

Update on Classification Hardware, Software, and QC/QA

Herb Nelson
Program Manager for Munitions Response
SERDP & ESTCP
571-372-6400
herb.nelson@nrl.navy.mil



Outline

- Hardware
 - ◆ Diversity of Deployment Platforms
 - ◆ Dynamic Survey Data
 - ◆ Data Acquisition Software Updates
 - ◆ Geometrics Update
- Analysis Software
 - ◆ Major improvements to workflow in UX-Analyze
- QC/QA Tools
 - ◆ Draft QAPP
 - ◆ SOPs
- Example Workflow

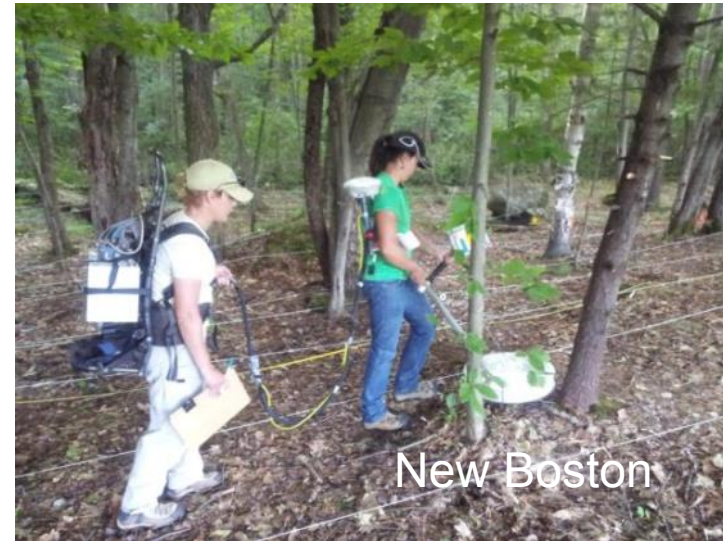
MetalMapper



TEMTADS 2x2



MPV

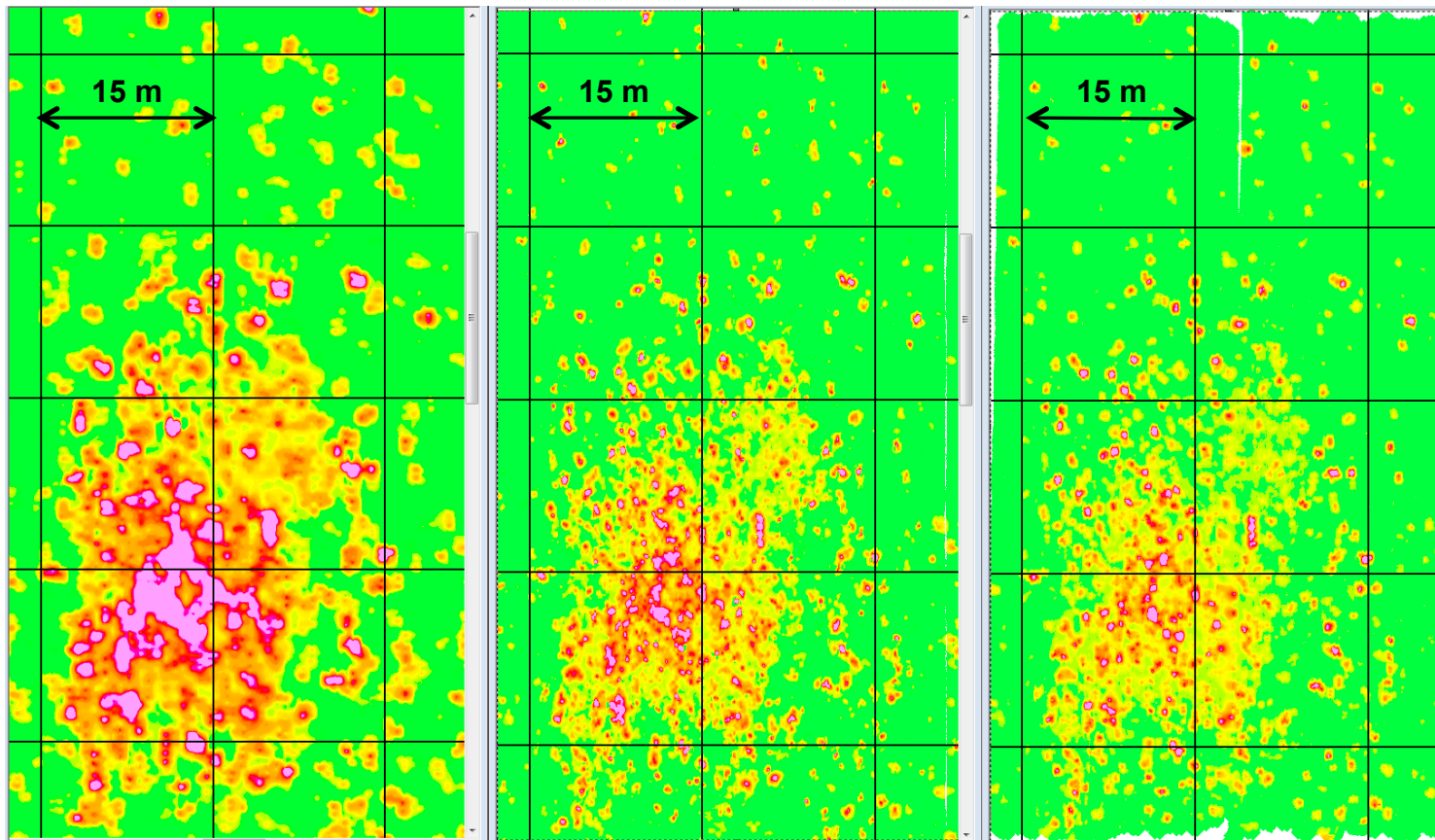


Dynamic (GPS or Line/Fiducial)

← Cued (local Beacon positioning)

Comparison of Survey Data

Camp Ellis



EM61

MetalMapper

TEMTADS 2x2

Comparison of Survey Data Seed Offsets

Spencer Dynamic Area Data

	Avg	Max	%>40 cm
EM61	27	54	17%
TEMTADS 2x2	12	28	0%

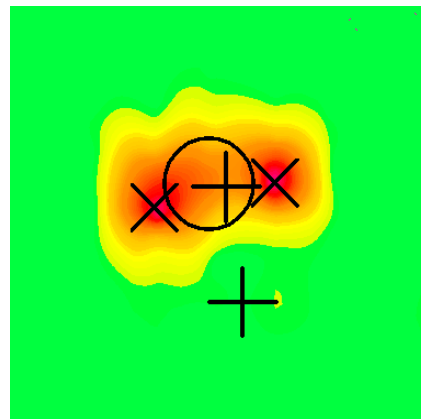
Ellis Dynamic Data

	Avg	Max	%>40 cm
EM61	33	100	29%
MM	18	50	4%

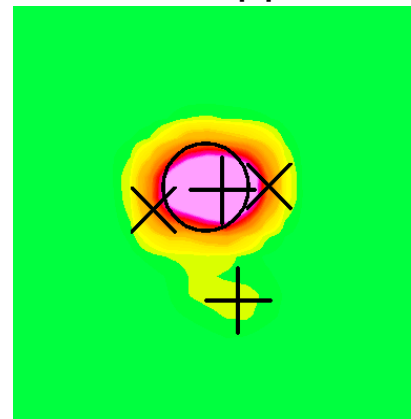
- Rethink acceptable offset: standard (~0.6-0.8m) vs cued (0.4m)
- Time wasted searching with 'dancing arrows' & recollects
- Potentially collect wrong target

Comparison of Survey Data Seed Offsets

EM61



MetalMapper



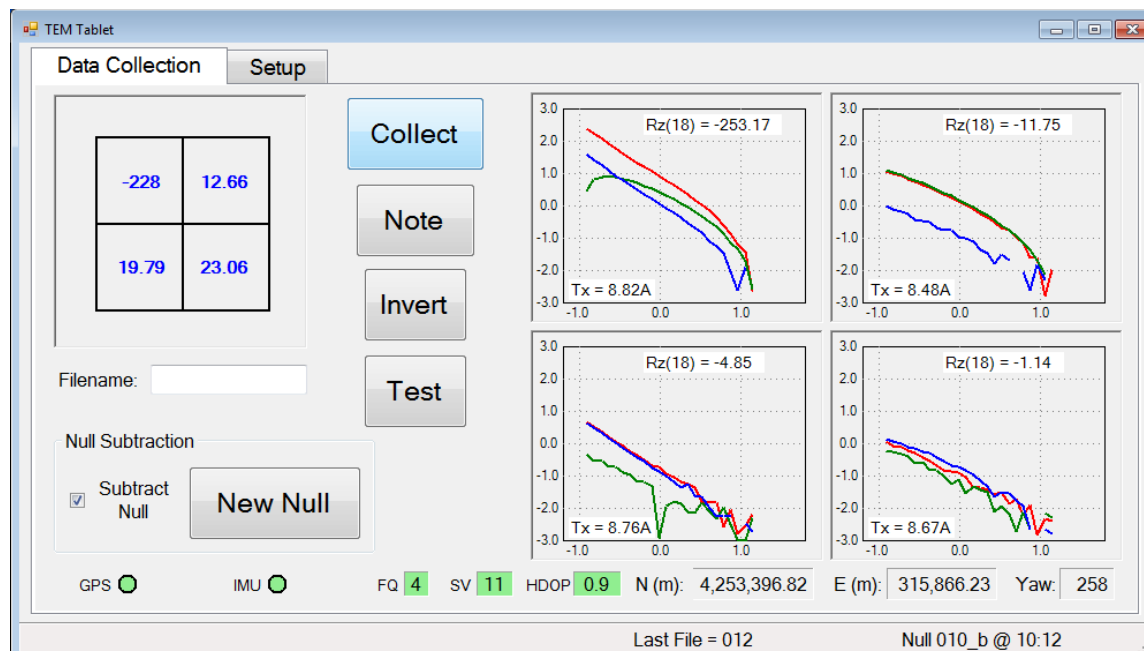
- 2.36" rocket
- X EM61- 0.74m offset
- + MM- 0.2m offset

