Efficient and Secure Cloud Computing for UXO Classification and Project Management

MR-201713
Dean Keiswetter
Acorn Science and Innovation, LLC
In-Progress Review Meeting
2/21/2018

MR-201713: Cloud Computing for UXO Classification

Performers: AcornSI and Geosoft, Inc.

Technology Focus

- Detection, Classification and Remediation of Military Munitio

Demonstration Site

- Former Lowry Bombing and Gunnery Range

Demonstration Objectives

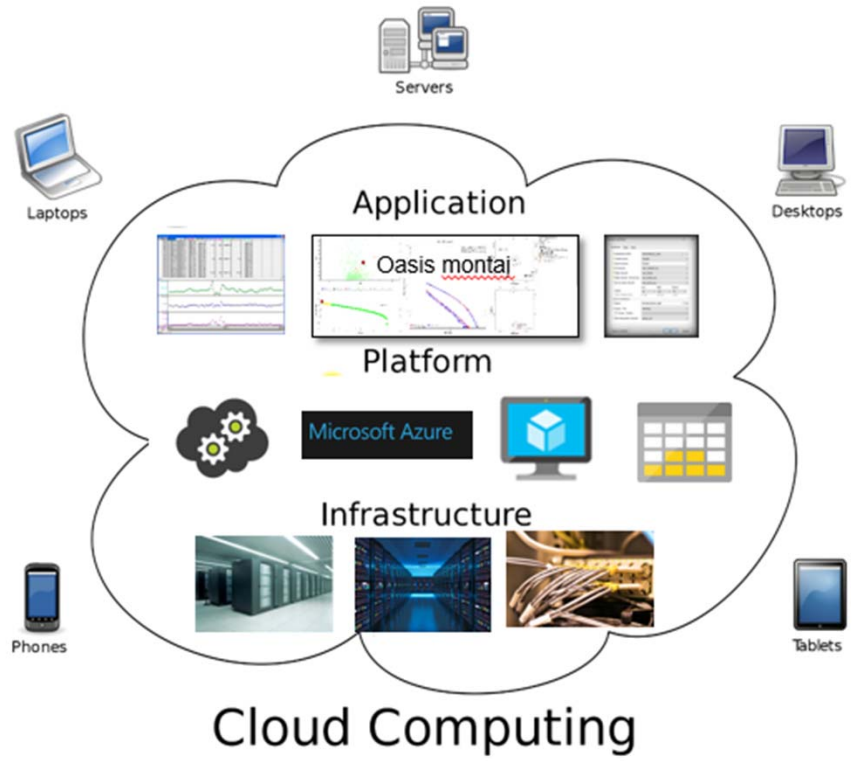
- *Develop and demonstrate Cloud based data analysis an classification capabilities*
- *Classification performance that matches PC-based UX-Analyze*

