Australian Government
Geoscience Australia

Australia's new datums and why they are useless without metadata standards

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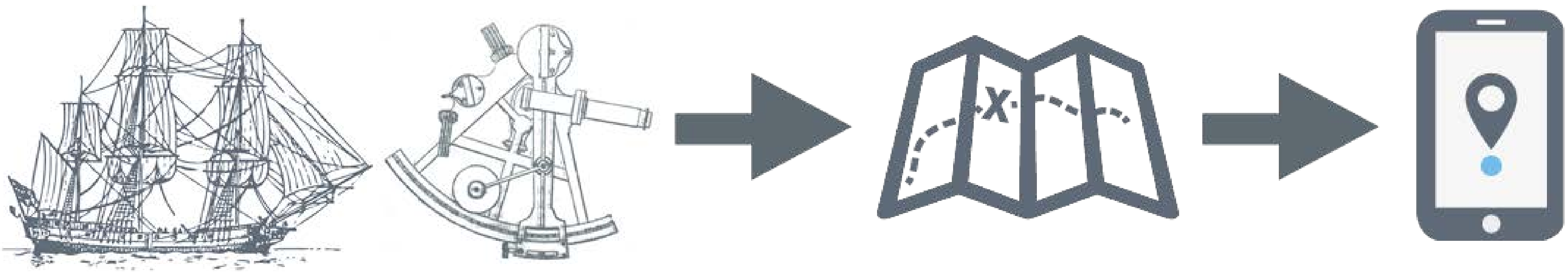
Why - Positioning, Navigation and Timing (PNT)



~$ 1.1 b

Adopting precise positioning technology in the mining industry was estimated to have increased output by $1 085 million in 2012 alone.

Mining

~$ 723 m

Precise positioning technology in the construction sector was estimated to have increased output by $723 million in 2012.

Construction

~$ 466 m

Precise positioning technology was estimated to have increased yields by up to $466 million in 2012.

Agriculture

Source: ACIL Allen Consulting, 2013

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Our Vision

An integrated national positioning capability to accelerate the adoption and development of location-based technology and applications in Australia







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NPI NATIONAL POSITIONING INFRASTRUCTURE CAPABILITY

- Precise Positioning anywhere, anytime at centimetre level
- Improved access to GNSS data and products for existing and new industries

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Budget 2018-19 – NPIC and SBAS

2018-19 Australian Federal Budget

- $64 million for National Positioning Infrastructure Capability (NPIC)
- $161 million for a Satellite-Based Augmentation System (SBAS)
- Ongoing operational budget

Budget
2018-19

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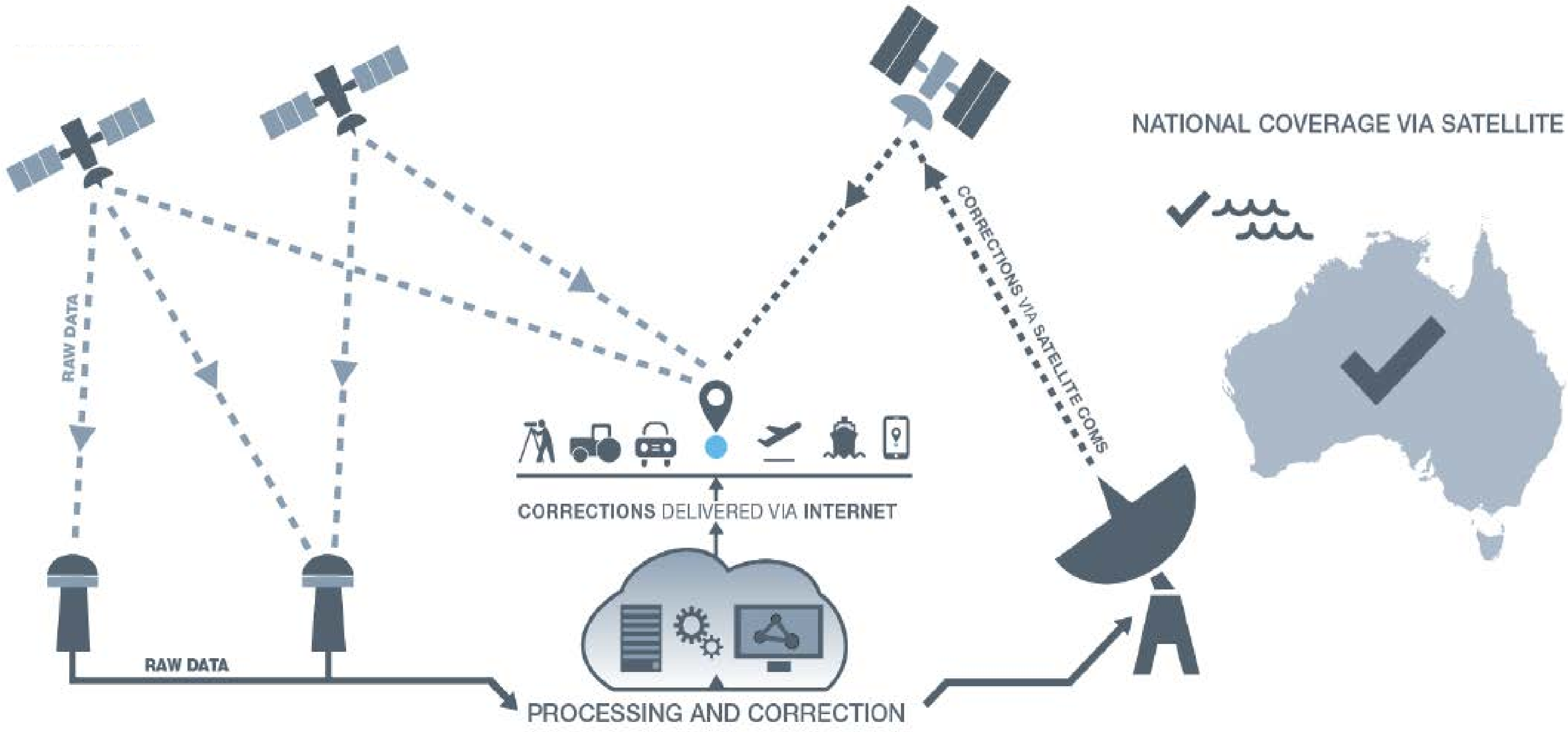
Satellite-Based Augmentation System (SBAS)



