

# Lessons Learned in an Emerging Drone-Based Geophysics Industry



PIONEER EXPLORATION





# Who We Are



**MICHAEL BURNS**

Position: President



**MACK EVENDEN**

Position: Vice President



**KIYAVASH PARVAR**

Position: VP of Geophysics



**ANDREW GAGNON-NANDRAM**

Position: VP of Technology

11 field staff

1 office support

Flat management structure, Culture of Ownership & Excellence, Minimal Turnover

- Highly experienced and fully supported survey teams
- Focus on Data quality & Excellent client support



# What We Do

Pioneer Exploration Consultants Ltd. is a drone-based geophysical surveying company providing ever expanding services to its major multinational clients across diverse industries including mineral exploration, unexploded ordnance (“UXO”) detection, remote sensing. Pioneer Exploration Consultants Ltd. is a Canadian company with 9 years of international experience in **drone magnetometer, hyperspectral and LiDAR surveys**.





# Where We Work

## 9 Years of UAV-MAG surveys





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## 9 Years of UAV-MAG surveys





## Our Start - 2013

- Company formed
- Exploration Services
- Purchased Drone! (for \$60,000!!)
  
- *Orthoimagery*
- *Geological mapping*
- *Pit and pile surveys*
- *Filming and Photography*
- .....until Frank Wang ruined my plans





## Our Start - 2013

- Company formed
- Exploration Services
- Purchased Drone! (for \$60,000)