Project Progress and Results

- *Cloud-based Workflow*
- *Cloud-based Architecture*
- *UX-Analyze Web Server*

Implementation Outlook

- *Excellent*
- *Rick Grabowski offered Corps of Engineers support*

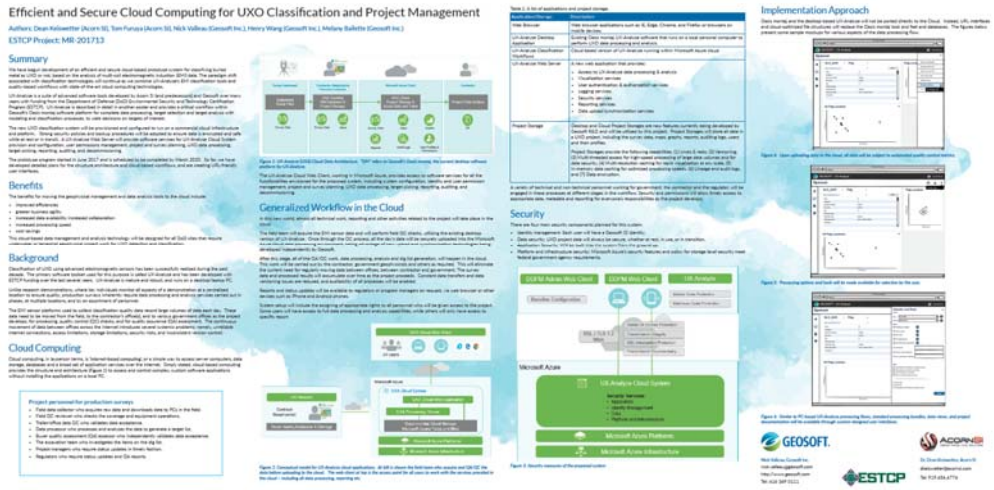


Social Media Content

"A new ESTCP project begun 2017 is bringing advanced UXO classification to the cloud. *This exciting project* is expected to deliver enhanced data and project security, speed of processing and analysis, auditability, and many other benefits. Year one developments included data handling schemes, system architecture, user experience interfaces, interactive linking, and EM inversions."

Efficient and secure Cloud Computing for UXO Classification and Project Management

SERDP-ESTCP 2017 Symposium Poster



Geosoft and AcornSI move UXO classification to the cloud

September 28, 2017 | Geosoft News

Geosoft is partnering with Acorn Science and Innovation to create a cloud-based technology solution for unexploded ordnance classification projects. The 3-year project, funded by the US Department of Defense's Environmental Security Technology Certification Program, will deliver a cloud prototype for classifying buried metal as either UXO or non-hazardous clutter based on the analysis of electromagnetic induction data.

READ MORE

http://www.geosoft.com/news/geosoft-and-acornsi-move-uxo-classification-cloud

Project Team

- Dean Keiswetter, Ph.D.
- Tom Furuya
- Bruce Barrow, Ph.D.

- Nick Valleau
- Hossein Madjidi
- Sameh Mora
- Melany Bailette
- Tara Marshall
- Darren Mortimer
- Rina Hartmann
- QA testers (2)

Problem Statement

This project addresses the detection, classification, and remediation of military munitions.

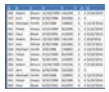
- It is highly relevant and important, given the 2017 DoD Policy that declares Advanced Geophysical Classification technologies the default technology for MMR responses.

The current approach is to utilize PC-based, UX-Analyze software. Limitations of PC-based solutions include:

- compartmentalized security
- compartmentalized collaboration and communication
- compartmentalized version control, activity logging, and auditing
- local IT requirements
- local and limited processing speed

Problem Statement (over simplified)

PC-based Analysis



State/Fed Regulator

Why am I not updated?

…process local, provide snapshots of progress

Contractor

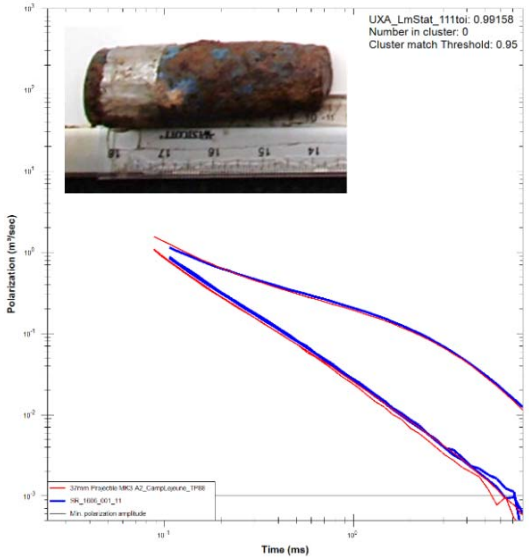
My government system can't view the data…

Government Buyers

Have they validated the sensor yet?

Technical Objective

Our objective is to develop and demonstrate an effective, efficient, and secure cloud computing technology for classifying buried metal as UXO or not, based on the analysis of multi-coil electromagnetic induction (EMI) data.



