Empowering Project Lifecycles with Geomatics Positioning for Enhanced Data Utilization

Presented For RemTec October 2024 Kris Kwiatkowski P.Eng







Δ What do you think of when you hear the name??

- Δ $\,$ Land Survey?
- Δ Mapping?
- Δ Photogrammetry
- Δ Imagery
- Δ LIDAR
- Δ GIS
- Δ CAD



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- △ Perhaps more important then what is Geomatics?? When do I use Geomatics?
 - $\Delta \quad \text{I need to measure my site } -3\text{D} \\ \text{Scanning}$
 - Δ $\;$ Where's the nearest pizza hut?
 - Δ $\,$ What does the site I'm going to look like?
 - Δ $\,$ Drop a pin GNSS Location $\,$



- Δ Siri "Navigate me to the Banff Springs" Map
- $\Delta~$ Blue Cruze
 - $\Delta \quad \text{Requires the road to be mapped} \\ \text{prior to being hands free}$
 - Δ Onboard Radar and 360 visual sensors
- △ Geomatics, tools systems and Position empower the modern world and is now used daily by virtually everyone.



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 Δ The Hub that holds the spokes of a project together





Introduction

- $\Delta~$ Kris Kwiatkowski P.Eng
- $\Delta~$ 2008 Batchelor of Science in Geomatics Engineering
- $\Delta~$ Certified Drone Trainer
- $\Delta~$ Director Engineering / Geomatics ProDelta Projects Inc.





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How is data gathered today?

Δ Surveyor

- △ Gathers high precision data specifically referenced in a coordinate system, to a monument or to Government control reference (PPP, CAN-NET, Smart-Net)
- Δ Establishes a project control network
- Δ Holders of site data and provides it to all contractors / or their own customer in a format usable for them.
- Δ Experts in coordinate systems and merging data
- △ Traditional owner of enhanced data collection methodologies High End RTK, Drones, Scanners, LIDAR
- $\Delta~$ Redundancy and Reporting



How is data gathered today?

Δ Environmental /Mapping

- Δ General mapping level data collection (+2m)
- $\Delta~$ Generally collected using a Ipad, Handheld
- Δ Correction Services (EOS, Catalyst, SBAS) 60cm, 30cm,
- Δ $\,$ General mapping coordinate system WGS84 / UTM $\,$
- Δ $\,$ Delivered via GIS $\,$
- Δ Multiple contractors Propagate Error
 - Δ Drone + 2m
 - $\Delta~$ EM Survey +30cm









How is data gathered today?

- Δ $\,$ Construction / Remediation $\,$
 - Δ Works in Local / site coordinates / UTM / UTM GROUND
 - Δ Flat Earth (5000, 5000, 100)
 - $\Delta~$ Has own survey contractor with GNSS or Total station
 - Δ $\,$ Machine Control.





The Problem

Δ Error Budgets

 Δ Your survey is only as accurate as your least accurate collection





The Problem

Δ Error Budgets

 Δ Imagery doesn't always align as expected in complex environments



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The Problem

Δ Coordinate Systems

 Δ Rotational issues? Elevation issues? Local vs UTM?





The Solution

Δ $\,$ Positioning is Key.

- Δ If your project starts at CM level positioning and control is available, then it is much easier to make subsequent datasets line up.
- Δ $\,$ Remember your Error budgets $\,$
 - Δ Can you prove your accuracies?
 - Δ Reports
- Δ Remember each contractor should have access to the same control.
- Δ Define control and have a chosen in house positioning workflow
 - Δ $\,$ Choose Parameters $\,$
 - Δ Choose Equipment
 - Δ Choose data sources





The Solution

- $\Delta \quad \text{Leverage a Geomatics based solution} \\ \text{ in all aspects of your project lifecycle}$
 - $\Delta~$ GIS Based
 - Δ $\,$ Constant coordinate system $\,$
 - Δ Access data via the map rather than File Manager.
- $\Delta~$ Ensure contractors are aware of your requirements
 - $\Delta~$ Provide control points
- $\Delta~$ Fly the drone regular and often to detect site variations
- $\Delta \quad \mbox{Training of your field and office staff on field procedures }$
- Δ Set processes to define project systems in GIS and CAD





Change Detection Image: Detection



- Δ $\,$ Data Integration and synchronization also makes AI and Machine much more effective
- $\Delta \quad \mbox{Train to look for features in a} \\ \mbox{photo} \label{eq:alpha}$
- Δ $\,$ Returns a confidence value $\,$
- Δ Can be trained to search for a variety of items
 - $\Delta \quad \mbox{Bring Transparency to your} \\ \mbox{sites and projects}$







 Δ Adding spatial and non-spatial data together allows you to draw conclusions that wouldn't normally be possible.





Constructability

- Δ Take Offs
- $\Delta~$ Cut/Fill Analysis
- Δ Grade Planning (Pipeline)
- Δ $\,$ Mass Haul Calculations $\,$
- $\Delta \ \ \, {\rm Bid} \ \, {\rm Support}$



		Area m²			Volume m ³	Comp/Ratio		Compact		Export	Change
	Total	Cut	Fill	OnGrade	Cut Fill	Cut	Fill	Cut	Fill	-Import	Per 0.1 m
Pad	32,503.83	15,127.74	16,276.56	1,099.53	6,737.38 6,146.56	1.00	1.20	6,737.38	7,375.87	-638.49	3,900.46
Road	21,750.61	7,488.91	12,860.22	1,401.48	4,163.03 3,505.87	1.00	1.20	4,163.03	4,207.04	-44.01	2,610.07
Regions Total	54,254.44	22,616.65	29,136.78	2,501.01	10,900.41 9,652.43			10,900.41 1	1,582.91	-682.50	6,510.53



The Opportunities Construction Progress Monitoring



- Δ Cut/Fill Analysis
- Δ Daily Progress Monitoring
- Δ Site Transparency
- Δ Volume Reporting
- $\Delta~$ App based site data
- $\Delta \ \ {\rm Real \ Time \ decision \ making} \\ {\rm and \ collaboration}$



Construction Progress Monitoring



The Opportunities Construction Progress Monitoring



The Opportunities Construction Progress Monitoring



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Machine Control Support

- Δ Program
- Δ Troubleshoot
- $\Delta \ \ \text{Update}$

ProDelta MST

One Mobilization – Multiple Scopes

- $\Delta~$ Environmental Drilling GNSS Location enabled Rig
- Δ Access Repairs
- Δ Small Decommissioning
- Δ Cut/Cap
- Δ Snow Removal (Limited)
- Δ $\,$ Ideal for Spill Response

Inputs

- Borehole Logs
- Chemical analysis
- Digital Elevation Model

Summary

- Δ $\,$ Geomatics and data integration is one of the key revolutions of the last 20 years
- Δ Just because you have the tools doesn't mean that things will just fit together
- Δ Consideration to data must start at the first stages of a project to get the most out of data
- Δ Invest in the right tools and the right people to make it happen
- Δ Spending time in the field to set a site up right opens the doors to leverage data at every stage of the project or over the lifecycle of an asset.
- Δ Remediation and closure of a site can be a complete lifecycle and geomatics tools like imagery and machine control can improve the safety on a site, reduce material disturbance and reduce costs significantly.
- Δ Giving Owners, Stakeholders, Professionals, Contractors and Inhabitants of the Land access to the data give new and unique collaboration opportunities.
- Δ Using Geomatics tools make projects more efficient, safer and bring down costs.

Questions www.prodelta.ca

Image Sources

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- Cansel.ca
- <u>https://www.munich-geocenter.org/research/geodesy</u>
- EOS (eos-gnss.com)