- Orthorectification
- Geomatics
- Photogrammetry
- Topography





# Our Start-2013





# Our Start-2013





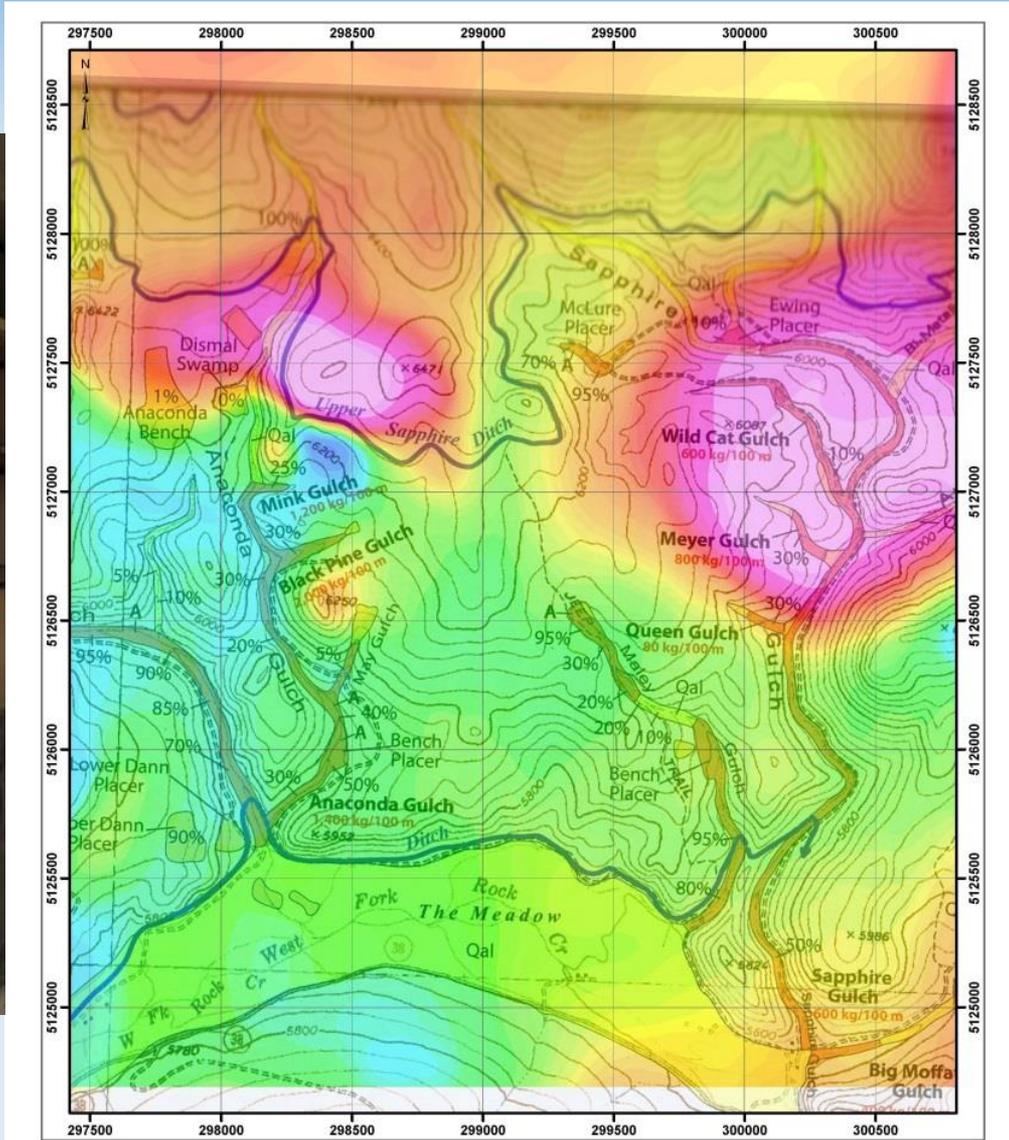
# UAV-MAG!!!- 2013



...what could go wrong with this genius idea?



# UAV-MAG!!!- 2013





# Growth Phase – 2014-2016

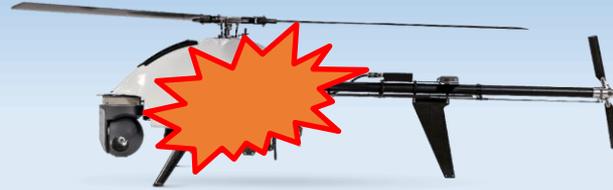


- Drones, drones and more drones!
- *Better payload*
- *Better endurance*
- *Increased survey production*





# Growth Phase – 2014-2016



- Drones, drones and more drones!

- *Better load*
- *Better endurance*
- *\*Complex*
- *\*Accident prone*
- *\*Expensive*
- *\*Poorly Supported (but a great sales team!)*
- *\*Complex Supply Chains*
- *\*Limited Parts & long lead times*





## Growth Phase – 2014-2016

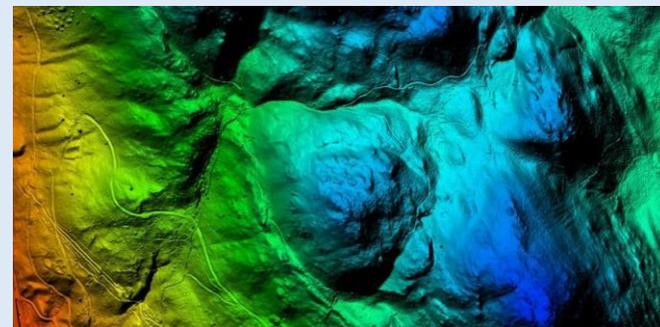
- DJI M600 & M600 Pro
- A complete revolution in multirotor drone technology
- *Better payload*
- *Better endurance*
- *Increased survey production*
- *Simple operation*
- *Durable*
- *Cheap*





# A Real Company– 2017-2019

- Finally started making money vs spending money
- *Steady growth of clients*
- *Adoption of UGCS & Collaboration and feedback on development*
- *Increased project capacity and project size*
- *Onboarding additional field crews*
- *Extended health benefits*
- *Safety culture, regulatory management, structure and organization*
- *Diversification (LiDAR, hyperspectral, Resistivity.)*