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Road

- Cooperative Intelligent Transport Systems
- Automated driving
- 3D digital mapping for automated and CITS
- Vehicle speed determination for regulatory applications
- Real-time road pricing

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General Aviation

- Approach Procedures with Vertical guidance (APV)
- Helicopter procedures

Image source: Royal Flying Doctor Service of Australia

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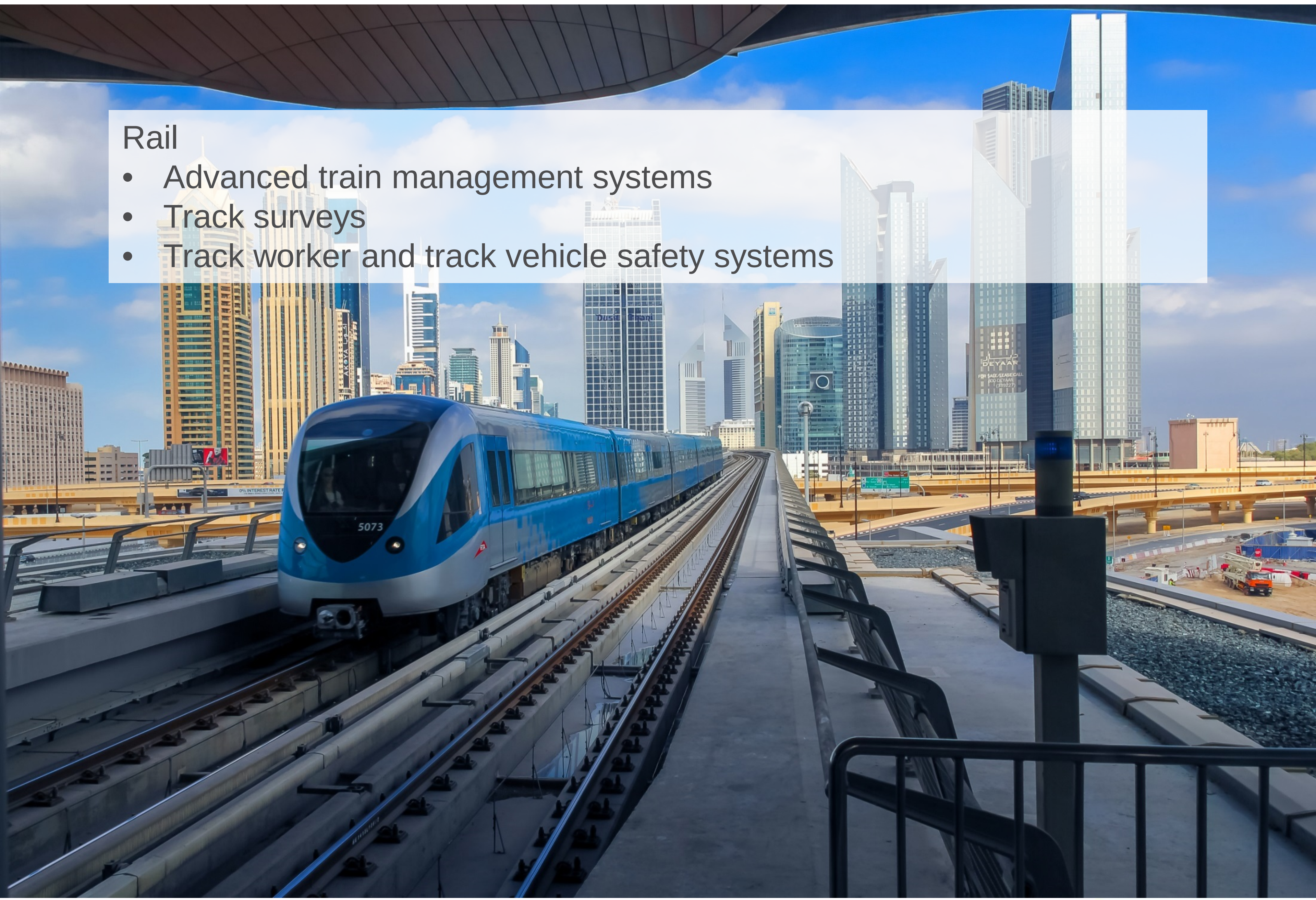
Rail

- Advanced train management systems
- Track surveys
- Track worker and track vehicle safety systems



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Construction

- Personal safety
- Aerial surveys

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UAV Aviation

- High-precision drone applications for agriculture and forestry
- Aerial surveys

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Agriculture – livestock

- Virtual fencing for strip grazing
- Behavioural modelling to enable early disease detection
- Quantification of reproductive relationships
- Intelligent spatial analytics

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Resources

- Mine safety
- Automation of mine sites and supply chains

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Consumer

- Safe guidance for the visually impaired
- Parcel delivery

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Maritime

- Close quarters positioning for improved port operations
- Under keel clearance monitoring for improved productivity
    - Port Hedland; 10 cm = extra $200M/yr of iron ore exports
- Safer navigation
- Tracking of container movements in intermodal container terminal

