The Map is Only as Good as the Positioning

Kate McKinley, PG & Matt Toland
THG Geophysics, Ltd.

Christine Iksic
Precision Laser & Instrument, Inc.

Advances in Geophysical Equipment

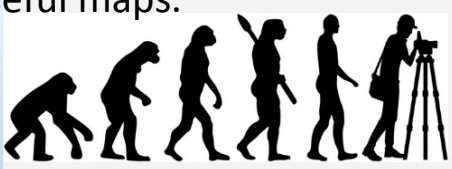
... are making us lazy!

- Geophysical equipment is becoming easier to use and better equipped with (automatic) positioning support.
- As a result, it may be increasing our chances for errors and mistakes!

- Geophysical equipment manufacturers are quick to sell us on features like:
  - automatic positioning support
  - built in GPS
  - easy bluetooth capabilities
- And, we rarely talk much to you about **what** you are "streaming" into your dataset.

Geophysicists are smart.

- We know about GPS.
- We've all spent the time learning about how it works, what the accuracy is and what the different data products are.
- At a minimum, we get an update on the advances with every new system we buy.
- We don't need to be Geodesists to collect good data and make useful maps.



Yet, I keep making mistakes

- As geoscientists, especially as geophysicists, we are expected to be experts in GNSS.
- And, meanwhile the advancements in GNSS are taking place just as quickly as those within our own field.
- We can't get lazy.

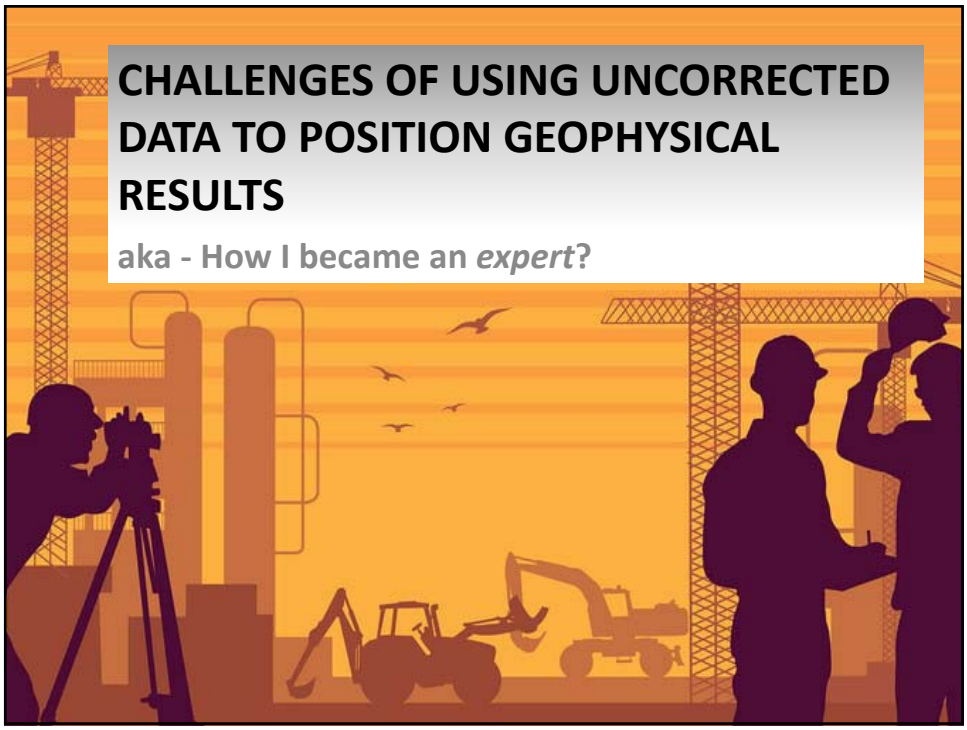
The easiest way to get the best data is to use field-corrected data.