## Where Are We Now?



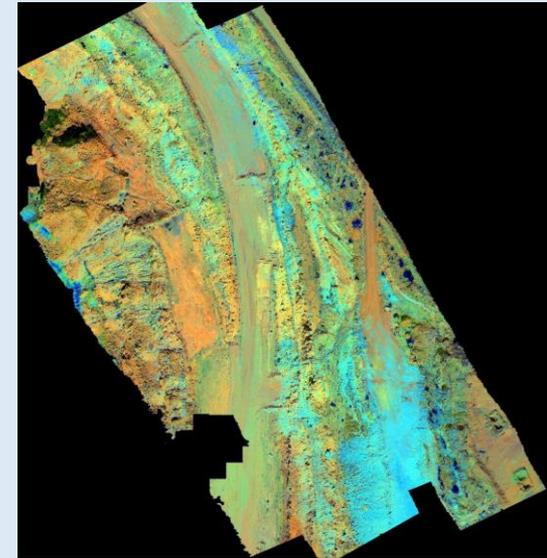
- Highly sensitive systems with less noise
- Better terrain following capabilities
- Early sense and avoid systems
- Updated regulations with increased scrutiny on safety and environmental impact





# Building a Team for the Future– 2020-2022

- Our people are the most important part of our success at Pioneer
- Maintaining workflow, management structure and task division
- Focus on investing in people – e.g., Gem Systems, black square drones, phoenix lidar \* Companies that fully support their products and offer exceptional service
- Adopting new technology\*





# Industry Ecosystem Growth

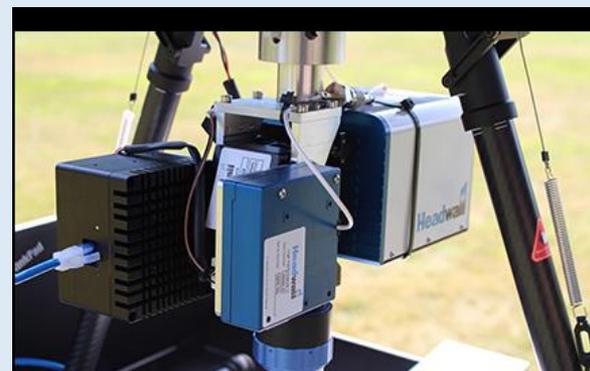
- Sensor manufacturers are now focusing on developing new drone-based geophysical sensors

Increase in:

- *Sensor manufacturers and sensor types*
- *Drone manufacturers*
- *Service providers*
- *Mass adoption of drone based surveys as an exploration service*

## Terrapulus drone sensors

- Magnetics
  - DRONEmag
  - AirBIRD
  - AirGRAD
- VLF
  - AirVLF
- Radiometrics
  - D230A
- EM
  - GEM-2 UAV
- Hyperspectral
  - Nano-Hyperspec VNIR Sensor
  - Micro-Hyperspec (Multiple Spectral Ranges)
  - Co-Aligned VNIR/SWIR Sensor
- GPR
  - GeoDrone 80

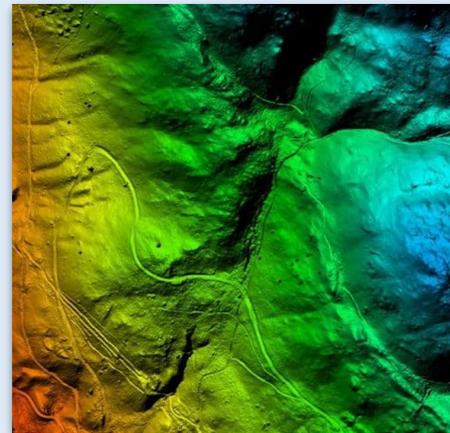




PIONEER EXPLORATION

# Light Detection and Ranging (LiDAR) Surveys

- Multiple flight platform options
- Phoenix Ranger-LR & XL Long Range LiDAR system
- Centimetre level resolution from up to 500m elevation, even through dense vegetation
- Ground Based GNSS RTK/PPK base station
- RTK-based Accuracy and Precision