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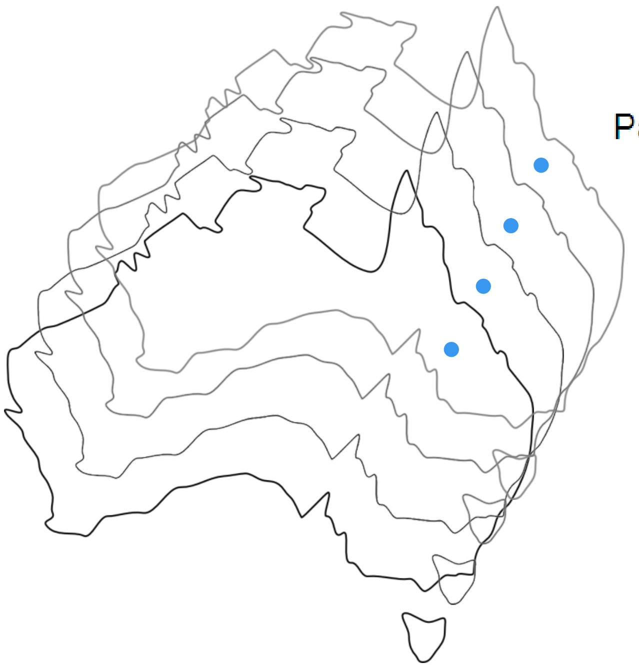
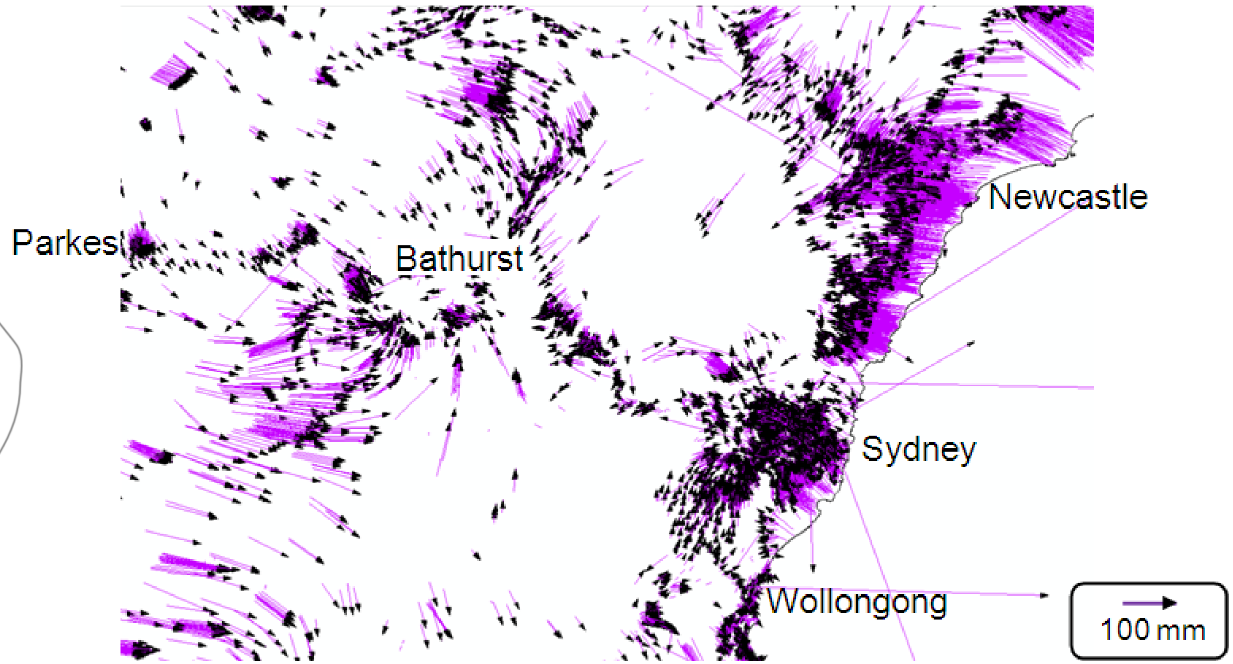
Data can only be as accurate as your datum