- Real time kinetic (RTK)
  - utilizes a local base station
  - survey grade accuracy
- Real Time VRS Network
  - Local subscriptions
  - Accuracy within 4 cm
- Trimble's RTX Network
  - Annual subscription
  - Works all over US
  - Decent signal in tree covered area
  - Accuracy within 4 cm

THG GEOPHYSICS

CHALLENGES OF USING UNCORRECTED DATA TO POSITION GEOPHYSICAL RESULTS

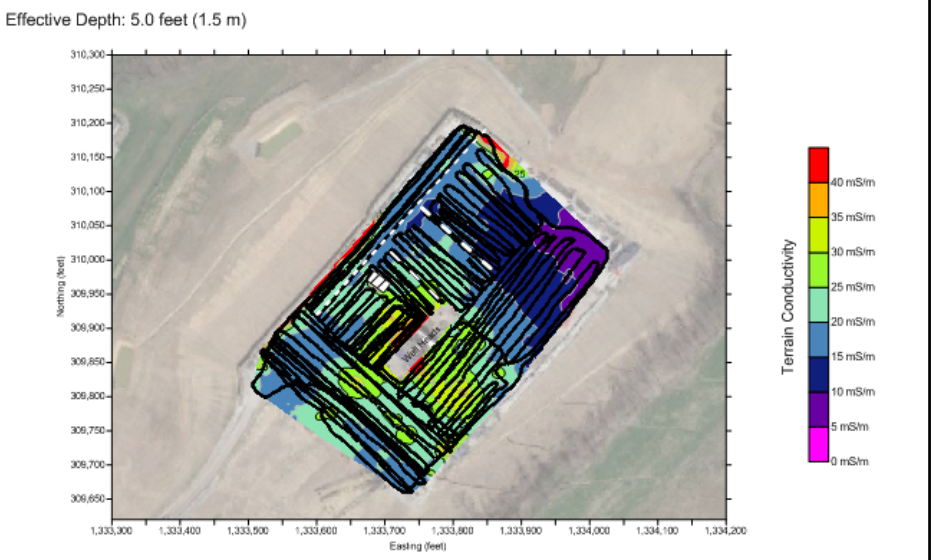
aka - How I became an *expert*?



Pushing a NMEA string

- When using continuous data acquisition systems, it is convenient to use real-time positioning support
  - Especially with easy configuration and Bluetooth connectivity
  - The only problem is that if you aren't using one of the real time corrected products discussed then you are incorporating "uncorrected" data into your dataset.

