

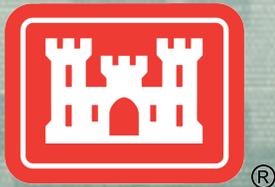
# Advanced Classification at Joint Base Cape Cod (JBCC) – The Challenge of Tech Transfer and Lessons Learned

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US Army Corps of Engineers  
**BUILDING STRONG**



# Execution!

- Early in 2013 USACE employees were tasked with assembling a Metalmapper to collect geophysical data at JBCC
- Within two months the instrument was assembled, on-site, and collecting data.
- By April 2014 two Metalmappers were on-site operating at full production.
- Many challenges were encountered and overcome through the entire duration of this project.



# Discussion Topics

- Unpacking, Assembly, and Implementation
- Mobilization Platform/Equipment
- Computer and Software
- GPS
- Wear and Tear



# Unpacking, Assembly, and Implementation

- Unpacking the Metalmapper
  - ▶ Crate first opened late February 2013
  - ▶ Are all the pieces there?
  - ▶ Where do all the pieces go?
- Initial Assembly
  - ▶ Missing pieces fabricated
  - ▶ The mobile Metalmapper
- Wiring and Computer Setup
- Data Collection
  - ▶ Data collection began May 2013



# Unpacking and Setup

- Metalmapper Shipped to us in a crate. Accompanied with several cardboard boxes, the sled and the boom
- Originally we were not sure the boom belonged to the instrument
  - ▶ All photographs that we had seen were of cart mode
- Instruction manual found in a cardboard box with the monitor
  - ▶ Helpful but not always clear



# Unpacking and Setup



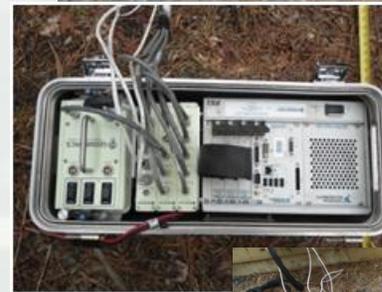
# Assembling the Metalmapper

- Are all the pieces there?
  - ▶ Mostly, but a couple key pieces were missing
    - 3 point adapter
    - Monitor mount
    - GPS
- Where do all the pieces go?
  - ▶ Not always clear
  - ▶ Instructions not always helpful
  - ▶ At this time there were only a handful of people to consult with issues



# Assembling the Metalmapper

- Missing pieces kept the Metalmapper stationary
- Missing pieces fabricated on-site



# Tractor-mounted Configuration



- Mobilization Platform
  - ▶ Developed based on existing photographs!
  - ▶ Tractor mounted
  - ▶ 3 point hitch to raise and lower boom
  - ▶ Monitor mounted in front of operator at arms length



# Computer and Wiring

- Although the Metalmapper was mobile, it could not collect data
  - ▶ Touch screen monitor did not function
    - Used keyboard and optical mouse with USB cable
    - 115 V PC monitor used
  - ▶ IMU not communicating
  - ▶ No GPS
- The Metalmapper computers are not plug and play
  - ▶ Each piece of hardware you connect needs a dedicated, properly configured port
  - ▶ Drivers or software may also need to be installed



# Computer and Wiring

- We needed help
  - ▶ We did not yet understand how to configure communication ports
  - ▶ We did not have access to or understand how to connect the GPS
- Contacted the manufacturer (Geometrics) and co-workers for help
  - ▶ Trimble R-8 GPS system rented
  - ▶ With some outside assistance and a little trial and error the Metalmapper could collect quality data



# Data Collection

- Data collection began May 2013



# Mobilization Platforms

- We have mounted the Metalmapper on two different types of mobilization platforms:
  - ▶ Tractor
  - ▶ Skid-steer (many different skid-steers)
- Original booms failed
  - ▶ New, stronger booms fabricated on-site



# Tractor

- Tractor-mounted Metalmapper
  - ▶ Data collection slower on rough terrain
  - ▶ Not very stable
  - ▶ Easily stuck in craters
  - ▶ Difficult to collect with Metalmapper level
  - ▶ Operator, paperwork, and Monitor in the elements
    - Cold, heat, mist, wind, and sun
  - ▶ Less expensive



# Skid-steer (rental)



- Open-cab skid-steer
  - ▶ First used at JBCC April 2014
  - ▶ Tracked Unit
  - ▶ Lower center of gravity
  - ▶ Front mounted design
  - ▶ Increased data collection rate
  - ▶ Still exposed to the elements
  - ▶ Rental equipment break-downs common
  - ▶ Original boom used
  - ▶ Track maintenance required
  - ▶ More costly than tractor



# Skid-steer (rental)

- Closed-cab skid-steer
  - ▶ Operator, paperwork, and monitor no longer in the elements
    - Cold, heat, mist, wind, and sun
  - ▶ Break-downs still caused loss of productivity
    - Worn-out rentals!
    - Rental company maintenance
    - Lots of lost time
    - Boom, monitor and wiring had to be removed and reinstalled each time the machine was exchanged



# Skid-steer (Purchase #1)

- NAB purchased new Skid-steer June 2014
  - ▶ Volvo (MCT 135 C) - Single-arm boom
  - ▶ Purchase cost offset by increased production rate and duration of the project
  - ▶ Increased stability and maneuverability
  - ▶ Decreased number of break-downs
  - ▶ Climate controlled - Closed cab
  - ▶ Dedicated unit



# Skid-steer – Sled Booms



Original 4" X 4" booms could not hold up to the abuse.

