WHERE'S THE MQO?

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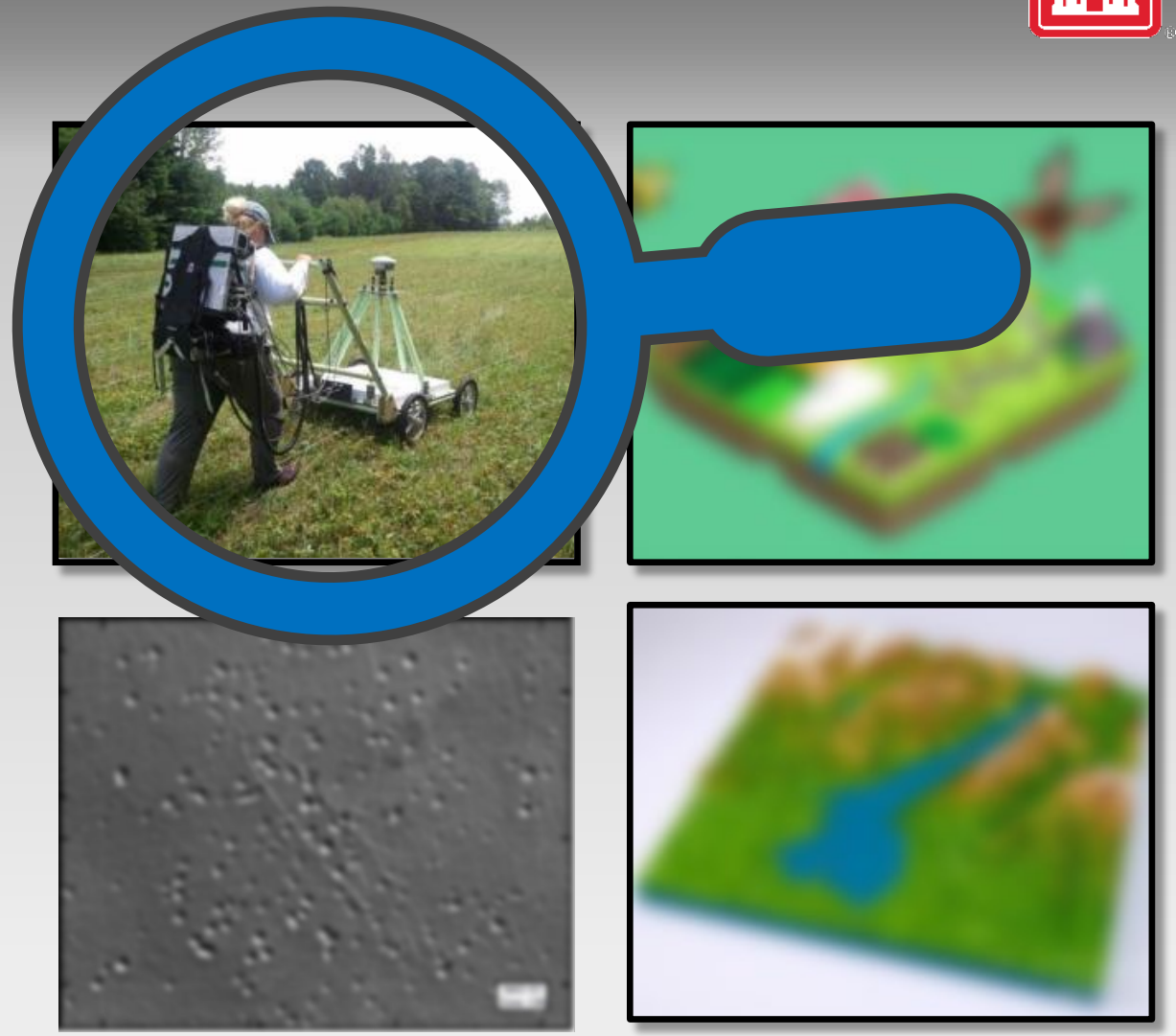
SO, WHAT'S THE PROBLEM?