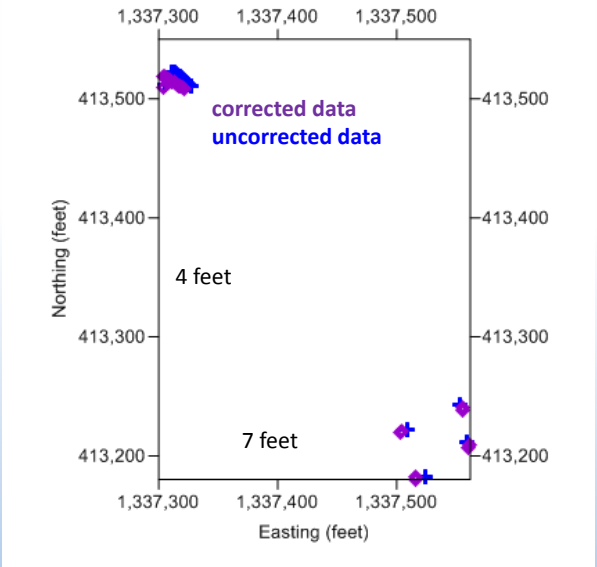
Brine Mapping

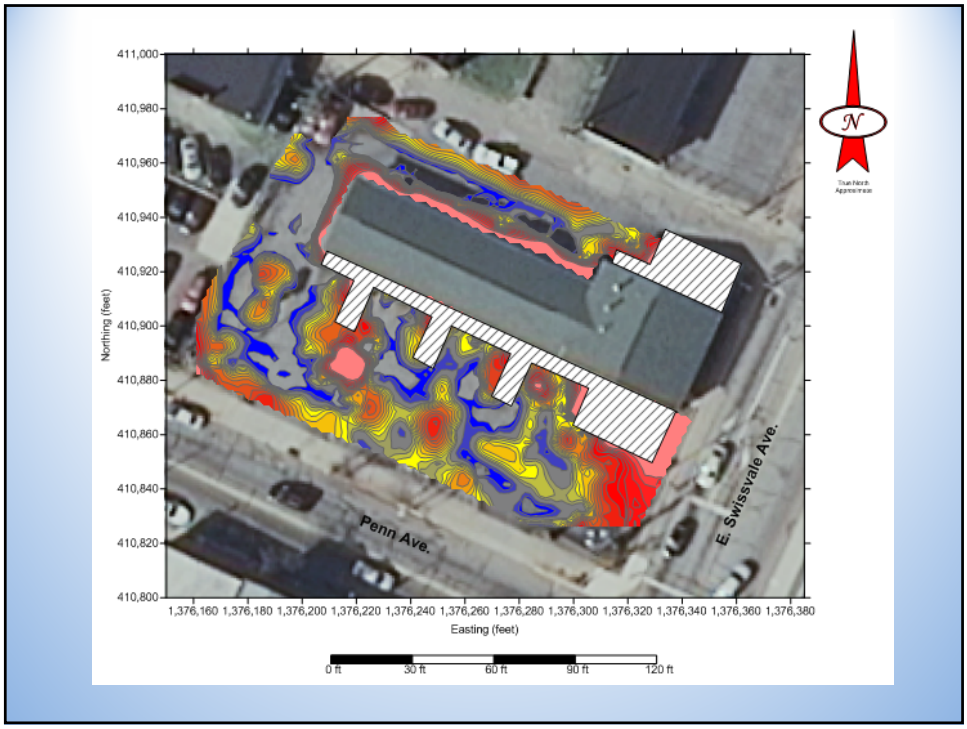


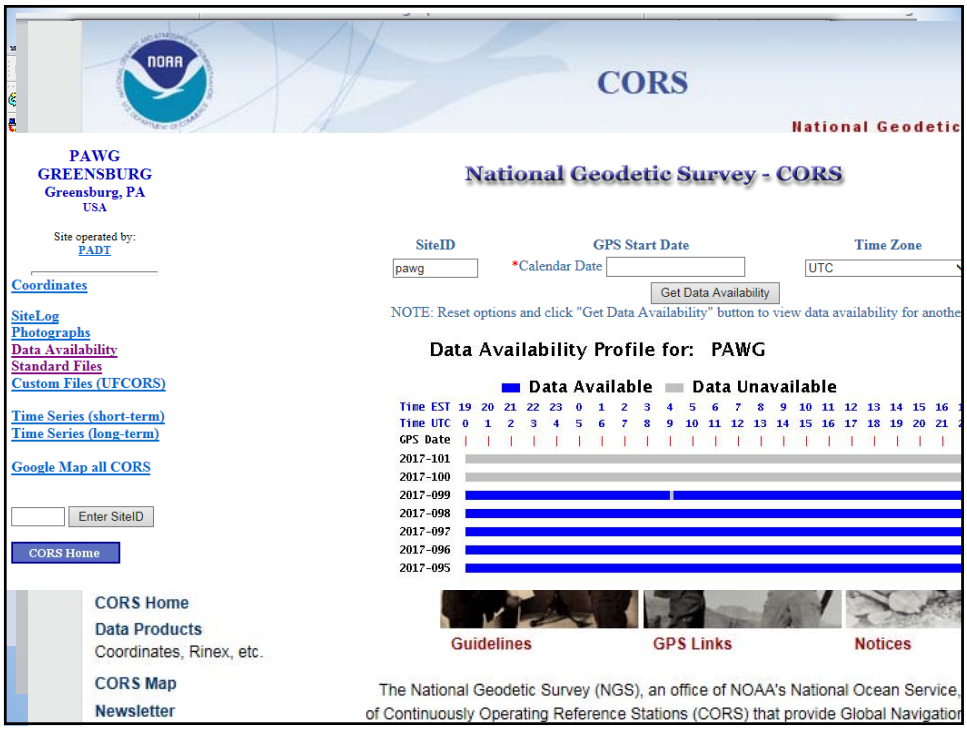
Pushing a NMEA string

- This isn't a bad approach.
- It is just important to understand what kind of accuracy that you have.
- It is more important to interpret and report results within that accuracy.
- It isn't appropriate to interpret targets or accuracies less than the accuracy of GPS data.
- **Or, these data can tediously be post-processed for greater accuracy.**

