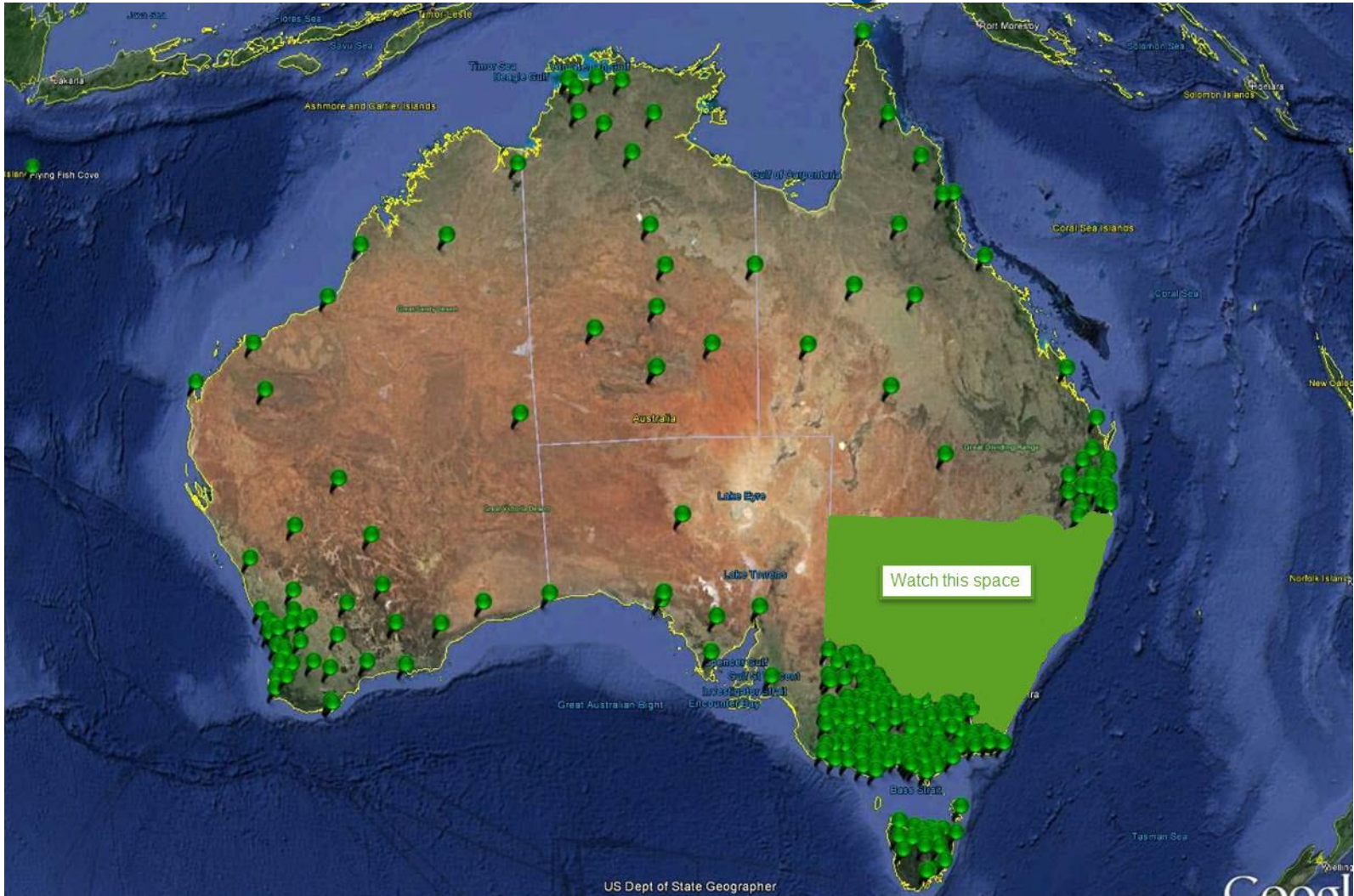
# NZ/Aust/PI

- iBASE enable by PositionNZ
- PositionNZ
- Geonet cGPS
- GPSnet (VIC)
- CORNetNSW
- SunPoz (QLD)
- RTKnetwest (WA)
- GA – across AU
  - South Pacific
  - Fiji Water Authority