- Need to remove biases and distortions and biases in GDA94





Source: Joel Haasdyk and Tony Watson, LPI NSW, APAS Conference 2013

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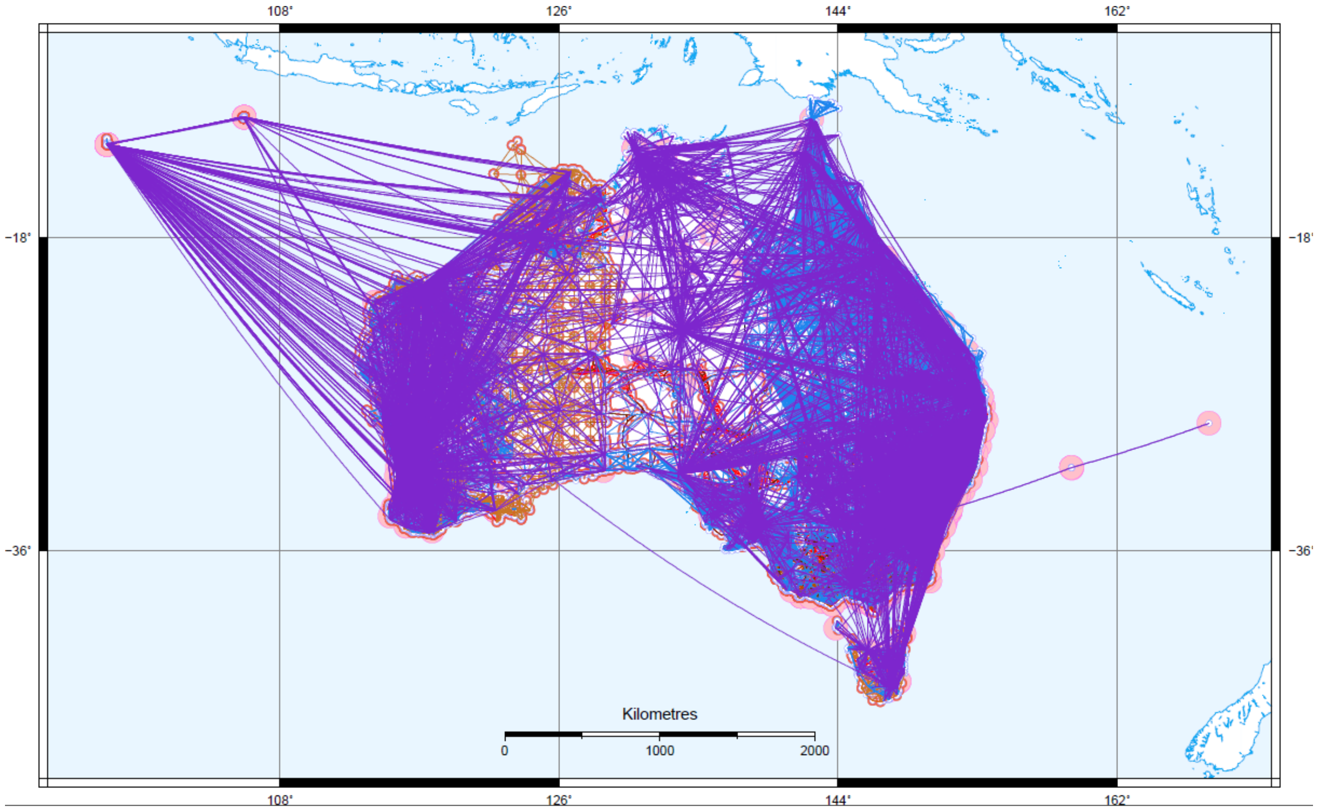
New national datum – GDA2020

- Determination made in October 2017
- Update from 21 to 109 reference sites
- ~2 million measurements (GNSS + terrestrial)
- ~250,000 stations
- Rigorous national adjustment using DynaNet

National Measurement (Recognized-Value Standard of Measurement of Position) Determination 2017

I, Dr R. Bruce Warrington, Chief Metrologist, National Measurement Institute, make the following determination.

Dated 11 October 2017



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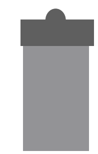

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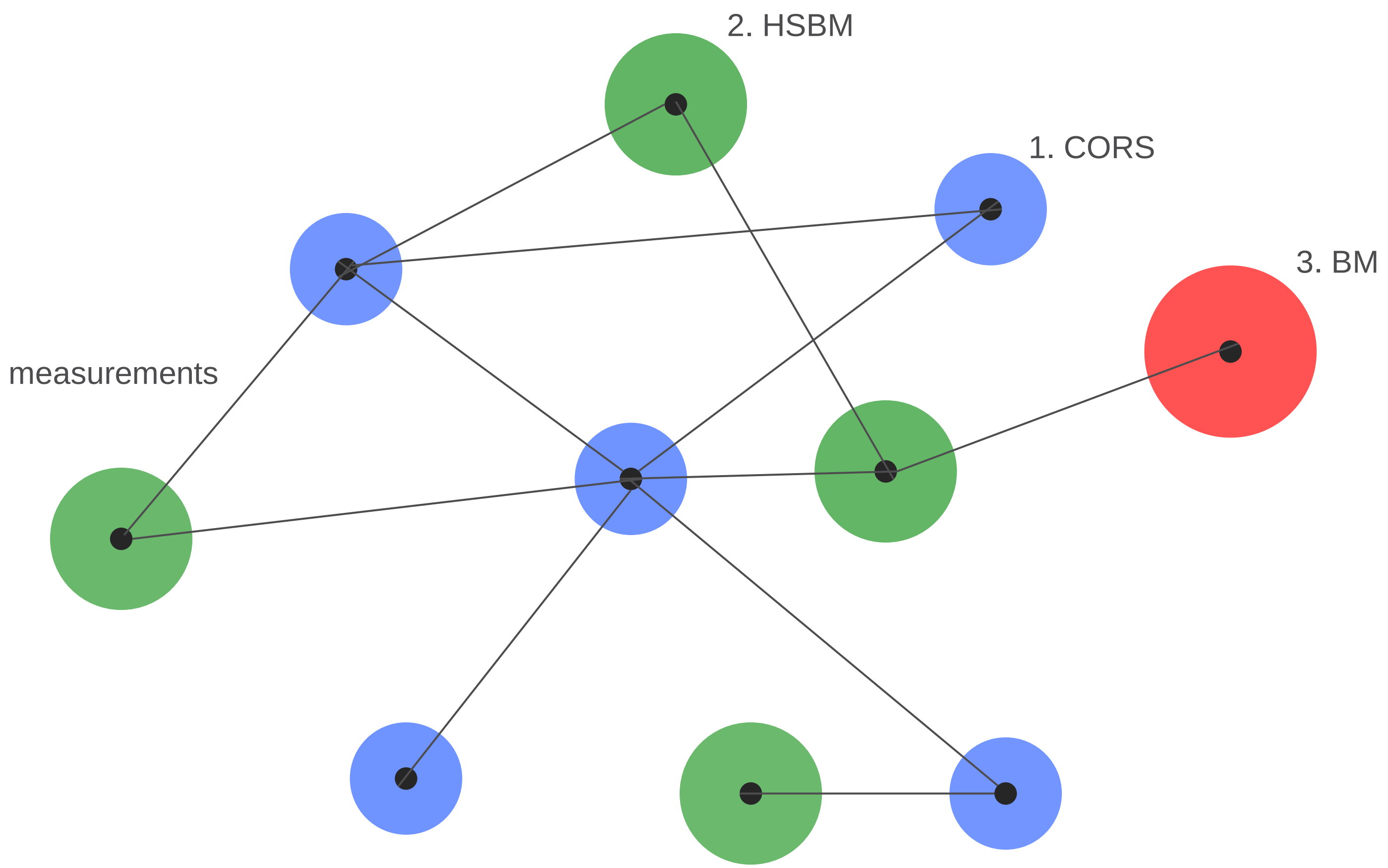