Differential Correction of Point Data

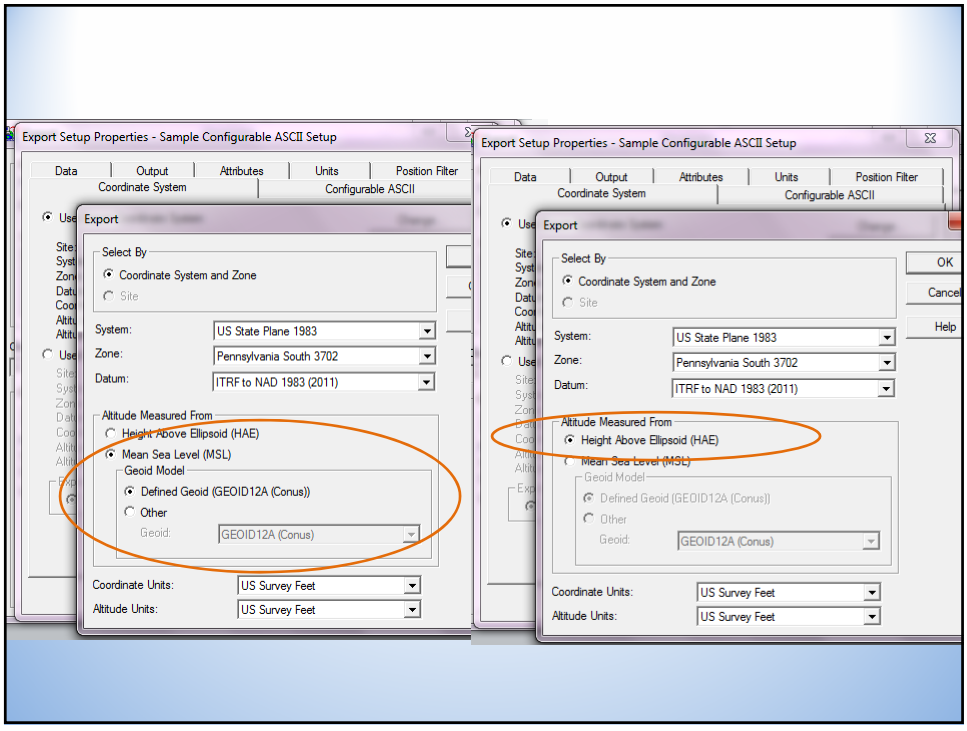



411,000
410,980
410,960
410,940
410,920
410,900
410,880
410,860
410,840
410,820
410,800
Northing (feet)
1,376,160 1,376,180 1,376,200 1,376,220 1,376,240 1,376,260 1,376,280 1,376,300 1,376,320 1,376,340 1,376,360 1,376,380
Easting (feet)
Penn Ave.
E. Swissvale Ave.
N
0 ft
30 ft
60 ft
90 ft
120 ft