Updates to Advanced Sensors

- In-field QC
- MetalMapper Improvement Project from Geometrics
 - ◆ ruggedize
 - ◆ standardize

Data Acquisition Software Updates

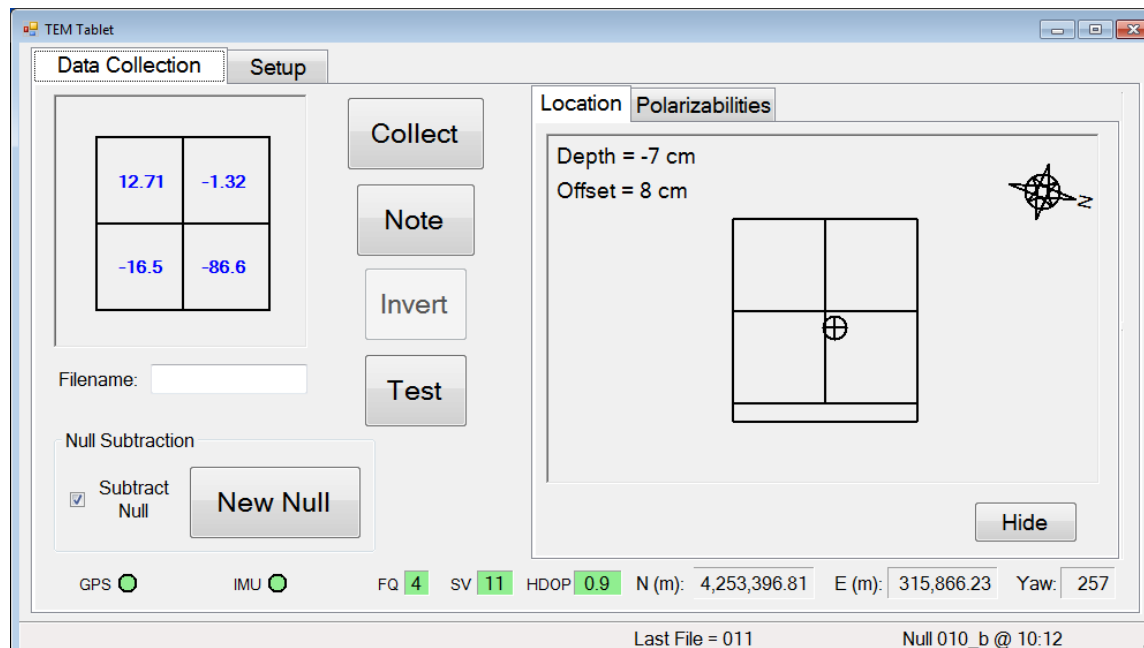
- ◆ TEMTADS 2x2
 - monitor data stream integrity