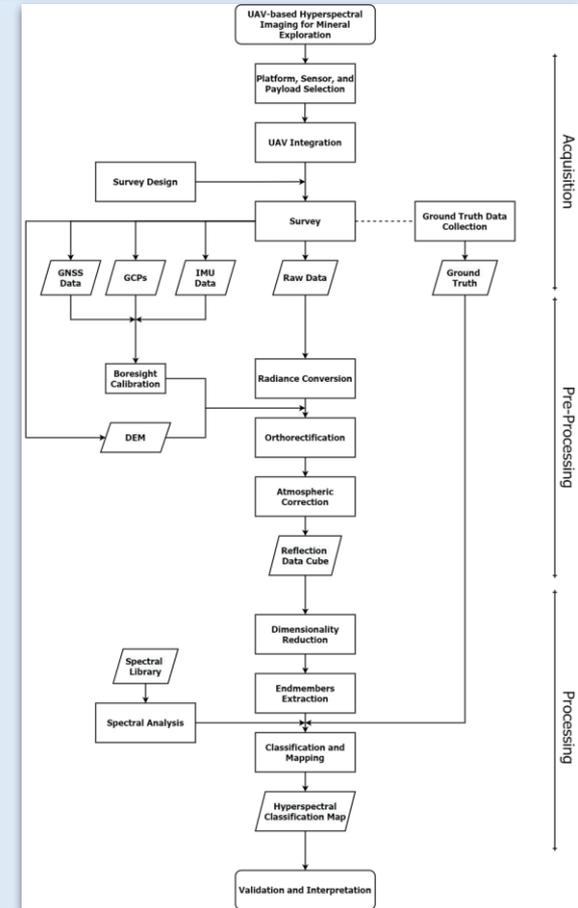
# Radiometrics: UAV-Mounted Gamma Ray Spectrometry

- Surficial geology mapping
- Glacial dispersal train delineation
- Radiation contamination detection





# Hyperspectral Imaging





# Where Are We Headed?

- Very Low Frequency (VLF-EM)
  - Larger, heavier sensors
  - Heavy lift, long endurance drones





# Important lessons

## **Safety makes us money**

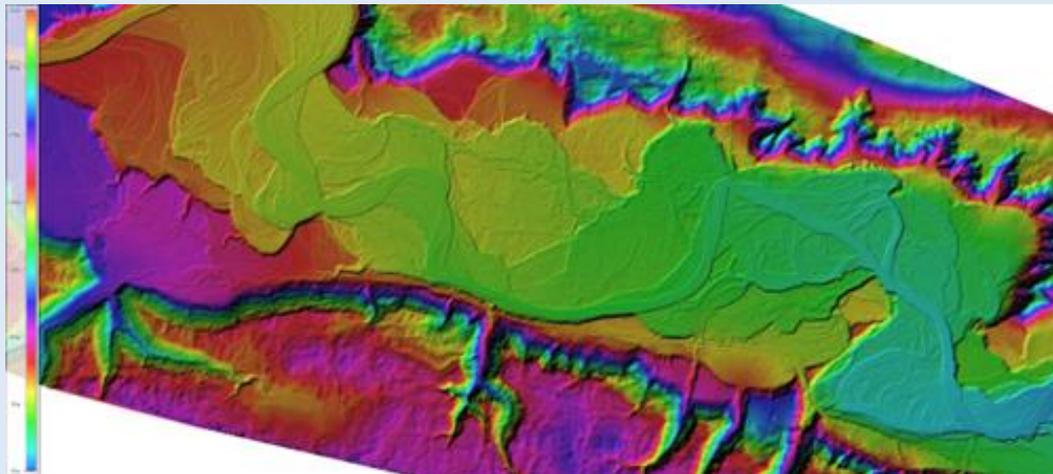
- Reduces risks, accidents lead to increased production, lower costs and more reliable service

## **Data Quality is paramount**

- No one cares that you fly a drone when they load your results into and start drill targeting or planning exploration

## **Keep pace with innovation – internal and external R&D**

- Build relationships with your sensor manufacturers, support your peers in the industry and give new things a try,
- Never give up – lessons from failures can lead to success
- Find solutions





The End

Thanks!