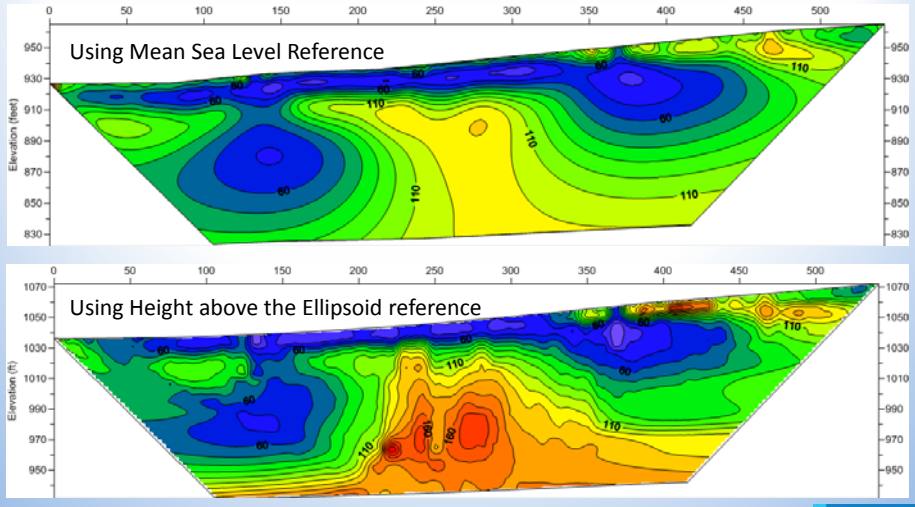

CORS
National Geodetic
PAWG
GREENSBURG
Greensburg, PA
USA
Site operated by:
PADT
Coordinates
SiteLog
Photographs
Data Availability
Standard Files
Custom Files (UFCORS)
Time Series (short-term)
Time Series (long-term)
Google Map all CORS
Enter SiteID
CORS Home
National Geodetic Survey - CORS
SiteID
GPS Start Date
Time Zone
pawg
*Calendar Date
UTC
Get Data Availability
NOTE: Reset options and click "Get Data Availability" button to view data availability for anothe
Data Availability Profile for: PAWG
Data Available
Data Unavailable
Time EST 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Time UTC 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
GPS Date
2017-101
2017-100
2017-099
2017-098
2017-097
2017-096
2017-095
CORS Home
Data Products
Coordinates, Rinex, etc.
CORS Map
Newsletter
Guidelines
GPS Links
Notices
The National Geodetic Survey (NGS), an office of NOAA's National Ocean Service,
of Continuously Operating Reference Stations (CORS) that provide Global Navigatior

Choose the Appropriate Z-Component

- The geoid corresponds with mean sea level (MSL).
- The ellipsoid is a smooth mathematical surface that approximates the size and shape of the earth.
  - GPS uses the WGS 84 ellipsoid as its height reference surface **(HAE)**.
- Throughout most of the Continental U.S. the geoid is below the ellipsoid.
- In western Pennsylvania, the difference between MSL and HAE is ~100 vertical feet