Collect Data - check GPS/IMU quality

Data Acquisition Software Updates

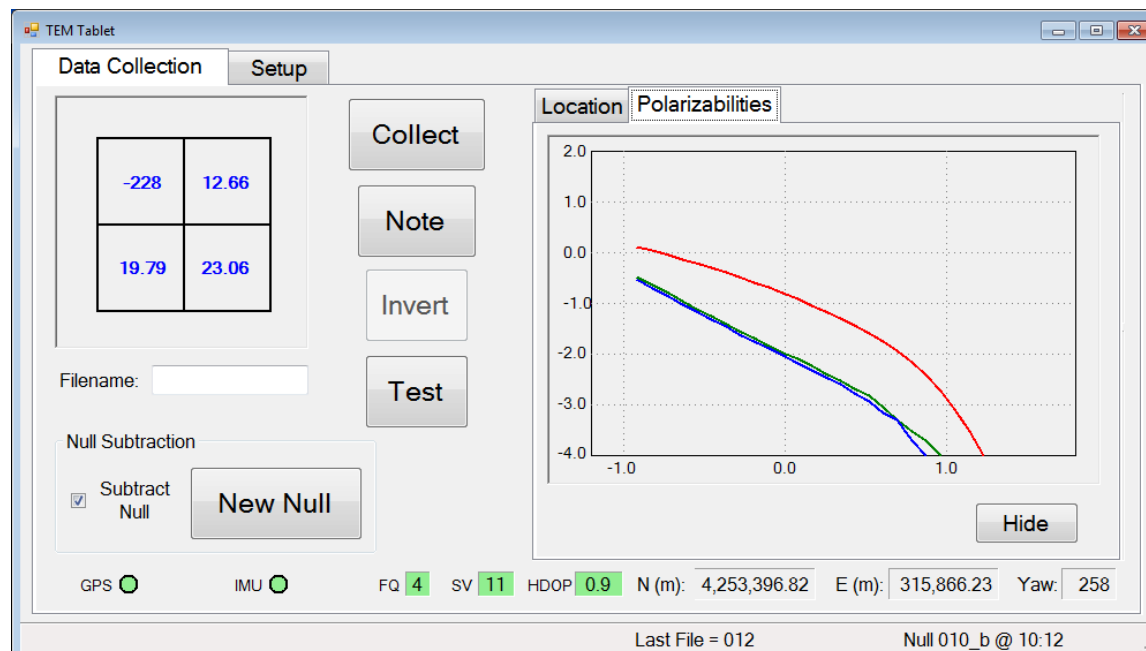
- ◆ TEMTADS 2x2
 - in-field inversion



Invert - check offset

Data Acquisition Software Updates

- ◆ TEMTADS 2x2
 - in-field inversion



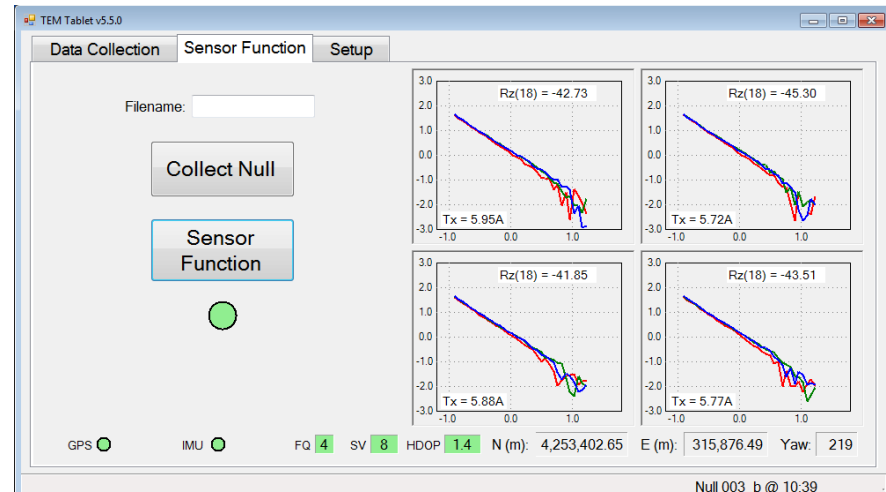
Invert - view polarizabilities

Data Acquisition Software Updates

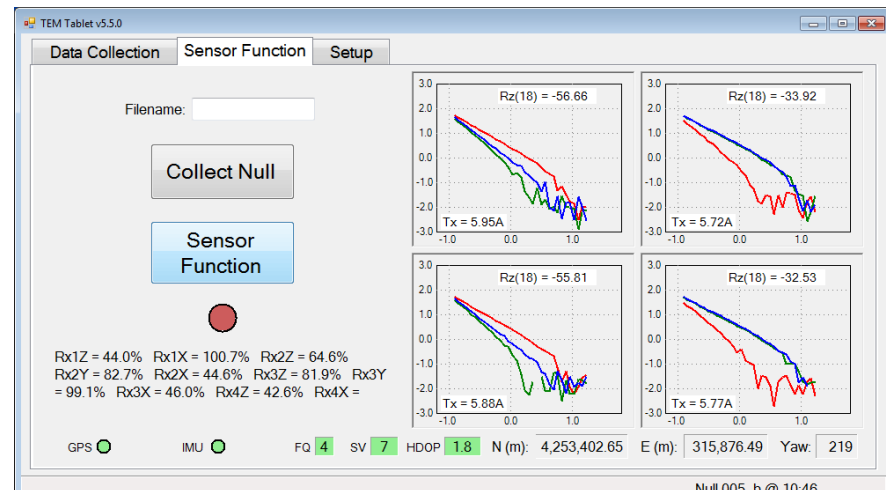
- ◆ TEMTADS 2x2
 - Sensor function test



pass

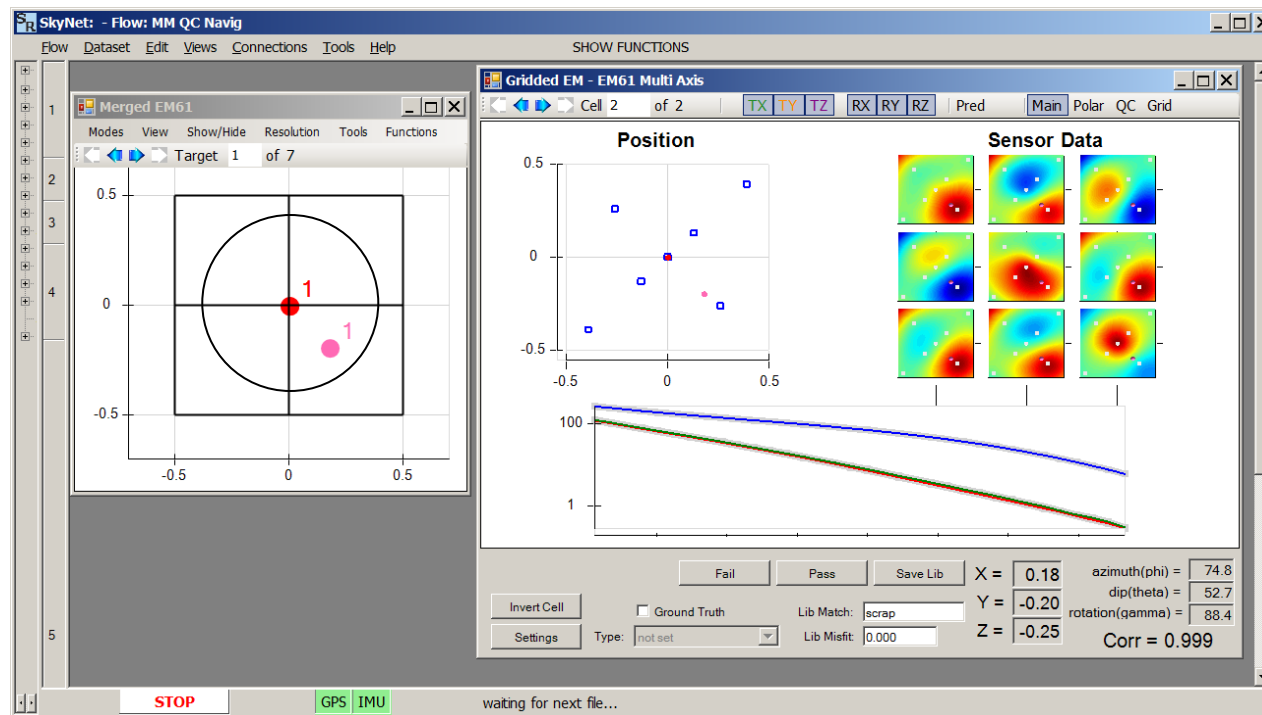


fail



Data Acquisition Software Updates

- ◆ MetalMapper
 - BT Field: in-field QC

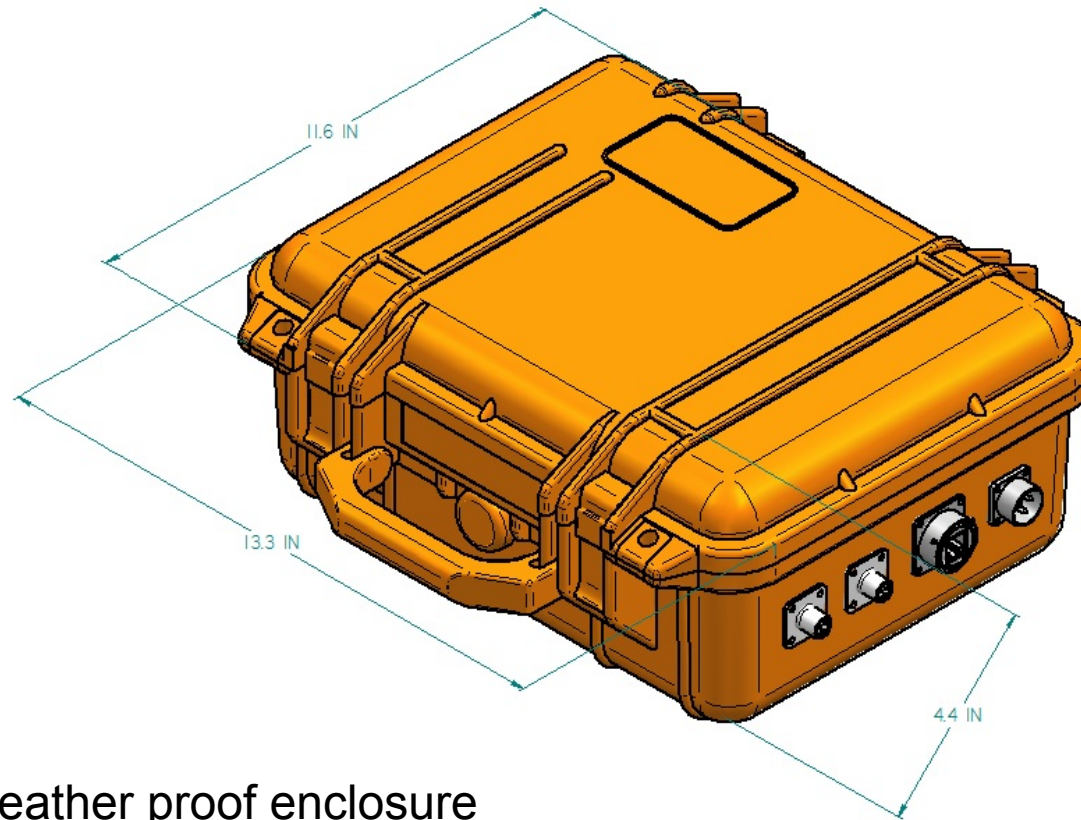


- Inverted position check
- 'Green light' GPS/IMU
- Polarizability plot & library match

Update from Geometrics

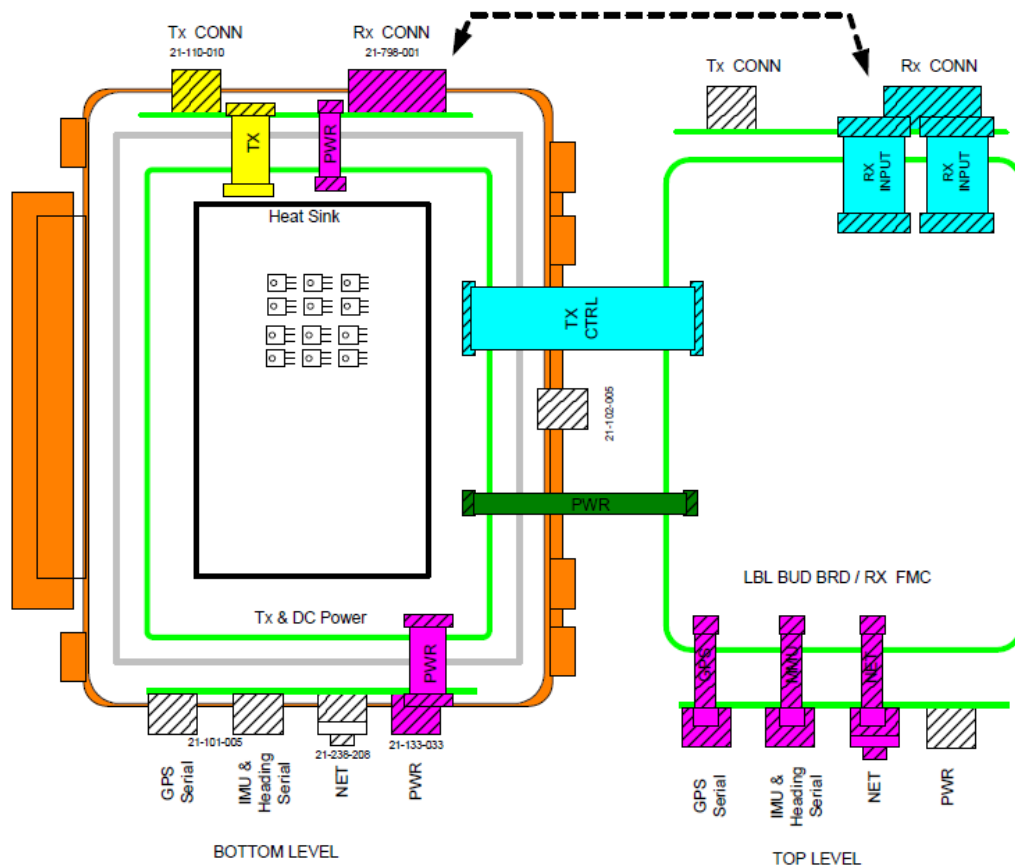
- ESTCP Project to ruggedize & standardize MetalMapper
 - ◆ hardware improvements
 - ◆ software simpler and more robust
- New version expected for sale/rent in Summer/Fall 2014

Ruggedized Electronics Packaging



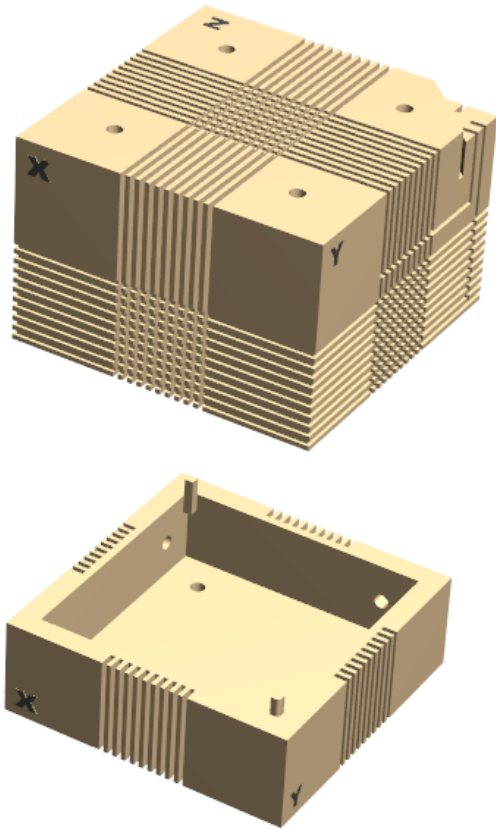
- Weather proof enclosure
- Reduced number of connectors

New Electronics



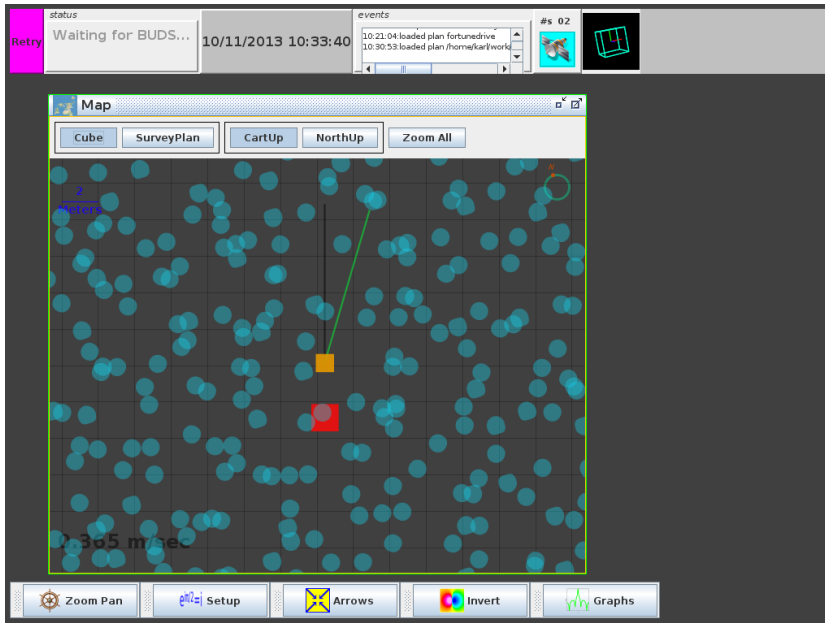
- New electronics with no reliance on 3rd party manufacturers
- Ability to package electronics in ruggedized package
- Reduction in power requirements
- Can support 3 or 4 transmitters