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Cloud Computing Characteristics

- *On-demand self service*
- *Ubiquitous network access*
- *Location-independent*
- *Rapid elasticity*
- *Pay per use*

Technical Approach

Leverage commercial cloud infrastructure and platforms with UX-Analyze work flows, processes, and solvers

Cloud Technology

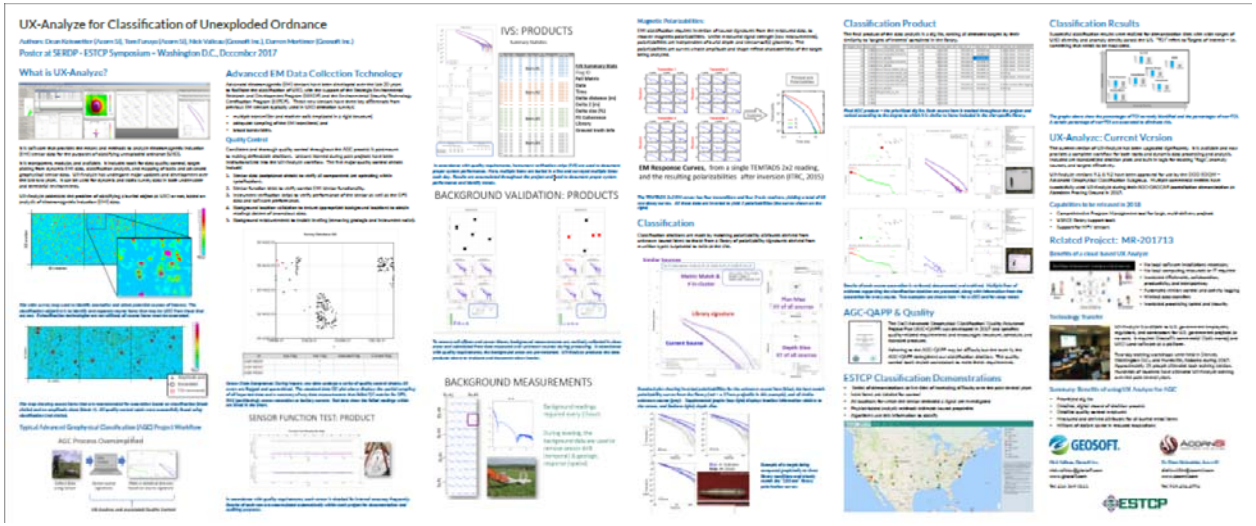
- Strong security policies and backup procedures
- Data is encrypted and safe while at rest or in transit
- Efficient data transfer and storage containers

UX-Analyze

- Mature solvers and classification logic
- Efficient user workflows and processing schemes
- Proven track record
- Strong user base

Technical Approach

UX-Analyze is a suite of advanced software tools developed by Acorn SI and Geosoft over many years with funding from ESTCP



Over 350 individuals(45 firms) have participated in 2-day, data-analysis workshops