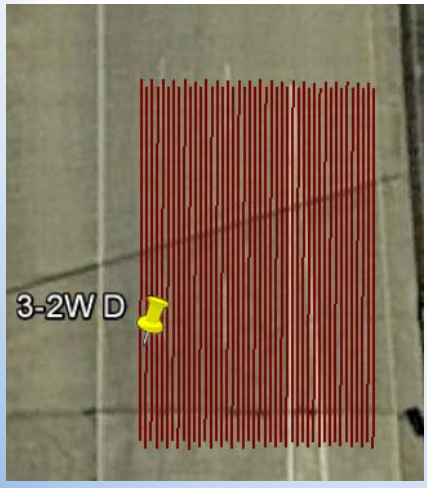
Exporting Vertical Data at MSL vs. HAE

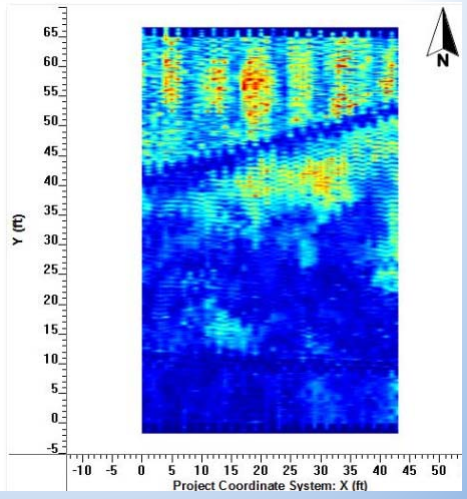


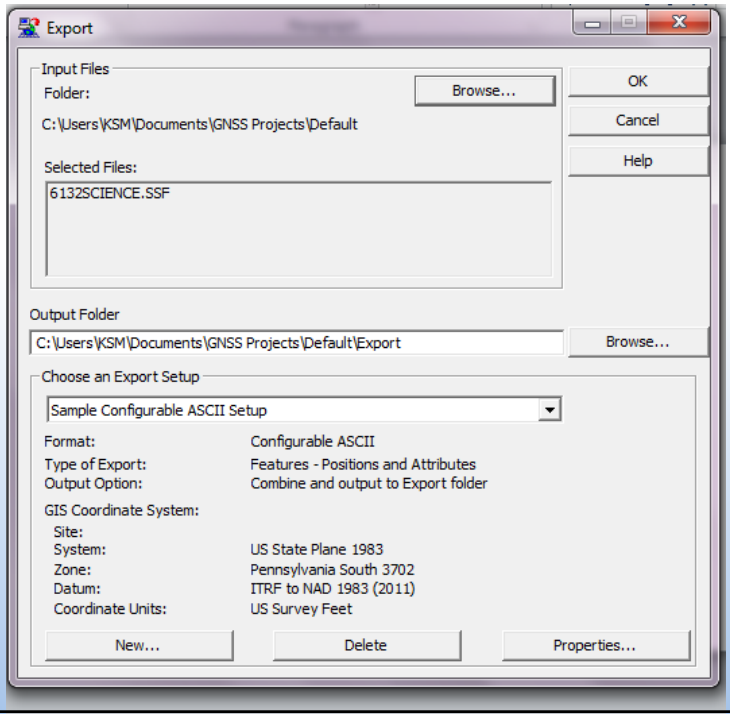
Exporting

- NAD 83 2011 is most current update of NAD 83
- If you were to export data referencing NAD 83 CONUS, then you could expect ~1 meter of error.
  - This would be the same as exporting WGS84 data, which today , has a difference of approximately 1 meter between them (this varies across the Earth)