Increased productivity came at a price.



# Skid-steer – Sled Booms



- Stronger booms had to be constructed to withstand the increased stress
  - ▶ 1<sup>st</sup> replacement constructed from 6" X 6" treated lumber
    - Very strong but heavy
    - Not very flexible
    - Designed to be built easily with local supplies



# Skid-steer - Strength and Agility



2<sup>nd</sup> replacement constructed from

4" X 6" treated lumber

- Very strong but lighter
- Some flexibility
- Designed to be built easily with local supplies

Skid-steers are far more capable than tractors on rough terrain

- Reach over obstructions
- Reach down into large depressions



# Skid-steer (Purchase #2)

- NGB purchased second Volvo (MCT 110 C) Skid-steer May 2015
  - ▶ Rental costs avoided
  - ▶ Decreased number of breakdowns
  - ▶ Climate controlled - Closed cab
  - ▶ Two track mounted skid-steers now collecting data!



# Hardware and Software

- The Metalmapper computers are not plug and play
  - ▶ Each piece of hardware you connect needs a dedicated, properly configured port
  - ▶ Drivers or software also need to be installed
  - ▶ IMU serial to USB adapters must be FTDI!
- EM3D
  - ▶ The original data acquisition software provided by Geometrics with the Metalmapper.
  - ▶ Somewhat difficult to use for navigation
  - ▶ Required 2<sup>nd</sup> visit to each grid for reacquisition