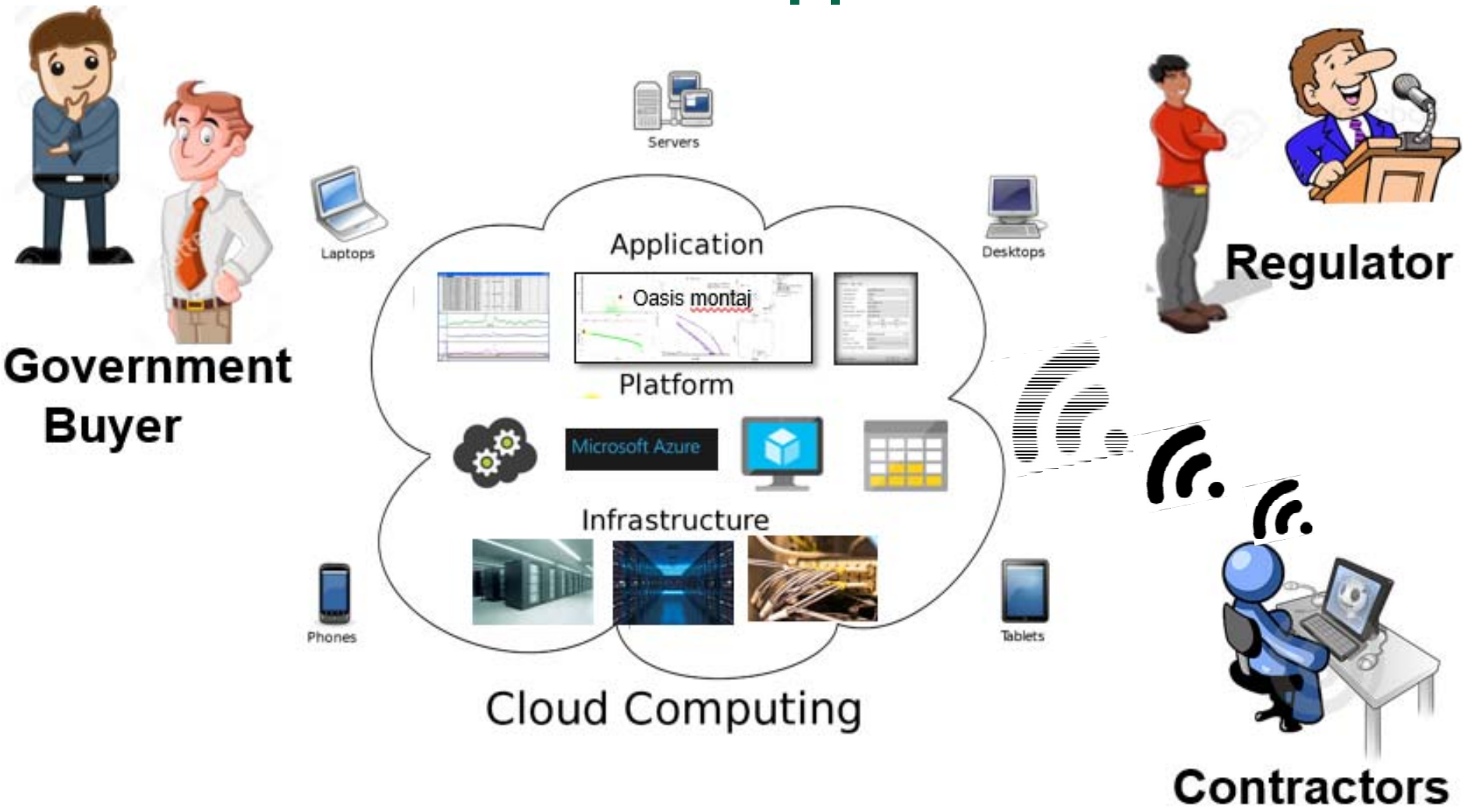
Multiple commercial firms have successfully used UX-Analyze during AGC-DAGCAP accreditation demonstrations

Technical Approach

UX-Analyze: Workflow & QC

- High level bundles to guide data analysis
- Institutionalized QC measures and products
  - Sensor function tests
  - Instrument verification strips (IVS)
  - Check every sensor stream for quality
  - Background location validation
  - Background measurements