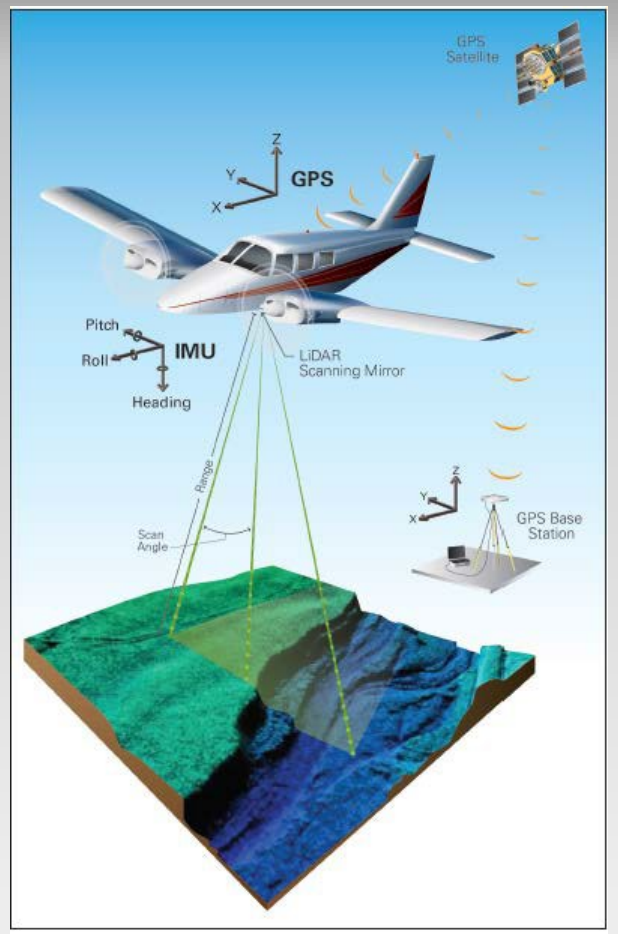
- MR-QAPP modules ***don't*** address *all data collection*
  - MR-QAPP Module 1 focused ***solely on geophysics*** past WS#11
  - Geophysics, and MPCs and MQOs, focus on AGC, non-AGC DGM, and analog
- EM 200-1-15 focuses on similar MQOs
- What's the problem?
  - Occasionally, project goals require geophysical sensors other than what's in these guidance documents (*e.g.,* for burial pit detection; LiDAR surveys)
  - The CX is seeing QAPPs with
    - No MQOs for DFWs (*e.g.,* LiDAR surveys)
    - Incomplete MQOs for non-standard methods
  - There are a lot of MQOs and sometimes they conflict



FROM WHERE DO WE GET MQOS?

EM 200-1-15 AND MR-QAPP

- Primary Guidance
  - EM 200-1-15 and MR-QAPP Modules 1 and 2 – MQOs in general alignment
  - They supersede AGC-QAPP and DoD QSR v.2.0 where conflicts exist
- What's missing?
  - Geophysical sensors typically used for burial pit detection or other purposes
    - Frequency domain EM sensors
    - DGM magnetometers
    - GPR
    - Resistivity
  - Sensors that don't reliably detect munitions
    - LiDAR
    - Side-scan sonar (SSS)
  - Excavation and sifting?
    - Start with analog and modify appropriately
  - New AGC sensors?
    - MQOs new sensors approved by EDQW prior to hardware validation



WHAT DOES EM 200-1-15 TELL US

- EM 200-1-15 Section 14.1 (pending publication)
  - "Details regarding QC requirements in this chapter need to be specified based on **site conditions and project requirements**. To ensure performance metrics and project objectives are met **the PDT must define project-specific QA and QC processes for each definable feature of work (DFW)."**
- Slight variation on EM 200-1-15 Section 11.1.1 (published in 2018)
  - "**The PDT must define project-specific objectives and performance metrics for each definable feature of work** that will be measurable and attainable. The PDT also must define project-specific QC and QA processes for each definable feature of work to ensure that performance metrics are attained and project objectives are met."