Ruggedized Construction of Tx and Rx

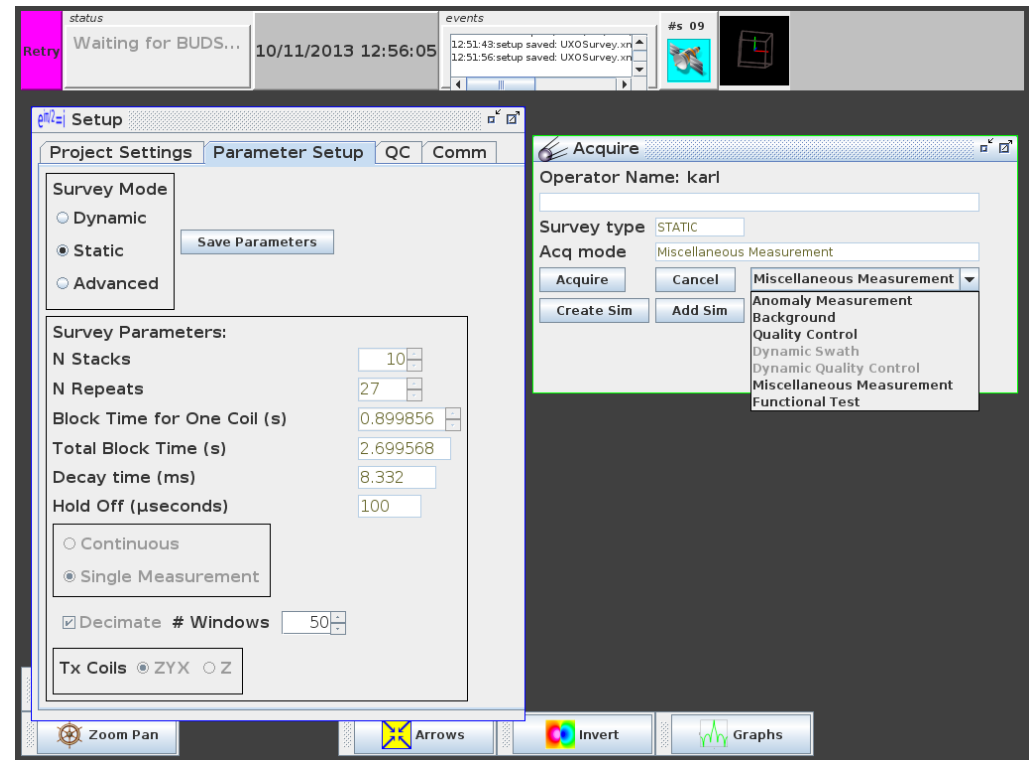


- 3D printing techniques used for receiver cubes
 - Less sensitive to effects of moisture
 - No change to response
- Currently evaluating costs for 3D printed transmitter coils
 - Too large to print as single item
 - Current Goal: 3D print complex parts (i.e. corners) and used milled plastic stock for sides.
 - This will allow simpler design/ construction of multiple transmitter coil sizes
- Development of 3D models will allow easy transition to molded parts for increased production at lower cost

Simplified Software Interface



- Increased use of icons to display QC information
- Integrated in-field inversions
- Increased QC checks
- Automated reminders for background measurements



- Simplified parameter input
- Data stored in open source format

Availability of Advanced Sensors

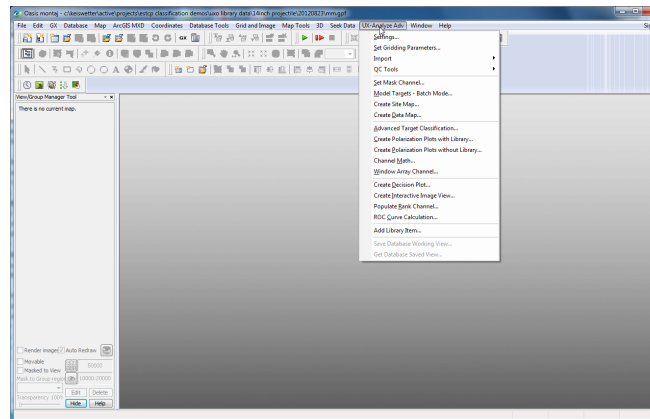
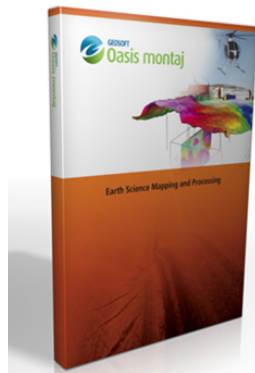
- ~10 MetalMappers
 - ◆ 4 USACE - GFE
 - ◆ Rent \$500/day
 - ◆ Summer/Fall - New model at substantial cost reduction
- ~6 TEMTADS 2x2
 - ◆ Navy owns one - Vieques
 - ◆ NRL - GFE
 - ◆ Within year - available for purchase from Geometrics
- 1 MPV
 - ◆ Possible transition - Geometrics' new electronics box will work

Updates to Analysis Software

- Major improvements to workflow in UX-Analyze
 - ◆ reduce routine load on the analyst
 - ◆ focus analyst time on QC issues
 - ◆ standardize data views and outputs
- Released to “power users” for comment
- Training in coordination with NAOC in April

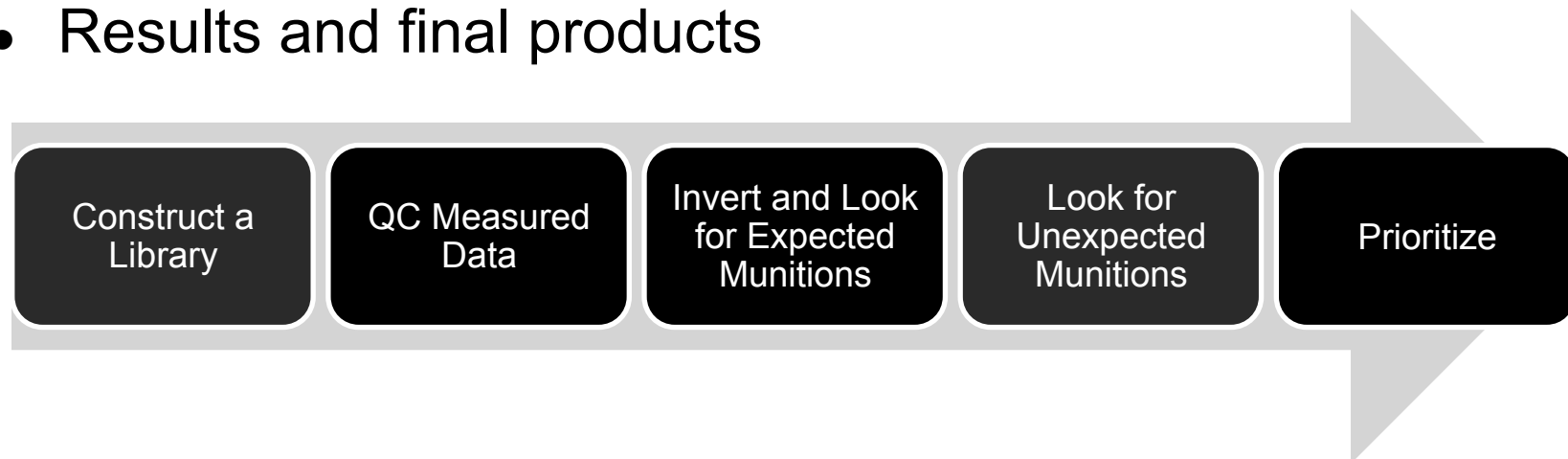
Software Overview

- **UX-Analyze is fully integrated into Oasis montaj as a menu driven set of functions for geophysical target characterization and classification.**
- These functions permit users to **effectively classify** munitions targets
- **Released** to the US Government and commercial contractors (free of charge to recipients)