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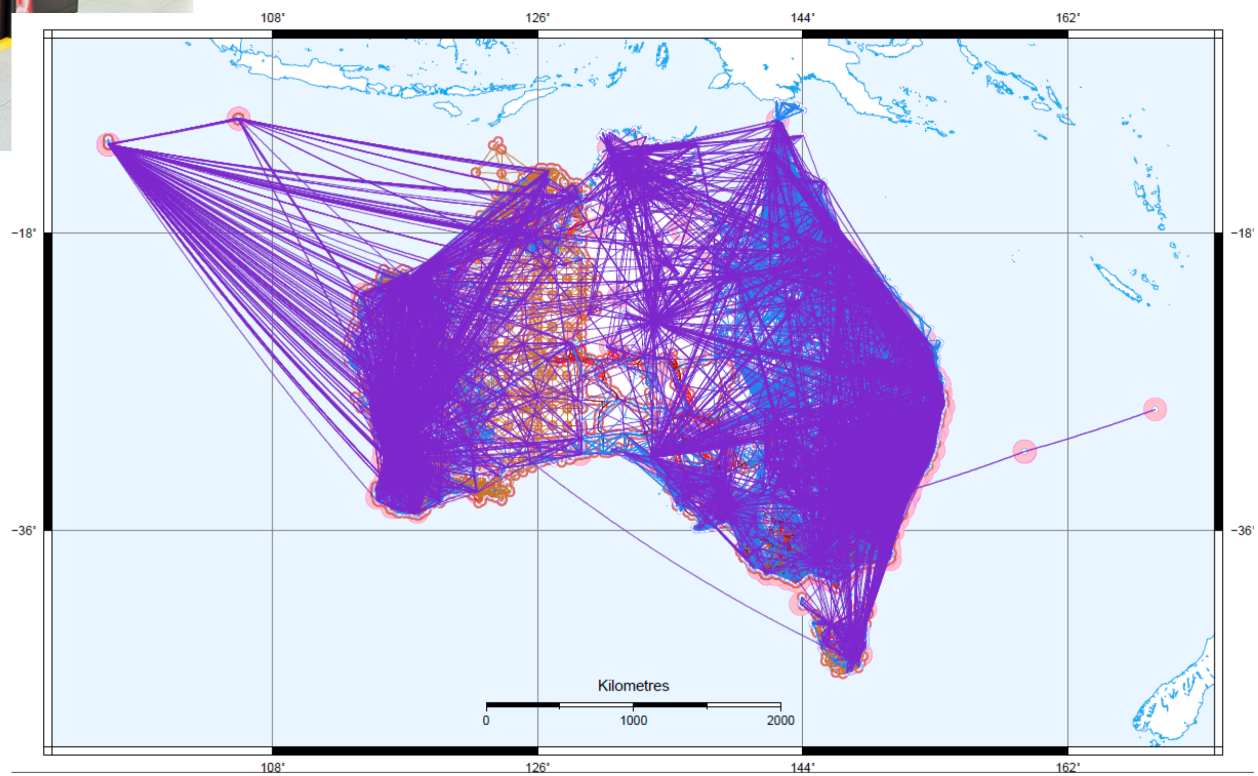
NCI Supercomputer

- 250,000 stations
- 2M measurements
- 2.8TB RAM
- ~5 hours



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Time dependent reference frame

- Location-based data can only be as accurate as the datum to which it is aligned
- Some applications require real-time, high-precision positioning such as the intelligent transport sector (e.g. autonomous vehicles and mining) and location-based services (e.g. asset management and emergency services)
- ICSM has endorsed a plan developed by PCG to introduce a time-dependent reference frame in 2020. This time-dependent reference frame will be called the **Australian Terrestrial Reference Frame (ATRF)**
- GDA2020 will be retained for as long as is needed