Use your data to check your positioning

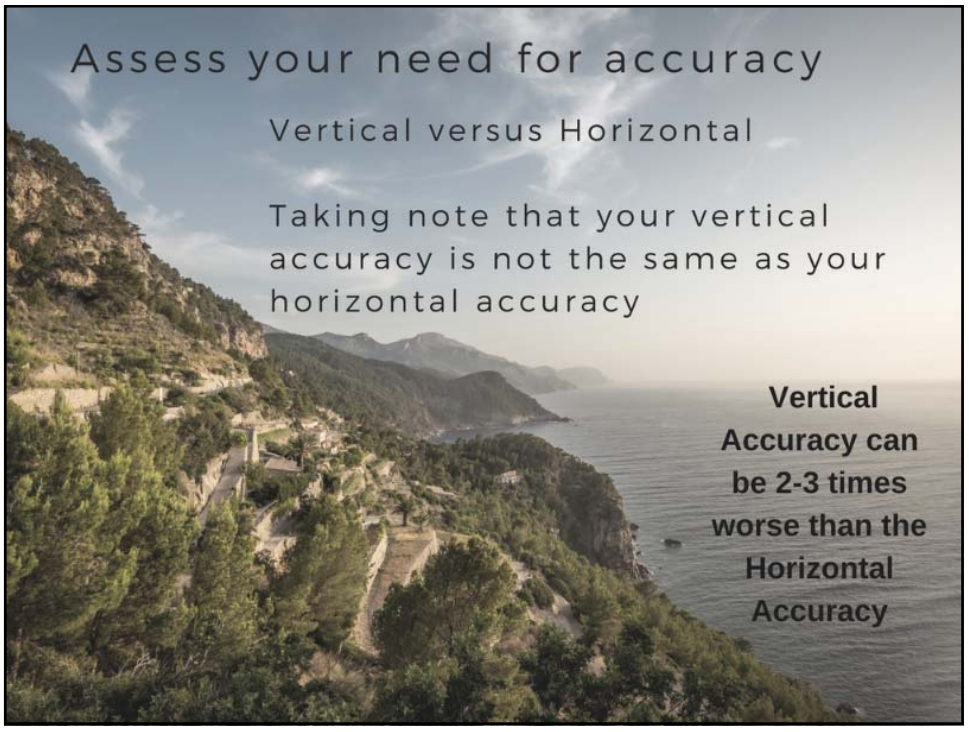


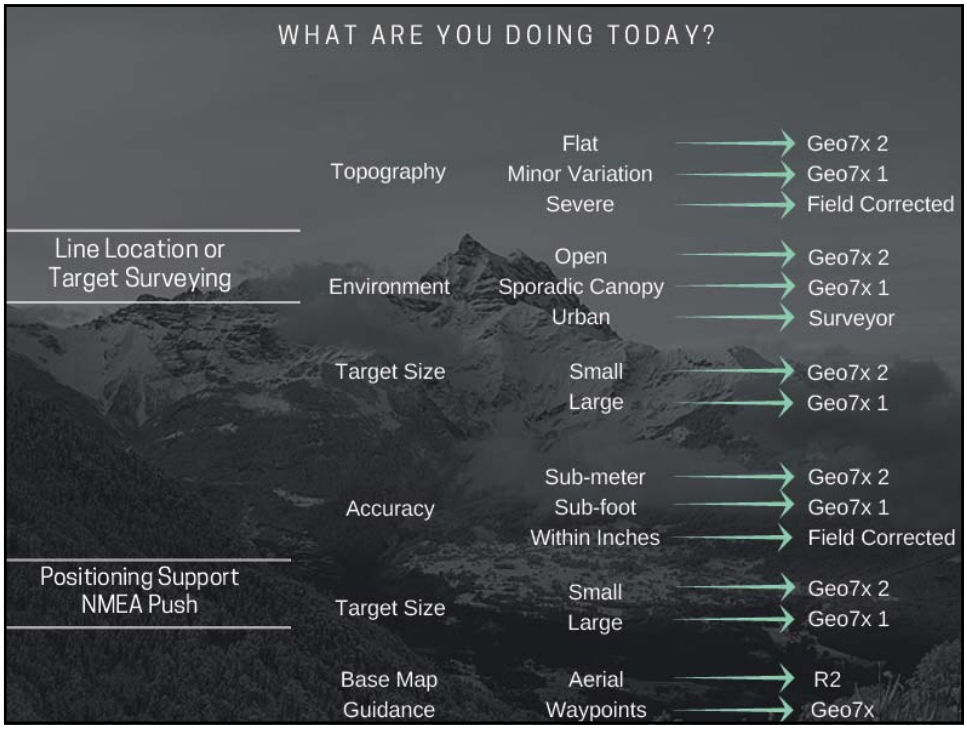




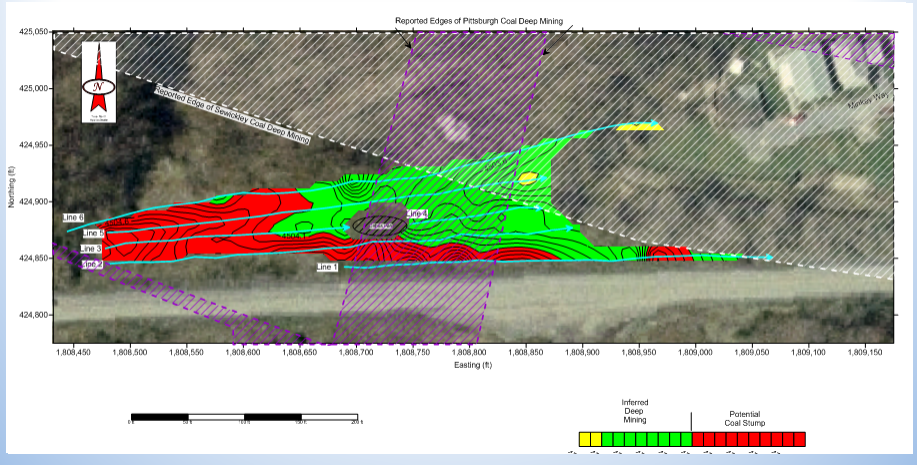
Data Overlay

- Choose a base map that matches your export parameters
- Ensure the map quality of your overlay
  - Google Earth should be ok when using KML
  - Some maps can introduce projection issues
- Great Aerial Imaging Sources Available
  - PA we have PASDA
  - NC – NC One Map
  - USGS is a great resource





Poorly Corrected Gravity Data

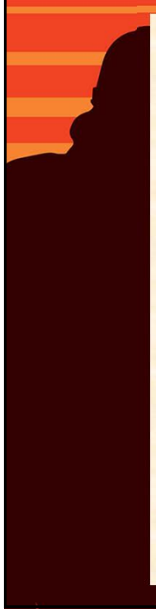


What do you need versus what do you have?

- It is important to give thought to your project objectives.
  - What do you plan to report? Projected anomaly size? Reason for survey?
- It is important to understand your equipment.
  - There is no need to go to great efforts to record data with accuracies significantly better than that of your measurement spacing.

THG GEOPHYSICS Ltd

CONCLUSIONS



- There are numerous ways that we can accidentally introduce positioning errors to our datasets:
  - Pushing a NMEA string
  - Differential Correction of Point Data
  - Using the Incorrect Vertical Component
  - Using the Inappropriate Export Settings
  - Poor Quality Base Maps
- **It is so important that we do not let the ease of accessing positioning data impact our map quality**
- **Don't get lazy.**