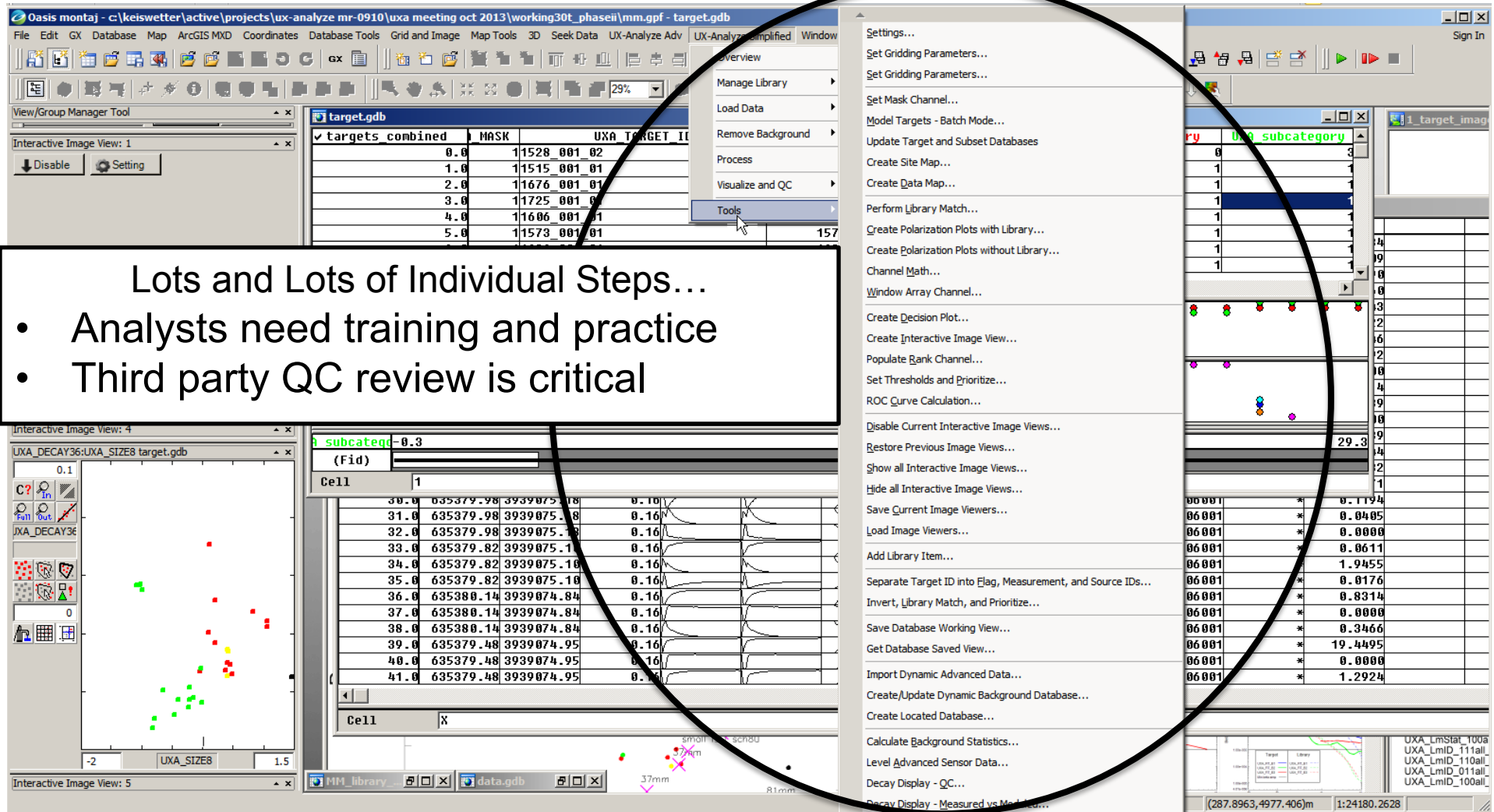


Processing Flow

- **Fundamental Analysis Steps**
 1. **Construct a Library** (Expected Munitions and Clutter)
 2. **QC Measured Data** (Blind and Background)
 3. **Invert and Look for Expected Munitions**
 4. **Look for Unexpected Munitions**
 5. **Prioritize**
- Results and final products



Lots Going On in Each Step



The screenshot displays the Oasis montaj software interface with several windows open. A large black circle highlights the 'Tools' menu and the 'subcategory' table. The 'subcategory' table contains the following data:

(Fid)	Cell	1
30.0	635379.98	3939075.18
31.0	635379.98	3939075.18
32.0	635379.98	3939075.18
33.0	635379.82	3939075.18
34.0	635379.82	3939075.18
35.0	635379.82	3939075.18
36.0	635380.14	3939074.84
37.0	635380.14	3939074.84
38.0	635380.14	3939074.84
39.0	635379.48	3939074.95
40.0	635379.48	3939074.95
41.0	635379.48	3939074.95

The 'targets combined' table in the background shows:

target.gdb	MASK	UXA TARGET ID
0.0	11528	001 02
1.0	11515	001 01
2.0	11676	001 01
3.0	11725	001 01
4.0	11606	001 01
5.0	11573	001 01

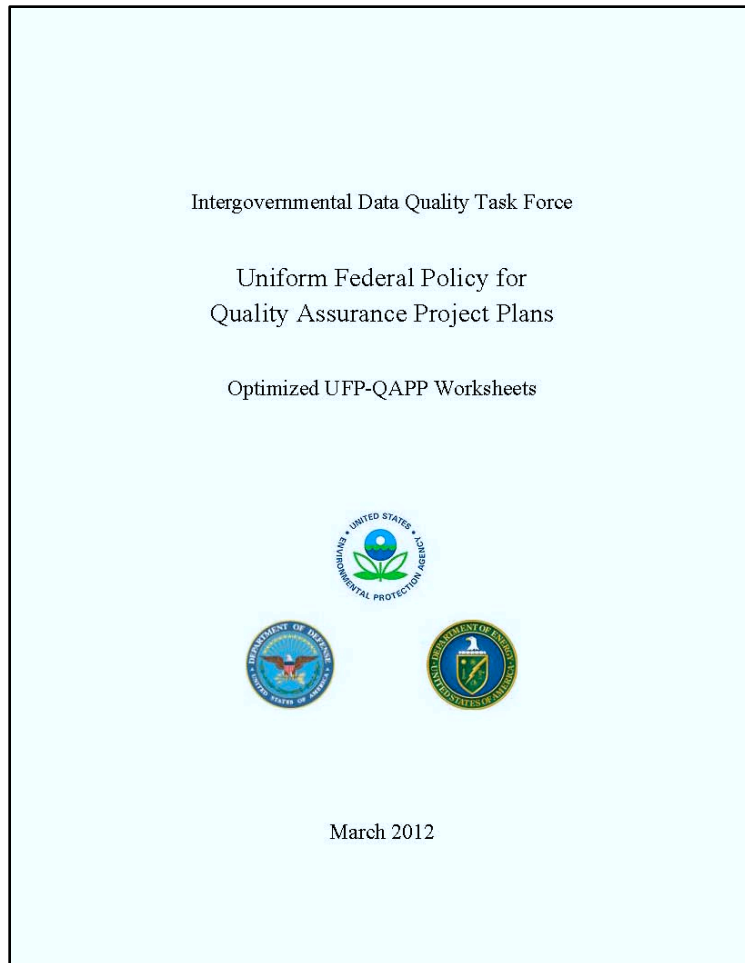
Lots and Lots of Individual Steps...

- Analysts need training and practice
- Third party QC review is critical

QC/QA Tools

- Draft UFP-QAPP worksheets
- SOPs for common operations

UFP QAPP for Classification



- ESTCP and CA DTSC have developed a draft QAPP for Classification applied to MR
- Handed off to a workgroup of the Intergovernmental Data Quality Task Force
 - ◆ finalize
 - ◆ promulgate
- Field test this summer at San Luis Obispo in conjunction with USACE

Worksheets Included

1 & 2	Title and Approval Page	13	Secondary Data Uses and Limitations
3 & 5	Project Organization and QAPP Distribution	14 & 16	Project Tasks and Schedule
4 , 7 & 8	Personnel Qualifications and Sign-off Sheet	17	Sampling Design and Project Work Flow
6	Communication Pathways	20	Quality Control and Corrective Action
9	Project Planning Session Summary	21	Field and Data Analysis SOPs
10	Conceptual Site Model	29	Project Documents and Records
11	Data Quality Objectives	34	Final Data Verification
12	Measurement Performance Criteria		

SOPs Included

1	Assemble the MetalMapper System and Verify Correct Operation
2	Test Sensor and System at the IVS
3	Production Area Seeding
4	Collect Dynamic Data Using the MetalMapper Sensor
5	Preprocess Dynamic Data and Identify Anomalies
6	Collect Static Background Measurements
7	Collect Cued Target Measurements
8	Verify Usability of Advanced Sensor Data
9	Background Correct Cued Anomaly Data
10	Invert anomaly data to extract source parameters
11	Compare extracted parameters to MEC signatures in the data library
12	Develop prioritized dig list using library matching and other factors
13	Verify recovered objects are compatible with analyst's predictions
14	Develop verification sampling dig list and perform verification sampling

SOPs Included (Pre-survey)

1	Assemble the MetalMapper System and Verify Correct Operation
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SOPs Included (Geophysical Data)

1	Assemble the MetalMapper System and Verify Correct Operation
2	Test Sensor and System at the IVS
3	Production Area Seeding
4	Collect Dynamic Data Using the MetalMapper Sensor
5	Preprocess Dynamic Data and Identify Anomalies
6	Collect Static Background Measurements
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SOPs Included (Extract Parameters)

1	Assemble the MetalMapper System and Verify Correct Operation
2	Test Sensor and System at the IVS
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4	Collect Dynamic Data Using the MetalMapper Sensor
5	Preprocess Dynamic Data and Identify Anomalies
6	Collect Static Background Measurements
7	Collect Cued Target Measurements
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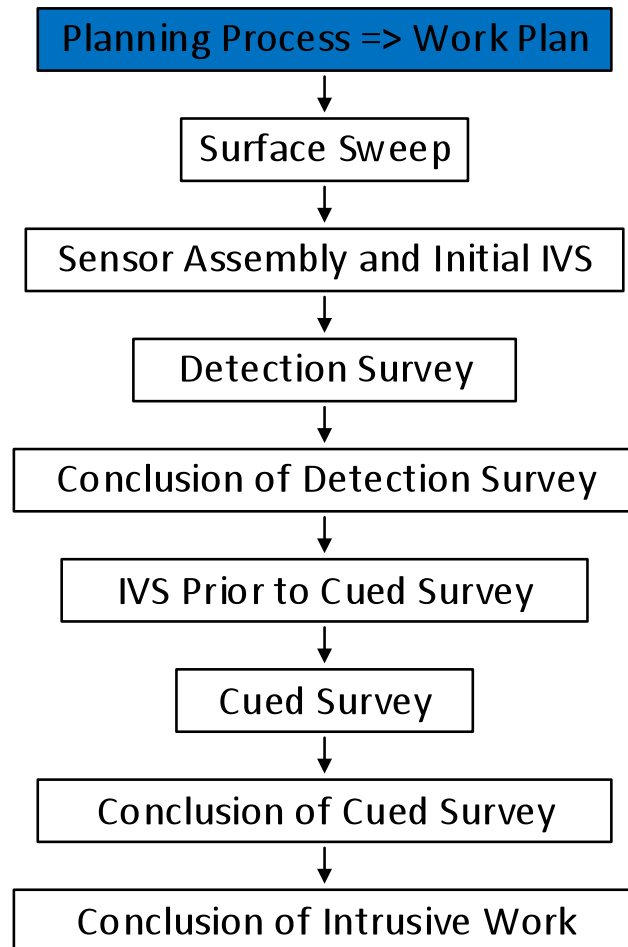
SOPs Included (Classify)