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Crustal Motion

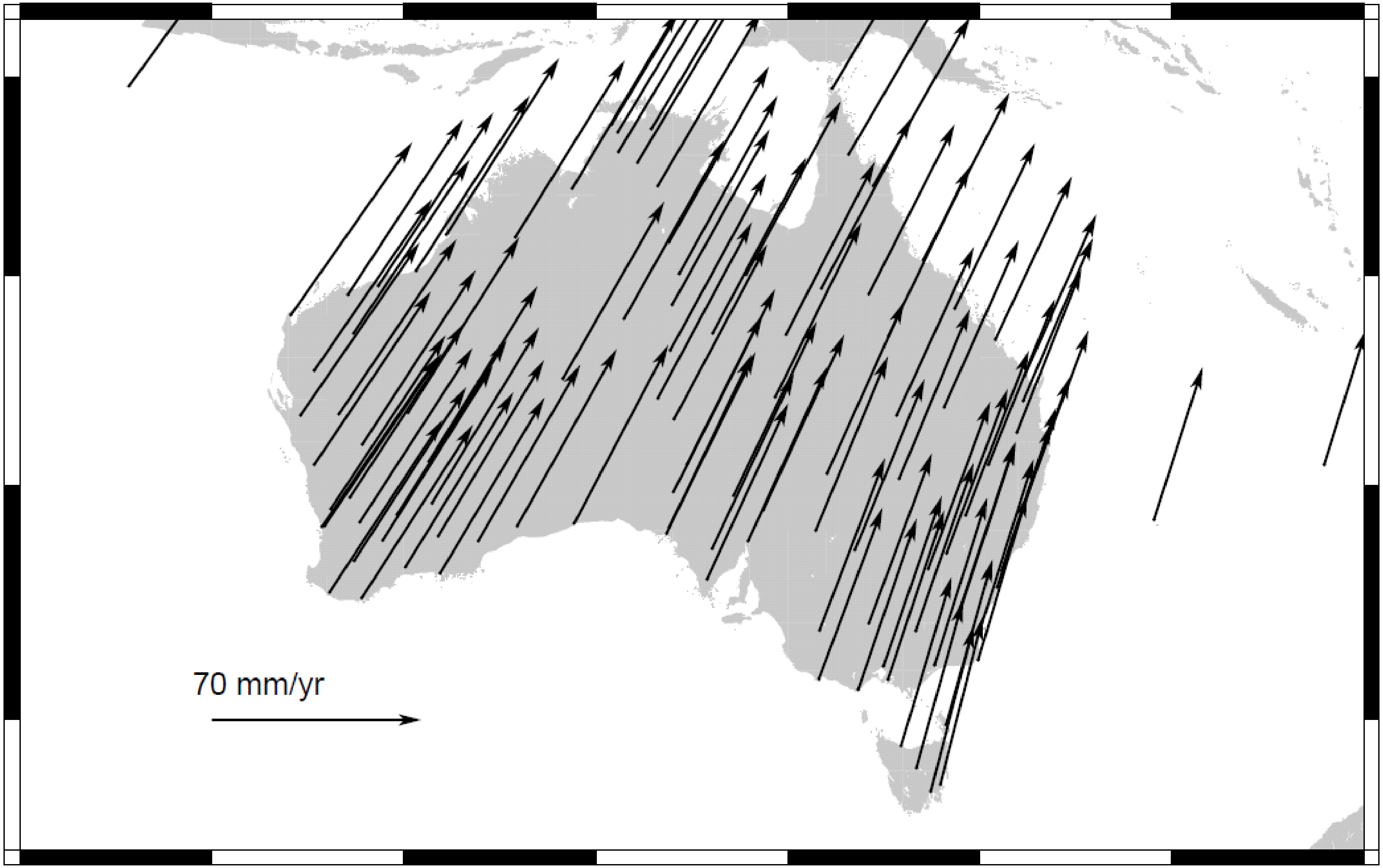

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Plate Motion Model

- GDA2020 / ITRF2014 can be converted to ATRF using the Australian plate motion model
- The model describes motion of the Australian tectonic plate based on continental plate motion
- Computed from 109 reference sites which define GDA2020
- Only **rotation velocities** of the 14-parameter transformation

Table 1: Transformation parameters for ITRF2014 to GDA2020 along with their one-sigma uncertainties (1σ). Units are in metres (m) and m/yr for the translation and their rates, respectively, parts-per-million (ppm) and ppm/yr for scale and its rate, respectively, and arcseconds and arcseconds/yr for rotations and their rates, respectively. The reference epoch t_0 is 2020.0.

	$t_x, \dot{t}_x$	$t_y, \dot{t}_y$	$t_z, \dot{t}_z$	$s_c, \dot{s}_c$	$r_x, \dot{r}_x$	$r_y, \dot{r}_y$	$r_z, \dot{r}_z$
rates	0.00	0.00	0.00	0.00	0.00	0.00	0.00
uncertainty	0.00	0.00	0.00	0.00	0.00	0.00	0.00
rates	0.00	0.00	0.00	0.00	0.00150379	0.00118346	0.00120716
uncertainty	0.00	0.00	0.00	0.00	0.00000417	0.00000401	0.00000370

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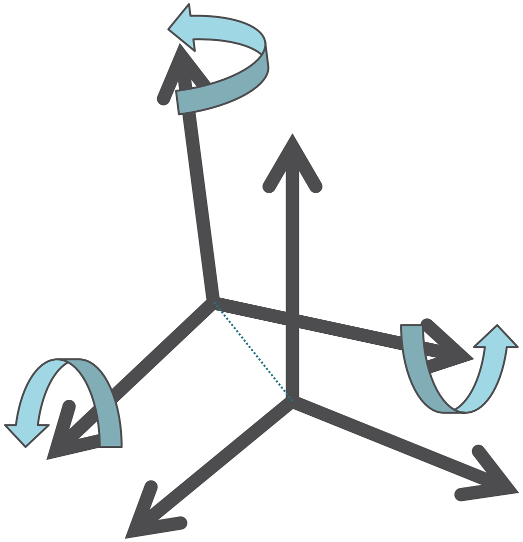
GDA94 – GDA2020 Transformation

- Use common points from GDA94 Determination and GDA2020 Determination
- 21 reference points from GDA94 AFN minus MAC1, COCO and XMIS due to seismic displacement
- Solve for the 7-parameters (3 x rotation, 1 x scale and 3 x translation) using CATREF software



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GDA2020 Products and Services

Intergovernmental Committee on Surveying and Mapping

GDA 2020

ICSM
ANZLIC COMMITTEE ON SURVEYING & MAPPING

Geocentric Datum of Australia 2020 Technical Manual

Version 1.1.1

Intergovernmental Committee on Surveying and Mapping (ICSM)
Permanent Committee on Geodesy (PCG)
8 January 2018

DATUM MATTERS

01

Changes are b
system that un
location inform
will bring Austr
latitude and lon
into line with gl
positioning sys
smartphones a
positioning tec

DATUM MATTERS

02 ***Know your data, know your datum***

Do you work with location information? Are you aware of the Modernisation of Australia's Datum and the accuracy of location data you use? With significant changes occurring in the world of location technology, it's more important than ever to understand the source and quality of your data.

Latitude and longitude coordinates are at best ambiguous unless they are linked to the related datum.

Why should I care about the national datum?