- What does this tell us
  - We need MPCs/MQOs for each DFW to ensure data quality is sufficient to meet overall project objectives and make the decisions we need to make
  - We need to make them site-specific
    - Sensor
    - Positioning system
    - Phase of work
    - What are the limitations of the sensors/positioning system for the site conditions
  - They need to be geared towards the project goals
    - What are we collecting?
    - How are we planning to use the data?
- What we need to do when MQOs don't exist
  - Take the existing MQOs and modify them, as appropriate, to all the factors above

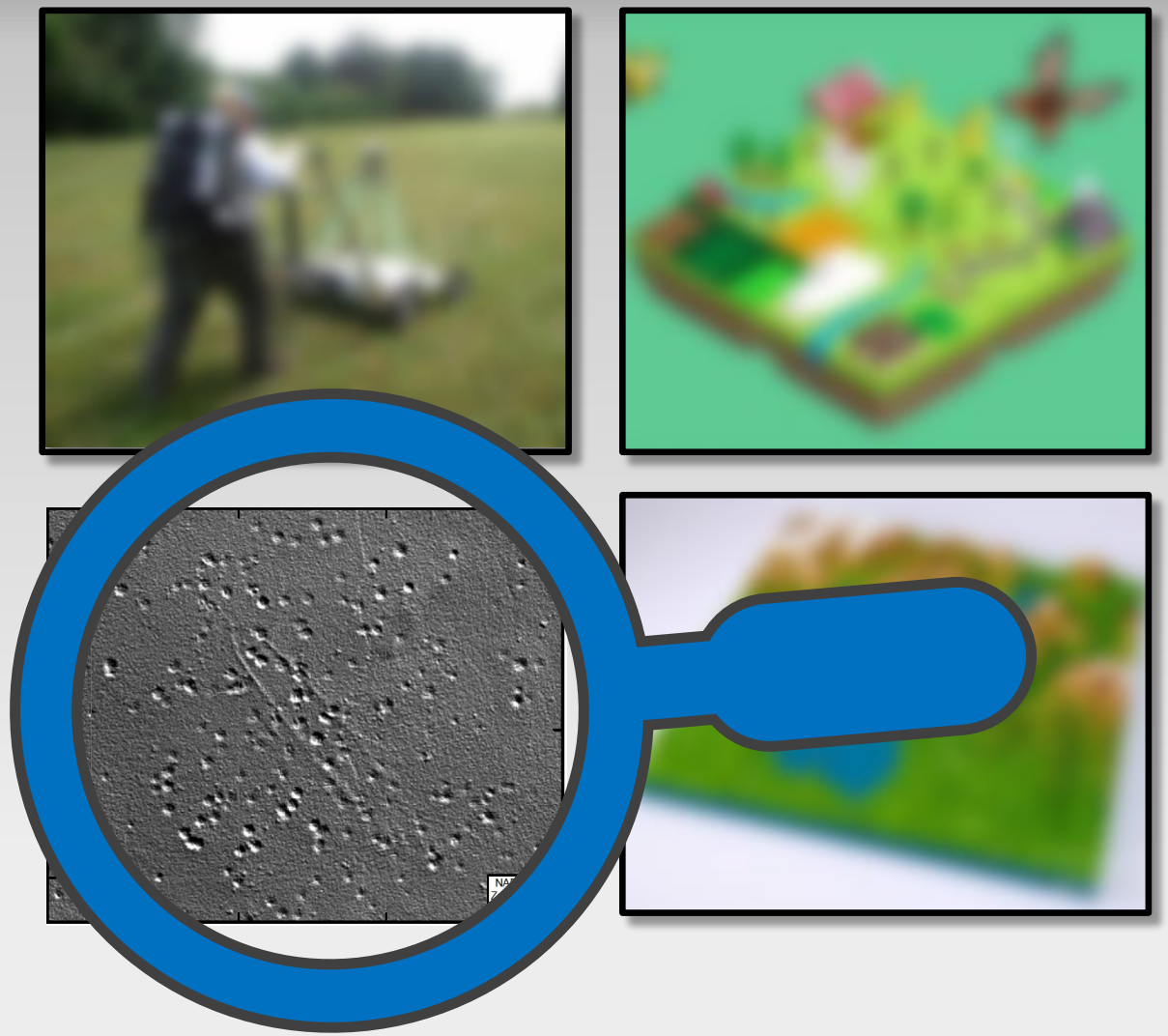
EM 200-1-15 MQOS

- Geophysical Systems Verification
  - Construct IVS
  - Verify correct assembly
  - Seed detection/recovery
- Geophysical Systems Function Tests
  - Battery voltage
  - Transmit current Levels
  - Static Repeatability (Initial and on-going)
  - Analog System Repeatability (initial and on-going)
  - Ongoing instrument settings check (analog only)
  - In-line measurement spacing
  - Coverage
  - Dynamic positioning
  - AGC Background Locations
- Geophysical Systems Function Tests (continued)
  - Anomaly Analysis
  - Confirm AGC inversion model supports classification