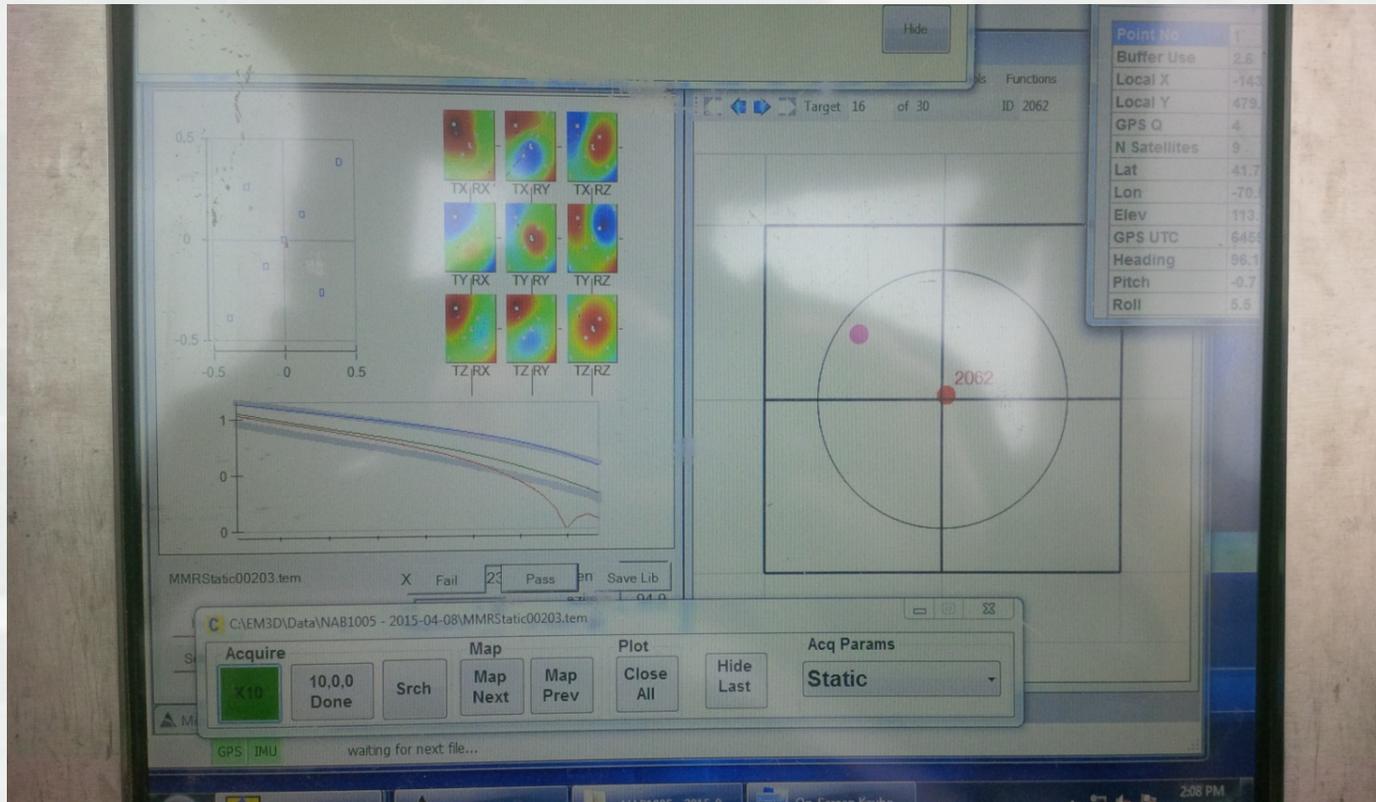


# Hardware and Software

- BT Field (Black Tusk Geophysics)
  - ▶ Improved navigation screen
  - ▶ Real-time data inversion
  - ▶ No need for 2<sup>nd</sup> visit to each grid for reacquisition
  - ▶ Productivity increased
  - ▶ Portions of the data retained in the memory
  - ▶ After collecting at 80 to 100 points it would take an extremely long time to collect data
  - ▶ Targets segregated into groups of 30 individual targets or “clusters”.
  - ▶ EM3D still used for data collection but BT field used for navigation and real time inversions and reacquisition



# Hardware and Software



# GPS – One Unit

- One (1) Metalmapper Unit
  - ▶ Rented Trimble R-8 system
    - High cost
  - ▶ NAB Purchased Trimble R-10 system (2014)
    - Purchase cost offset by high rental cost and duration of the project



# GPS – Two Units

- Two (2) Metalmapper Units
  - ▶ Trimble R-10
  - ▶ Trimble R-8 system borrowed from HNC
  - ▶ Required two base stations, two control points, and two different GPS initiations each morning
  - ▶ Transitioned to all R-10
    - ▶ One R-10 base with 2 R-10 rovers
    - ▶ One rented rover (high cost)
    - ▶ Required only one base station, control point, and GPS initiation



# GPS – Current Configuration

- Current configuration for two (2) Metalmapper Units:
  - ▶ One R-10 base with 2 R-10 rovers
  - ▶ 2nd rover purchased by NGB
  - ▶ Purchase cost offset by high rental cost and duration of the project
  - ▶ Do not use fiberglass extension rod on Metalmapper GPS platform!!!!



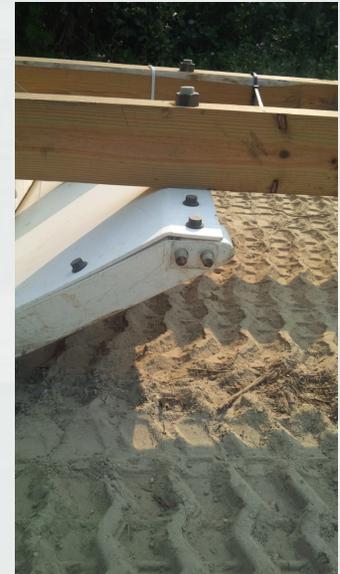
# Wear and Tear – GFE

- Government Furnished Equipment (GFE)
  - ▶ Metalmappers were used on demonstration projects
  - ▶ Abused
  - ▶ Broken
  - ▶ Not Maintained
  - ▶ Repairs were needed!



# Wear and Tear - Expendables

- Expendable Items:
  - ▶ Booms break
  - ▶ Nylon straps on new booms break
  - ▶ Fabricated steel rear boom support
- Nuts and bolts:
  - ▶ Ensure all nuts and bolts remain secure
  - ▶ Maintain a supply of spares



# Wear and Tear – GPS Platform

- GPS Platform
  - ▶ Weak point
  - ▶ Leg ends split causing legs to break
  - ▶ If one breaks and not repaired others will follow
  - ▶ GPS rover will follow broken legs causing damage
  - ▶ Manufacturer supplies not always available
  - ▶ Always have an extra set (4)



# Wear and Tear – Weak Points



# Storage and Maintenance



- Storage Container
  - ▶ Somewhat difficult to get machine and Metalmapper inside
  - ▶ Experienced operators needed
  - ▶ GPS legs easy to damage
    - Always remove GPS rover
  - ▶ Damage to sled caused by pulling in instead of backing in
  - ▶ Other damage could easily occur
- Computer and Coils
  - ▶ Require more frequent maintenance and repair



# Recommendations

- Seek help from others that have experience
- Have the proper personnel available
- Minimize wear and tear by proper maintenance and operation
- Maintain a healthy stock of spare cables and other parts
- Problems will occur but they can be overcome



# Questions?