GDA94 – GDA2020 Online Transformation Service

Purpose

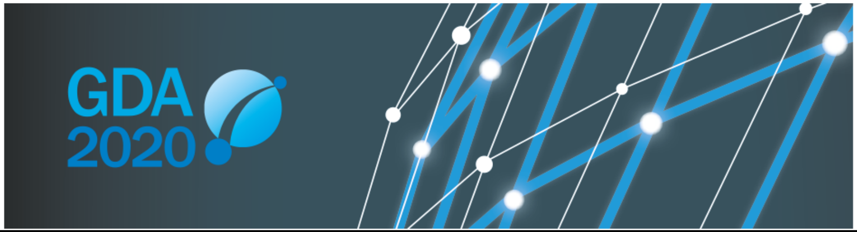
The online transformation service (powered by FME) provides a reference standard that enables software developers and spatial professionals to transform their data from the Geocentric Datum of Australia 1994 (GDA94) to the Geocentric Datum of Australia 2020 (GDA2020). Users can simply "drag and drop" files onto the page and receive an email with a link to download the output file.

Please note, this service is not intended to enable users to transform all their data from GDA94 to GDA2020; instead it aims to provide a method of checking systems and processes implemented by government or the spatial industry to ensure the transformation results are correct. The online transformation service accepts the following formats at this time: Shapefiles, CSV, ASCII Grid, GeoTiff, ECW, JPEG2000, GeoJSON

Home | Scientific Topics | Positioning and Navigation | Datum Modernisation in Australia

Datum Modernisation in Australia

DATUM MODERNISATION IN AUSTRALIA	PRODUCTS AND TOOLS TO ASSIST WITH TRANSITION	IMPLEMENTATION ACROSS THE AUSTRALIAN GOVERNMENT	INFORMATION FOR SPATIAL SOFTWARE PROVIDERS	GDA2020 TECHNICAL SPECIFICATIONS



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eGeodesy

- The ubiquitous nature of positioning now means we need to share our data and metadata with a new [and non-spatial] audience [sometimes in real time].
- Many of the standards we use are still text based (e.g. site logs, RINEX, SINEX)
- In order to service user demands our geodetic data and the associated metadata need to be **standardised, discoverable**, **interoperable** and **authoritative**
- The continual increase in the volume and complexity of data means we also need to generate, transfer and use data and metadata via a machine readable form
- There is a need to develop a standard to encode and exchange geodetic data and metadata

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Standards

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Standards

International Organisation for Standardization

ISO 19136:2007

GML

Geography Mark-Up Language

- TimeSeriesML
- Observations and Measurements
- ISO19111 – Spatial Ref. by. Coords
- ISO19127 – Geodetic Register
- ISO19161 – ITRS

+ GeodesyML (proposed GML Application Schema)

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Extending GML

- GML provides a rich set of primitive objects like (geometry, coordinate reference system, time etc.)
- But not detailed / specific standards
  - e.g. GML can not be used to describe everything about a GNSS, VLBI, SLR, DORIS site.
- The geodetic standard needs objects like antenna, receiver, cable, adjustments etc.
- GML Application Schemas <u>extend</u> GML to meet the needs of a specific community of interest (e.g. SensorML, GeoSciML, GeodesyML (proposed))

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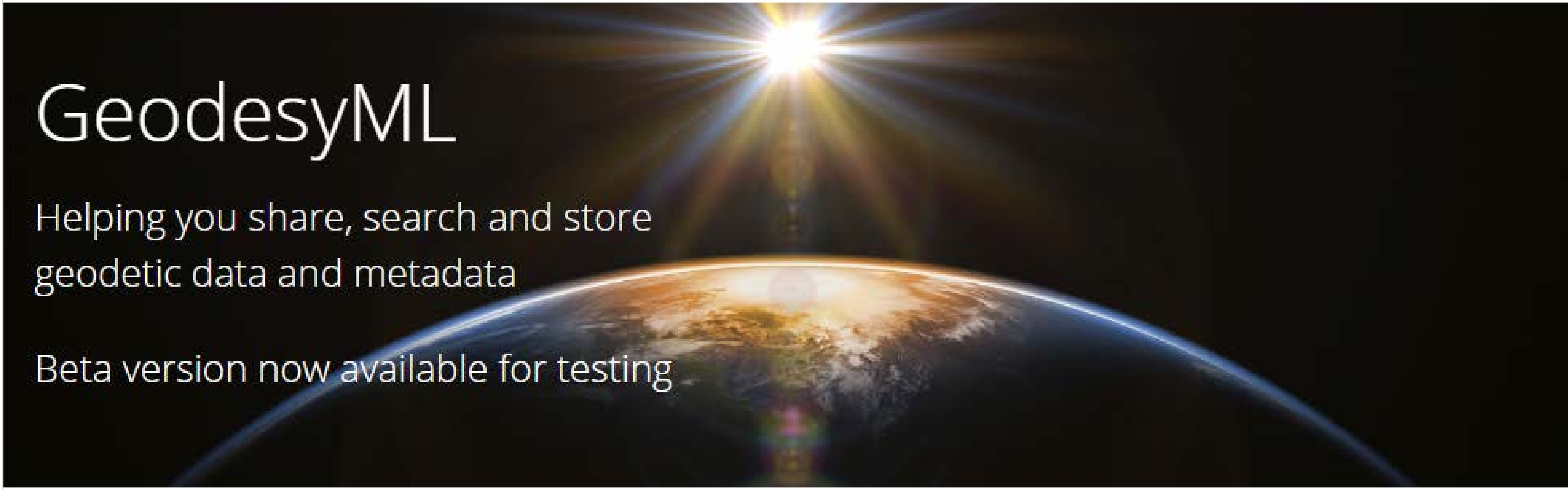
GeodesyML



Is GeodesyML for me?