  - Maximum velocity (analog only)
  - Dynamic Repeatability
- Dig List Reacquisition, Excavation Resolution, and Excavation Reporting
  - TOI Reacquisition
  - TOI (DGM)/Anomaly (analog only) Resolution
  - Documenting recovered sources
- Geodetic Methods
  - Geodetic Equipment functionality
  - Geodetic internal consistency
  - Geodetic accuracy
  - Geodetic repeatability

We need MQOs for both the full functionality of each piece of equipment as well as each processing and interpretation method.

WHAT IF THERE ARE NO MQOS?

- The PDT must determine what data quality standard is required
  - Develop DQOs, MPCs, and MQOs
  - It's ok to develop your own MPCs, MQOs
  - It's ok to modify MPCs, MQOs if you have a reason
- LIDAR, for example
  - EM 1110-1-1000 covers LiDAR and some QC considerations
  - 3 Types of control
    - Airborne GPS control: Airborne GPS and IMU
      - Requires valid GPS and IMU measurements
      - Frequency of GPS measurements
    - Ground control
      - Either existing control network or one established for the project
    - QC checkpoints
      - Ground control "seeds"
  - Data density
  - Velocity

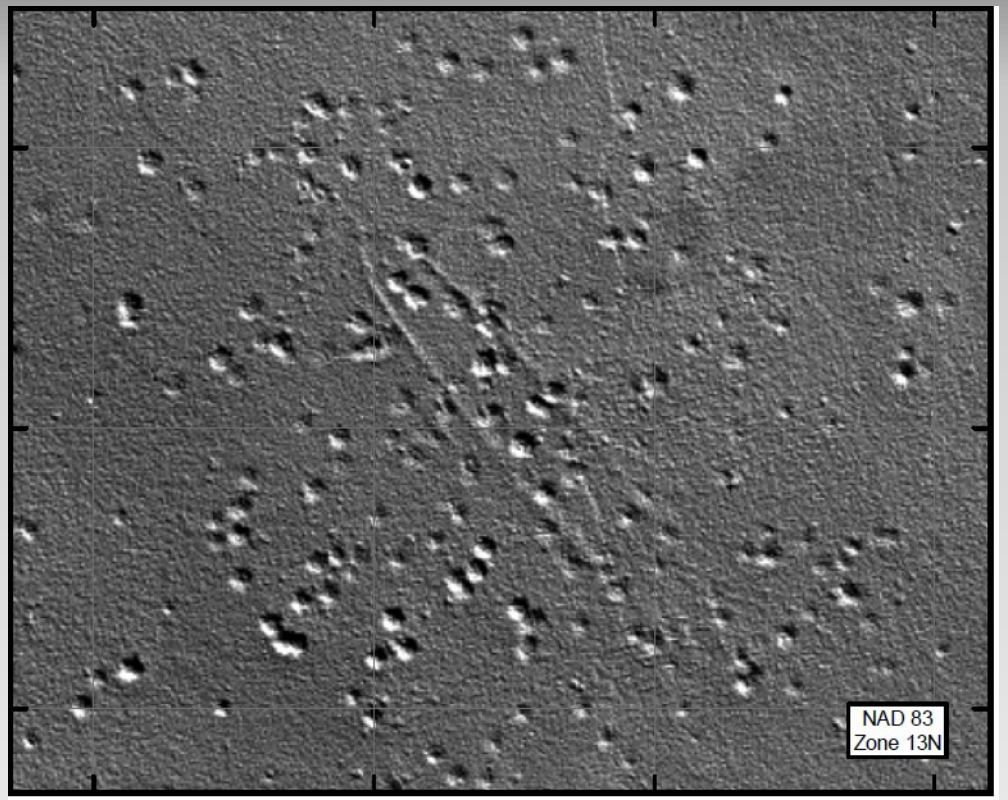


EXAMPLE LIDAR MQOS FOR CRATER DETECTION (NOT GUIDANCE....YET)