1	Assemble the MetalMapper System and Verify Correct Operation
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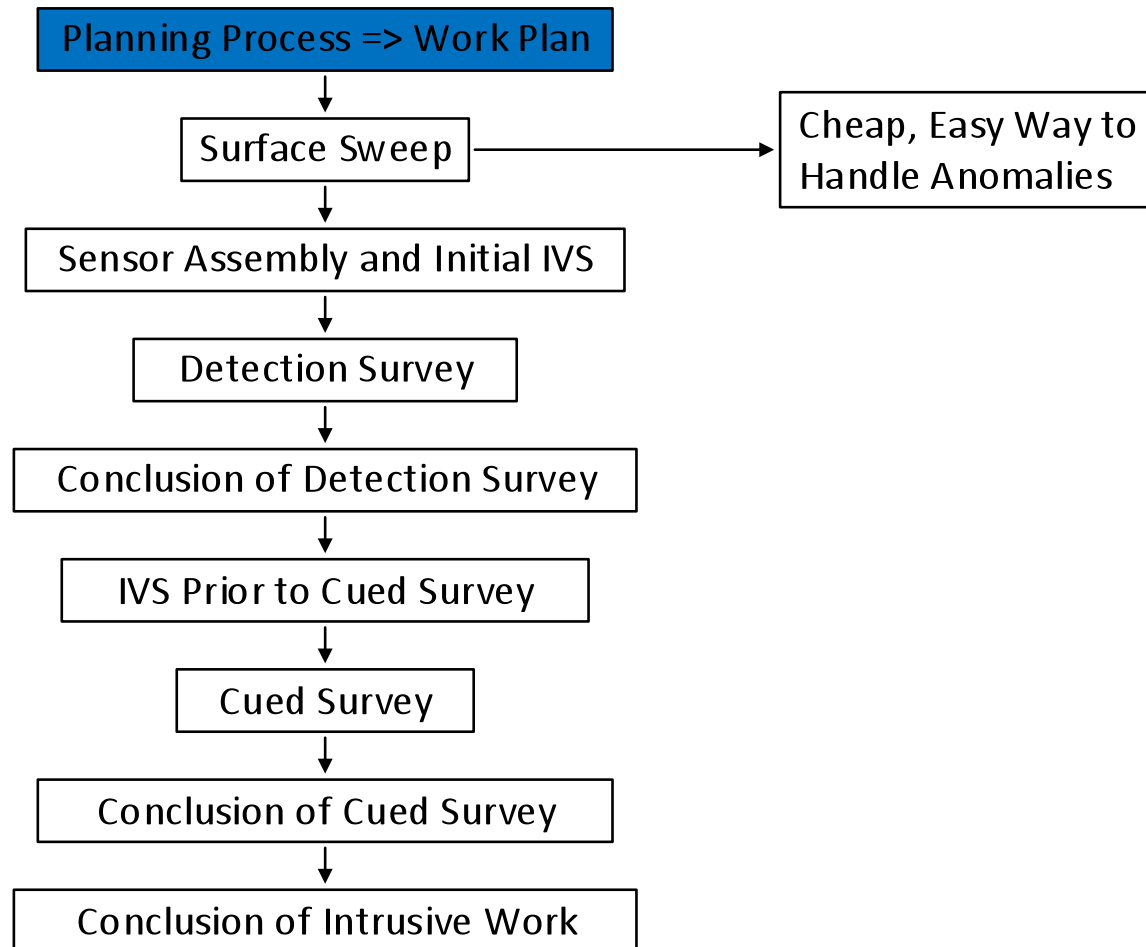
SOPs Included (QA)

1	Assemble the MetalMapper System and Verify Correct Operation
2	Test Sensor and System at the IVS
3	Production Area Seeding
4	Collect Dynamic Data Using the MetalMapper Sensor
5	Preprocess Dynamic Data and Identify Anomalies
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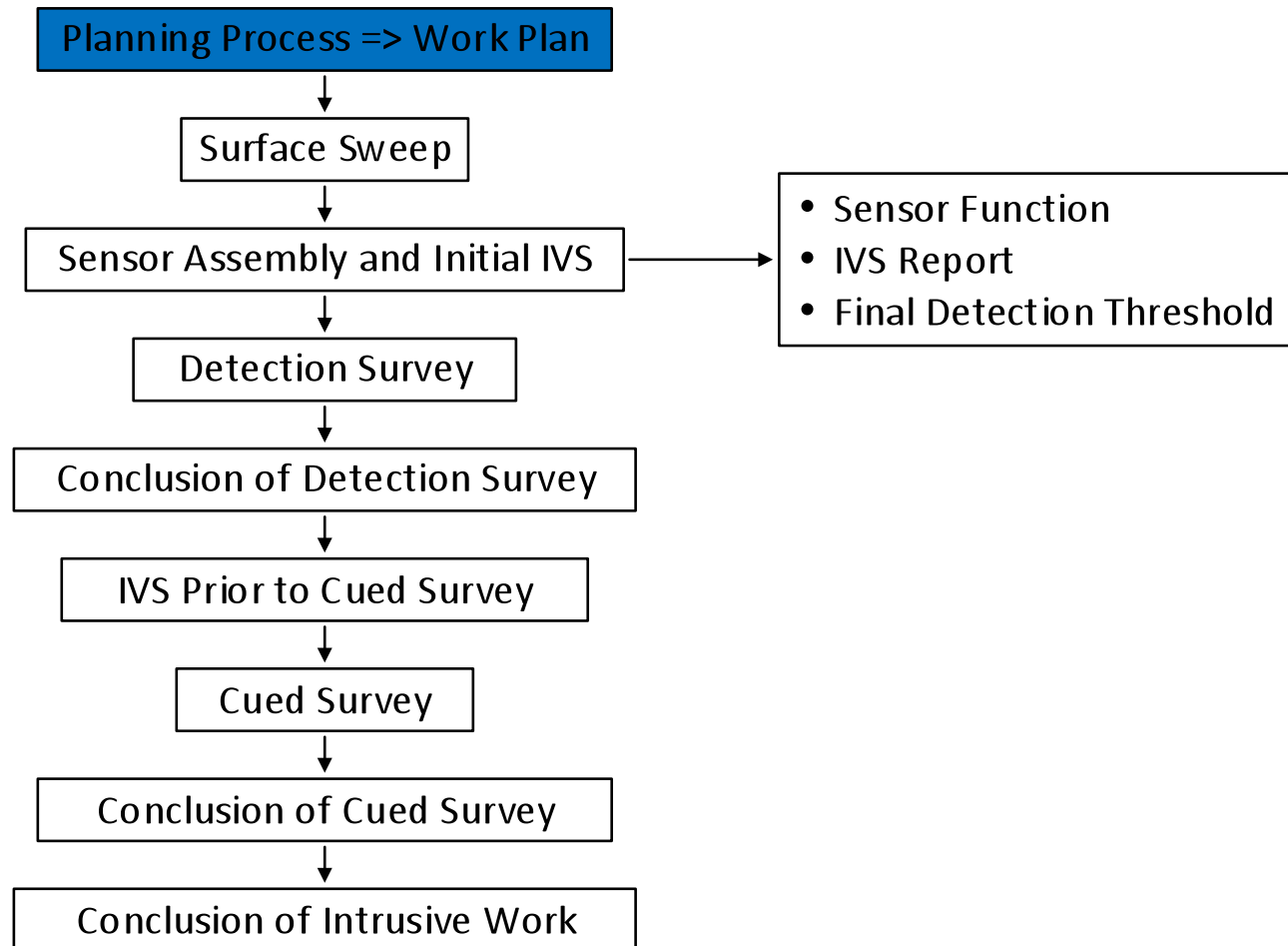
Example Workflow