# Trimble VRSNow Australia

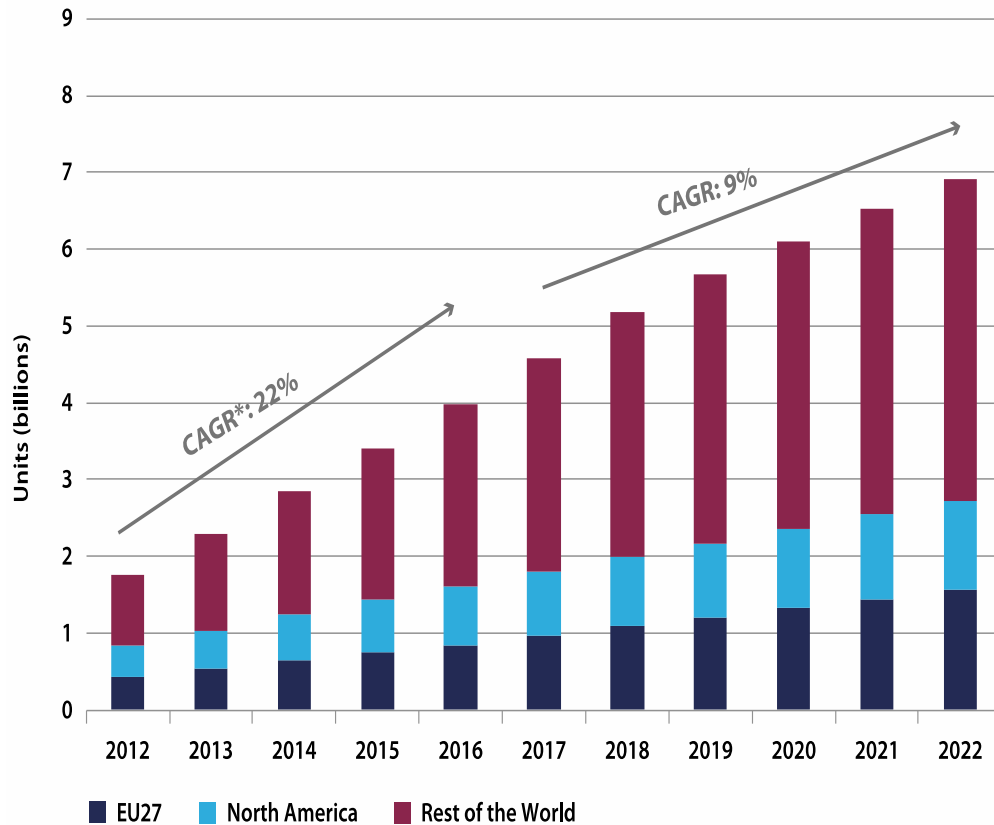
coordinated use of existing resources



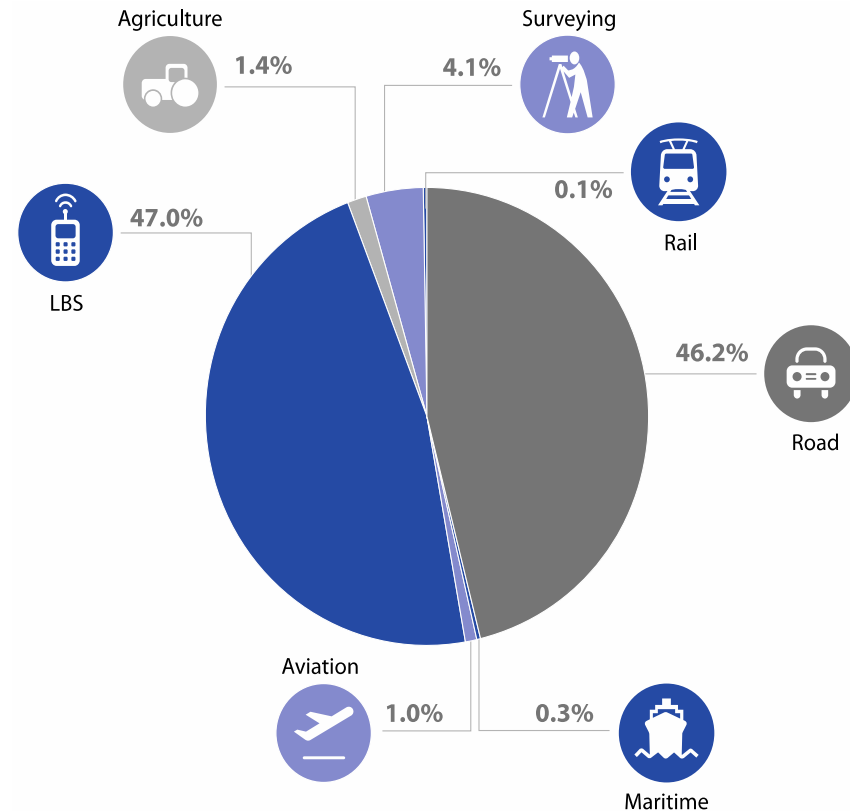


# More GNSS than people? 7Bn GNSS devices forecast by 2022

Installed base of GNSS devices by region



Cumulative core revenue 2012-2022



# Discussion contributions

- **Completely ratify the goals of 2014 report**
- **In the NZ context, private industry has been enabled by taxpayer investment and government leadership**
  - **Please continue!**
  - **Please keep provided Infrastructure at the cutting edge of available RTN technology**
    - **Enable industry with all in view GNSS tech is important**
  - **Capturing & communicating deformation a critical enabling role of government**

# Discussion contributions

- **Requests**
  - **Increase outreach of non-standard processing methods. Esp: PPP and RT-PPP**
    - **Best practises**
    - **Drive standards**
  - **Perceived benefits of increased PositionZ density**
    - **More applications eg MET, InSAR**
    - **Greater enablement of private sector**
    - **Streamline deformation model generation**



# Discussion contributions

- **Requests**
  - **Access to the datum the single most important driver to grow geospatial business value in NZ**
    - **Bring ALL into terms**
    - **Remove complexity**
    - **Presently – a complex process**
  - **Continue promoting and supporting value in the industry**
    - **Especially the benefits of technology (not threat)**

# Finally

- **Trimble will continue to contribute to dialogue, and promote expertise the region has to offer in all sectors.**