MQO	Frequency	Acceptance Criteria
Verify correct assembly	Once following assembly	As specified in Assembly Checklist
Dynamic positioning	Every measurement	GPS Status Flag indicates RTK fix and dilution of precision less than 4.0; valid IMU data
Coverage	For each MRS	100% coverage at project required flight line spacing
Ground control QC	For each ground control QC point	100% of ground control QC points detected within 1 meter
Data Density	For each survey unit	100% have a point density greater than 25 points per square meter
Crater analysis	For each survey unit	All features greater than 1-meter diameter identified
Geodetic Functionality	Each day	Measured position of control point within 10cm of ground truth
Geodetic accuracy		

EXISTING LIDAR

- What if I'm using existing lidar data for my RI
  - It's a secondary data source
    - For what are you using it?
      - Slope analysis?
      - Range-related feature detection to guide RI/FS fieldwork?
  - Follow MR-QAPP Toolkit Module 1 WS 13
    - Evaluate the quality of the LiDAR data in terms of project-specific MPCs
      - Are the data of the type and quality necessary to support their intended uses
        - When was it collected?
        - What were the data collection methods
        - What were the data verification/validation procedures
        - What are the potential sources of uncertainty
        - What supporting documentation is available?
        - Comparability



- This is also true for all secondary sources!!
  - EE/CA data
  - TCRA/NTCRA

WHAT HAPPENS WHEN MQOS AREN'T EQUIVALENT

Requirement	Performance Standard/Acceptance Criteria	Frequency	Consequence of Failure	Application Notes Specific to this Table
EM 200-1-15 Construct ITS: Verify as-built ITS against design plan	All seeds buried per Project QAPP ITS construction specifications[a]	Once following ITS construction	RCA/CA: Make necessary changes to seeded items and re-verify	[a] See 6.5.3 for guidance on constructing the ITS and determining maximum depth of detection for seeds
Draft Final MR-QAPP Module 2 (11/22) Construct Instrument Test Strip (ITS): Verify as-built ITS against design plan	Small ISO seed items for analog methods buried at 30cm; All seeds buried horizontally in the crosstrack orientation	Once following ITS construction	RCA/CA: Make necessary changes to seeded items and re-verify	

- EM 200-1-15 Section 6.5.3
  - Determine maximum detection depth (e.g., air testing or test pitting)
  - ITS seed items placed within test lane at 95% to 100% of respective max detection depth for their buried orientation
  - ITS test lanes are same width as daily detection ops and 25m long

- So, which do I use?
  - For FUDS projects, EM 200-1-15 and the 95-100% max detection depth
  - For others, recommend EM 200-1-15 requirement

Even better, follow FUDS Policy and use AGC

KAARTA SLAM MQOS

Measurement Quality Objective	Frequency	Responsible Person/Report Method/Verified by	Acceptance Criteria	Failure Response
Geodetic Accuracy	Evaluated for each base map	Project Geophysicist/ QC Database/ QC Geophysicist	Maximum error reported in the UXO_QC.csv file less than or equal to 8cm.	RCA/CA
Geodetic Accuracy	Evaluated for each measurement	Project Geophysicist/ QC Database/ QC Geophysicist	Recorded SLAM localization confidence quality greater than 5 (NMEA output; 50,000 for SLAM output).	RCA/CA
Geodetic Equipment Function Test	Each time localization is initiated	Field Team Leader/ field forms/ Project Geophysicist	Measured position of control point within 10 cm of ground truth.	RCA/CA

QUESTIONS

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