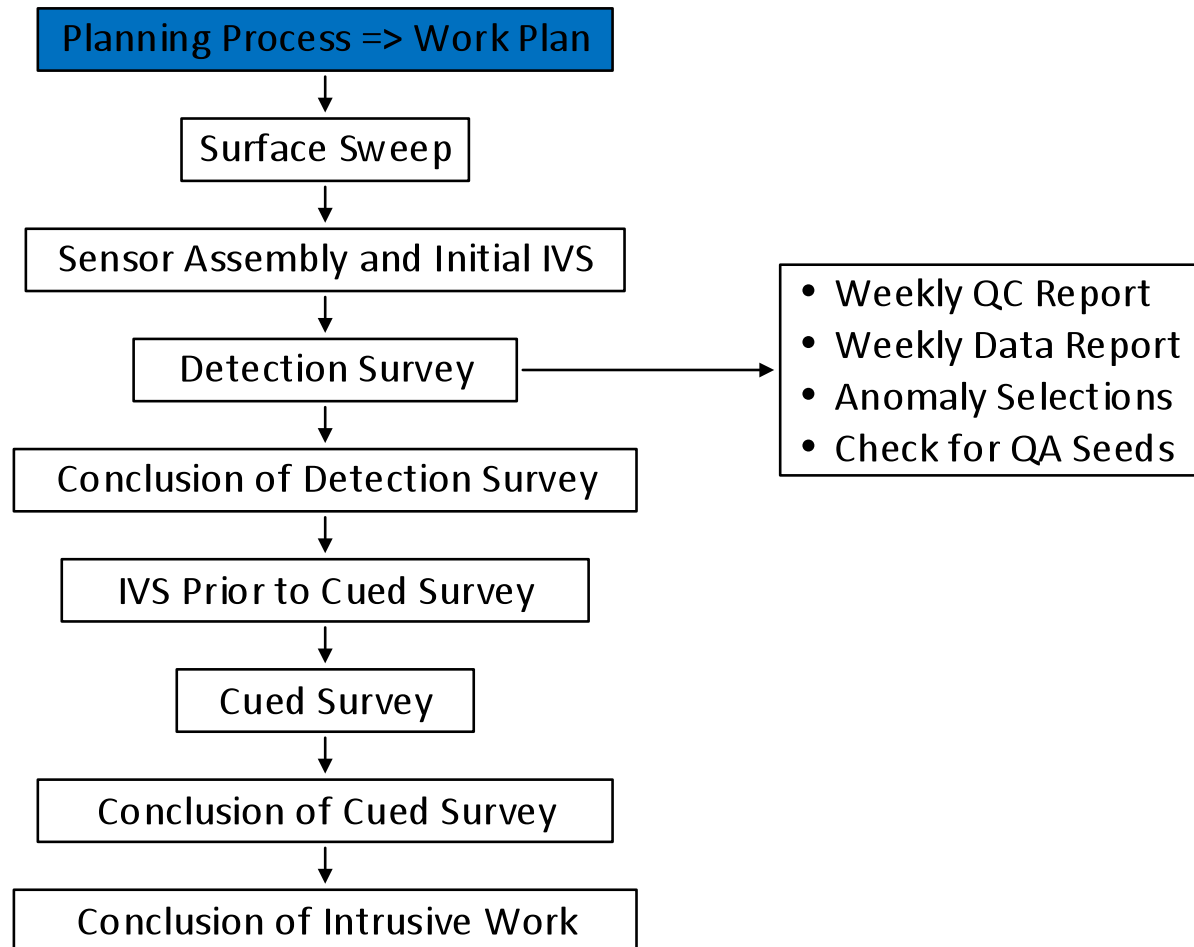
Surface Sweep



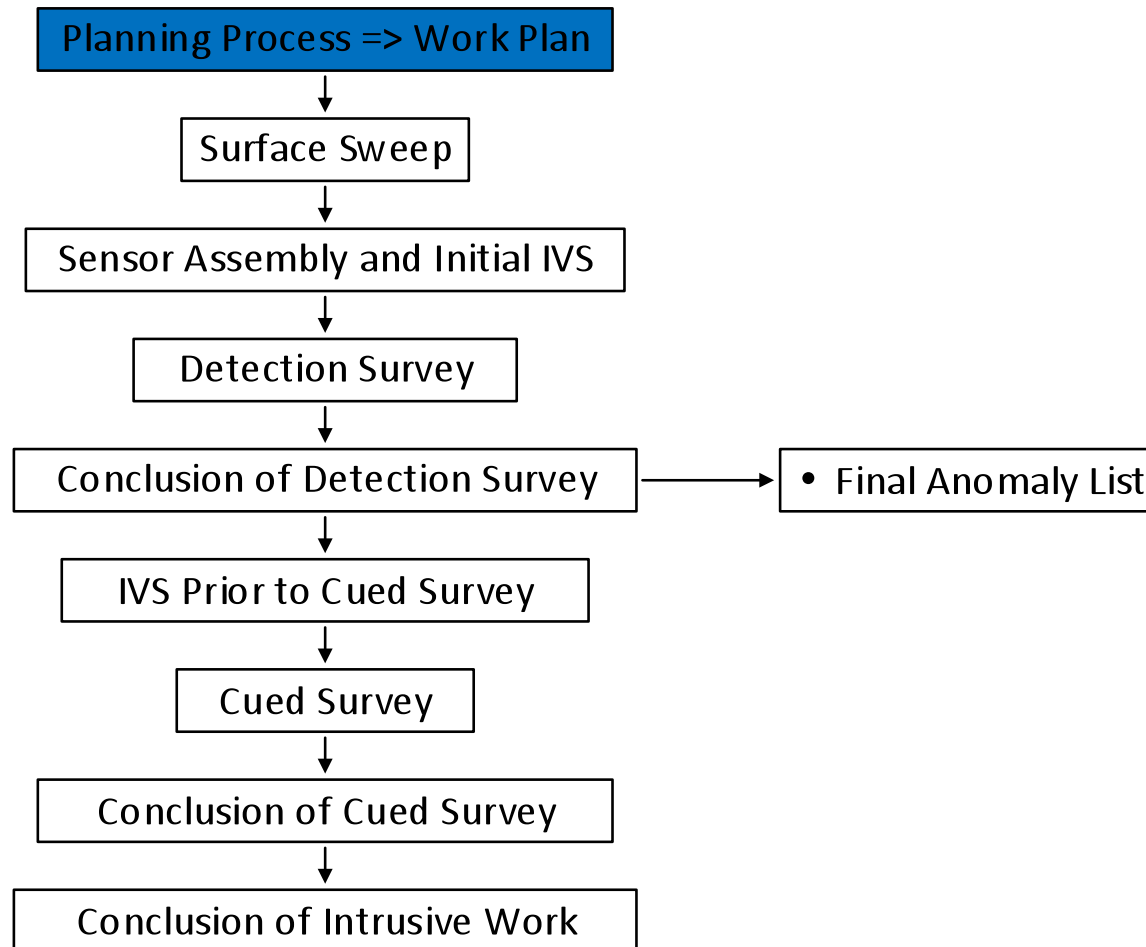
IVS Report



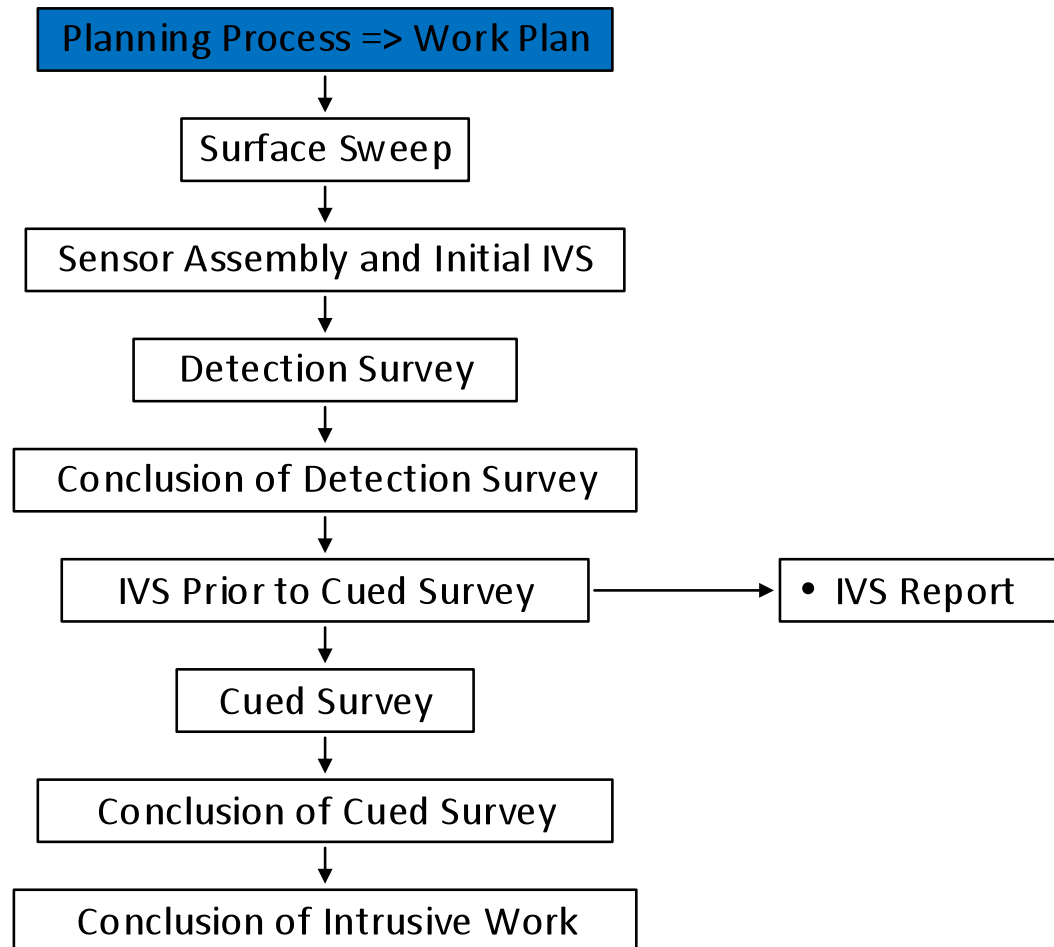
Detection Survey



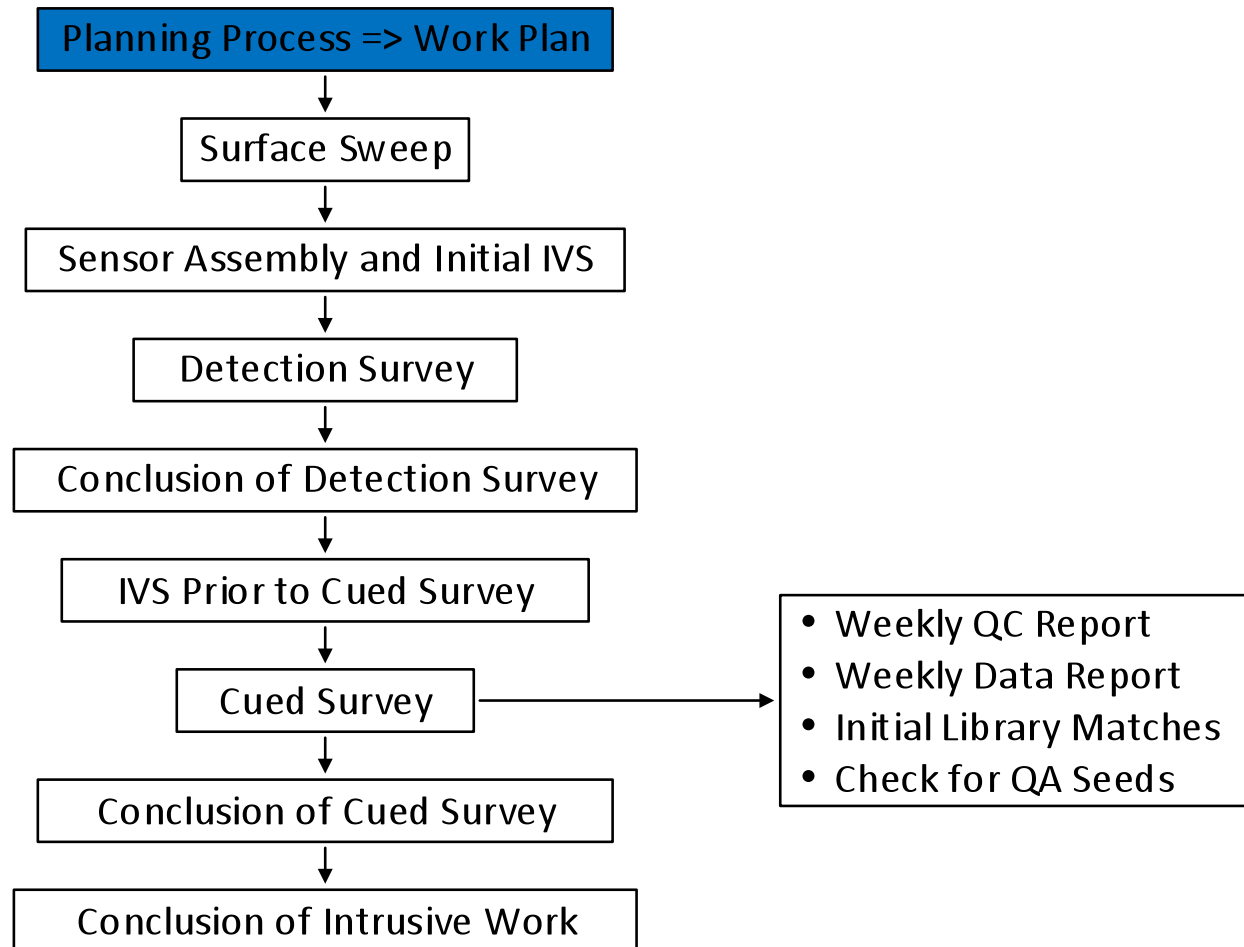
Conclusion of Detection Survey



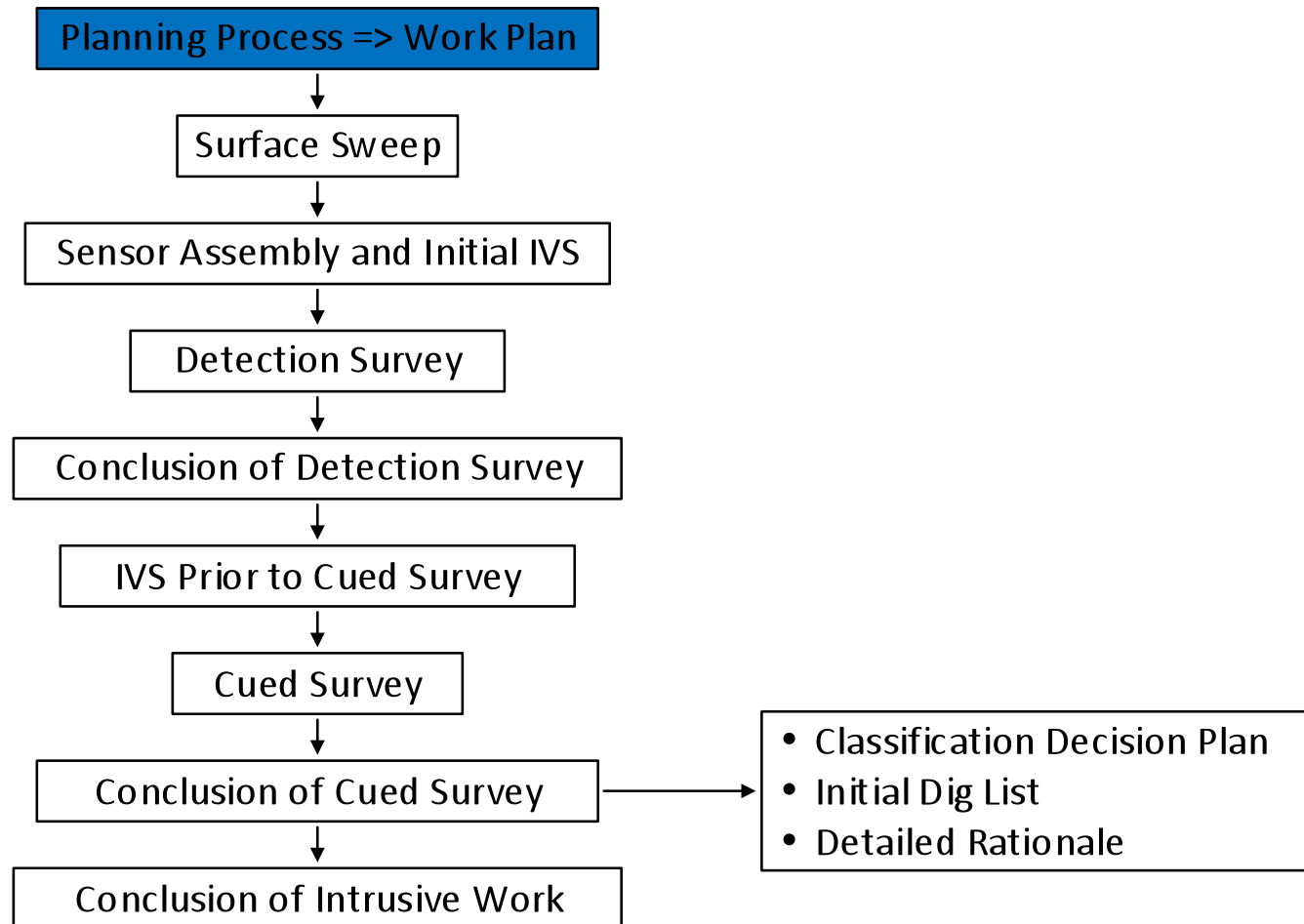
First Cued IVS Visit



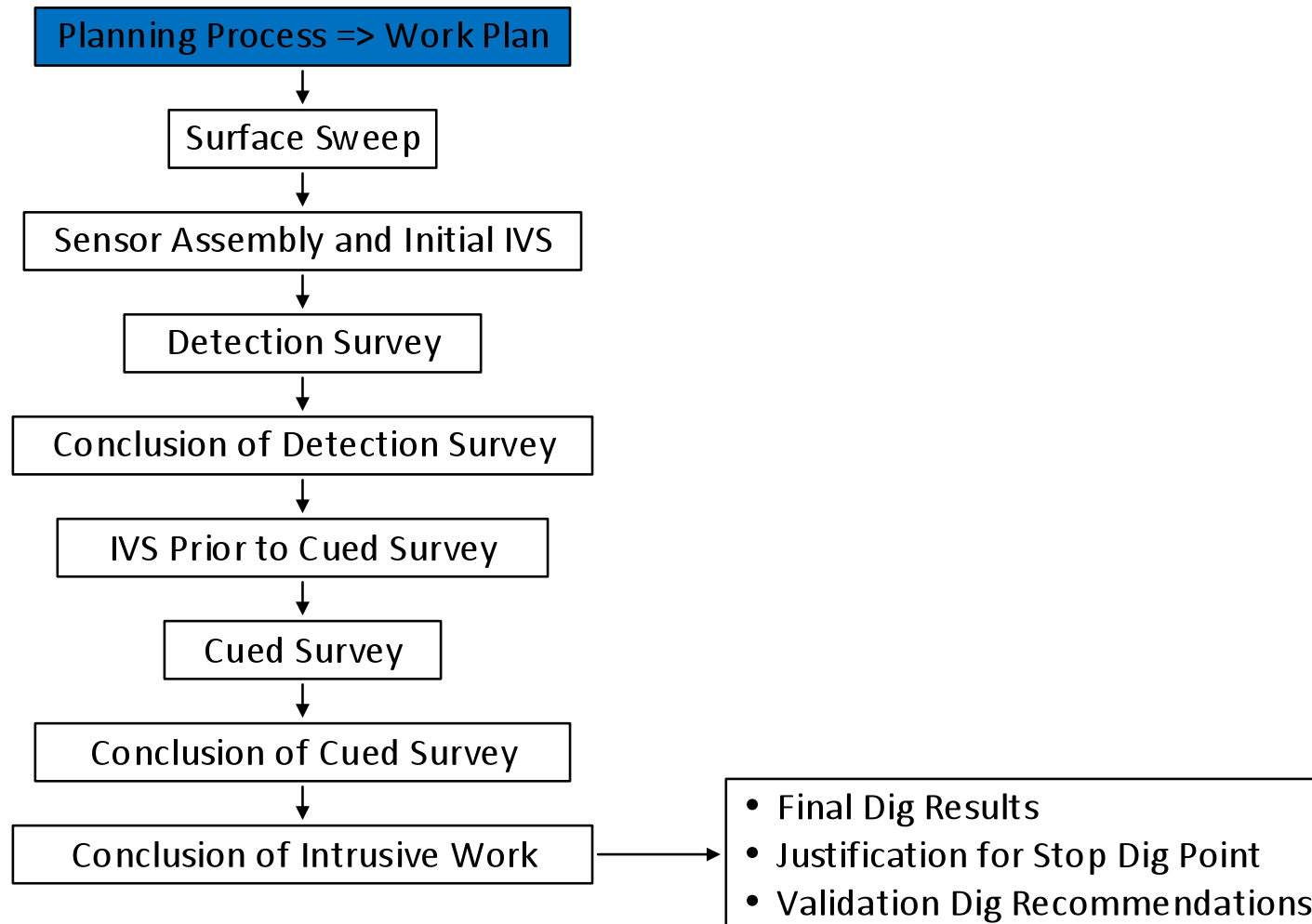
Cued Survey



Conclusion of Cued Data Collection



Conclusion of Intrusive Work



Final Stage of Project

- Government prepares final validation plan
 - ◆ test each decision threshold
 - ◆ random digs of non-TOI to test inversion results
- Validation digs
- If no surprises, project is complete



For More Information

serdp-estcp.org

**Featured Initiatives > Munitions Response Initiatives >
Classification Applied to Munitions Response**

Or

Search – Classification Applied to Munitions Response