Learn more about how the Geodesy Markup Language (GeodesyML) can help you share, search and store geodetic data and metadata

I am part of the geodetic community and am interested in finding out more

Read More »

GeodesyML for Managers

Find out how Implementing GeodesyML can help you improve the interoperability and discoverability of your geodetic data

I manage geodetic networks and work with users of geodetic data

Read More »

GeodesyML for IT Specialists

Technical information for IT specialists supporting geodesy programs including schemas, examples and code

I support geodesy staff with databases, programming and web services

Read More »

GeodesyML includes

- Standard way to encode and exchange:
  - GNSS related data and metadata
  - Terrestrial observations
  - Reference frames
  - Adjustments
  - Measurements
  - Site
  - Quality
  - Local Ties
- GeodesyML has been accepted by the IGS Board as the XML Standard to encode and transfer site log information.
- Future work will extend GeodesyML for the other techniques SLR, VLBI, DORIS.

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GNSS Site Manager

ALIC

You have not logged in and are not authorised to edit ALIC.

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GNSS Site Manager

ALIC

You have not logged in and are not authorised to edit ALIC.

Site Information

GNSS Receivers

New GNSS Receiver

Current GNSS Receiver (Since 2018-05-21)

Delete

Receiver Type	LEICA GR25
Serial Number	1830439
Firmware Version	4.20.232/6.524
Satellite Systems	☑ GPS ☑ GLO ☑ GAL ☑ BDS ☑ QZSS ☐ SBAS ☐ IRNSS
Elevation Cutoff Setting (degrees)	0
Temperature Stabilization (°C)	
Date Installed (UTC) *	2018-05-21 00:35:00
Date Removed (UTC)	
Notes	Firmware update only

Previous GNSS Receiver (2017-02-23 – 2018-05-21)

Delete

Previous GNSS Receiver (2017-01-31 – 2017-02-23)

Delete

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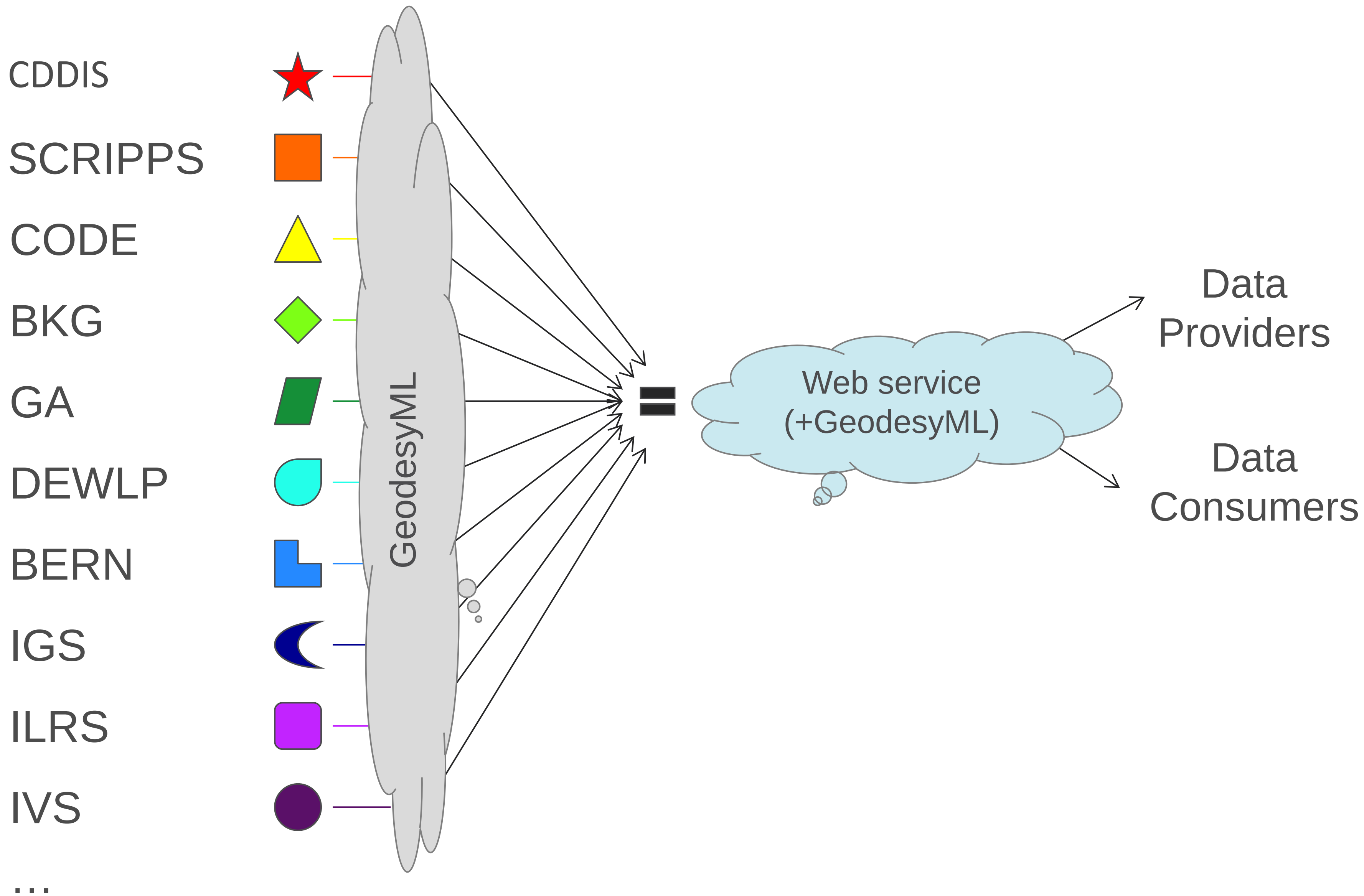

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