Technical Approach

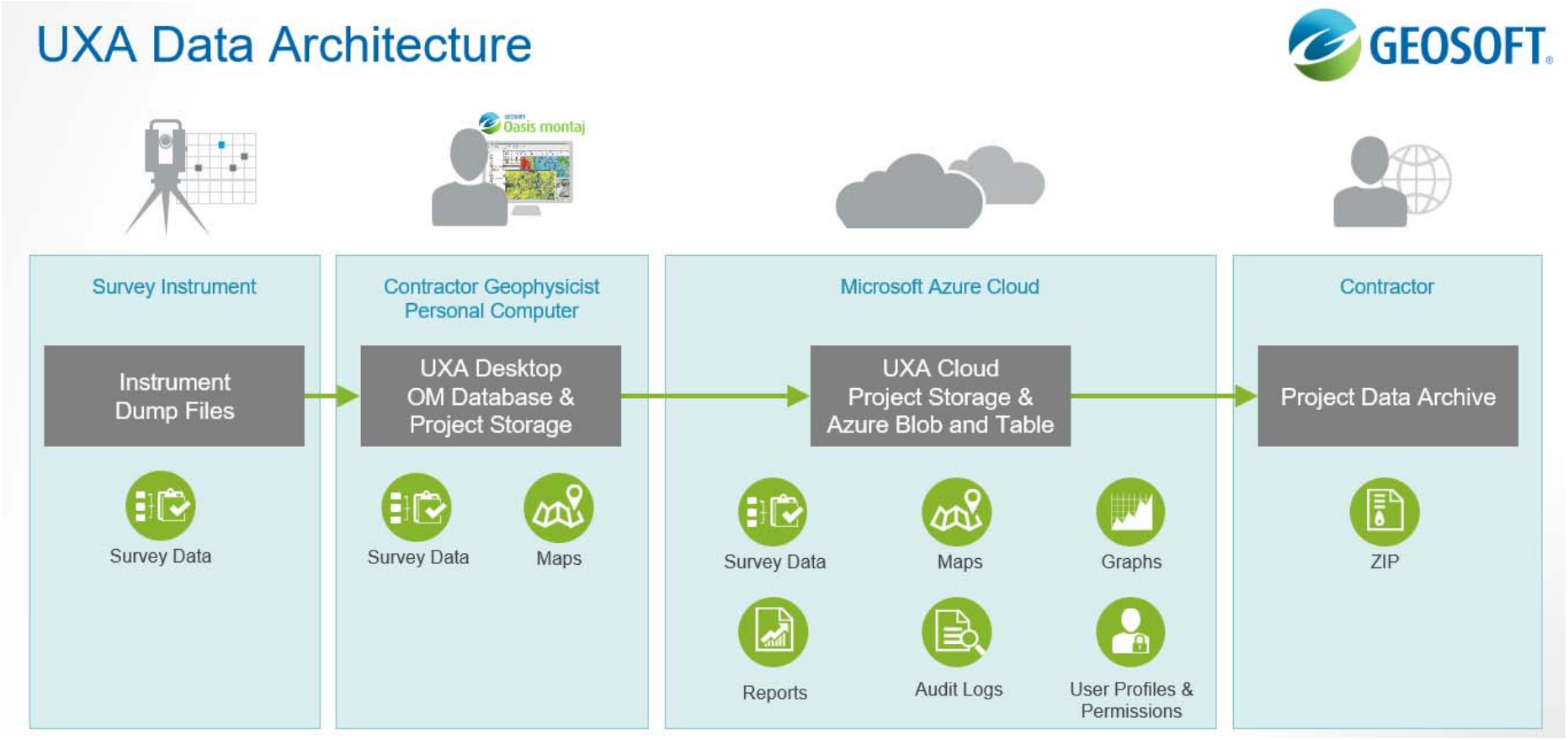


Cloud-based analysis

Technical Progress

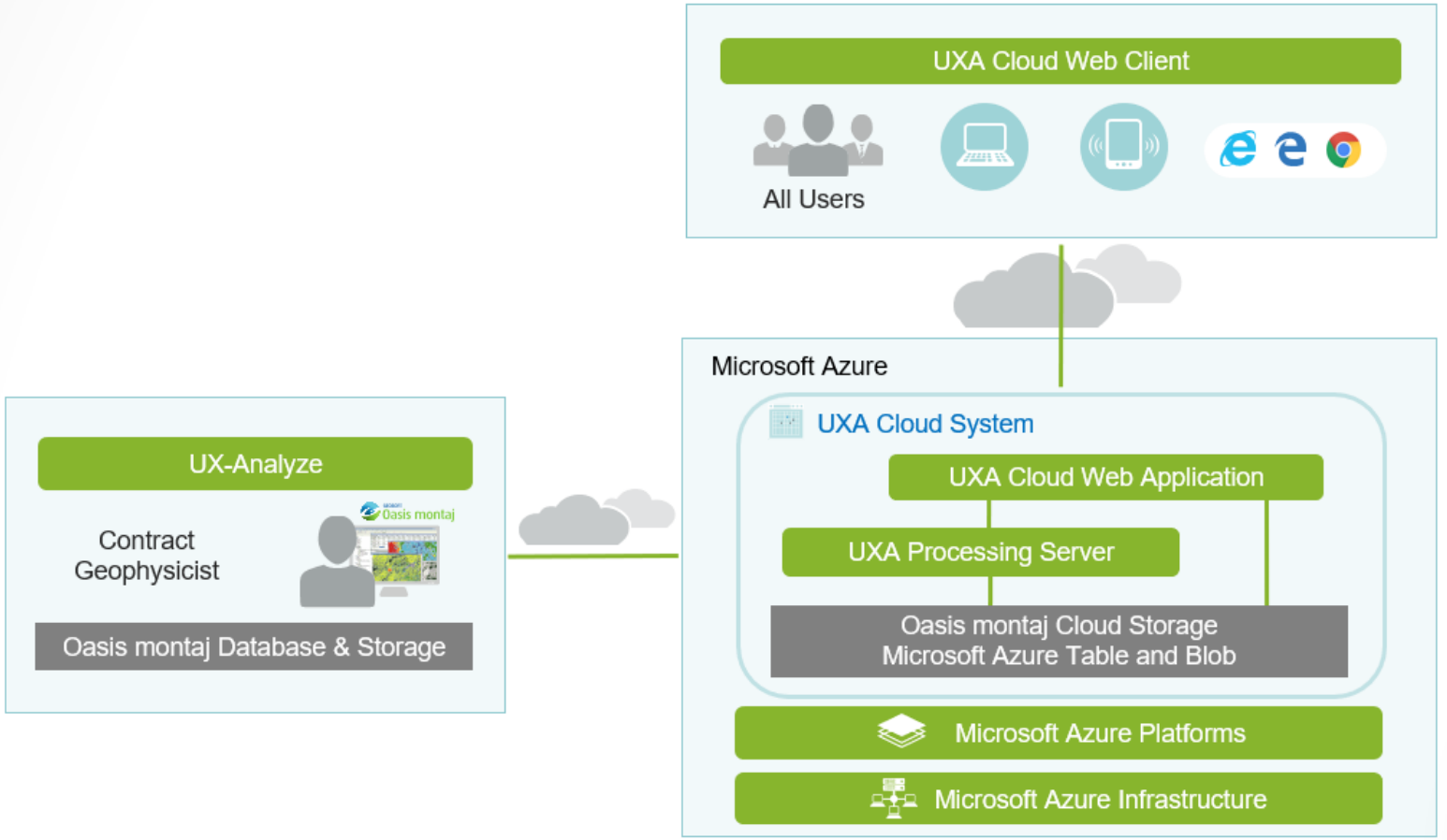
TASK	DESCRIPTION	Year 1				Year 2				Year 3		
		Jun-Aug '17	Sep-Nov '17	Dec-Feb '18	Mar-May '18	Jun-Aug '18	Sep-Nov '18	Dec-Feb '19	Mar-May '19	Jun-Aug '19	Sep-Nov '19	Dec-Feb '20
1	Plans											
1a	Cloud-based Workflow											
1b	Cloud Structure Architecture											
2	Development											
2a	Project Storage Container											
2b	UX-Analyze Web Server											
2c	UX-Analyze Enhancements (Option 1)											
3	Demonstration											
4	Management											

Technical Progress



Technical Progress

UXA Cloud Applications

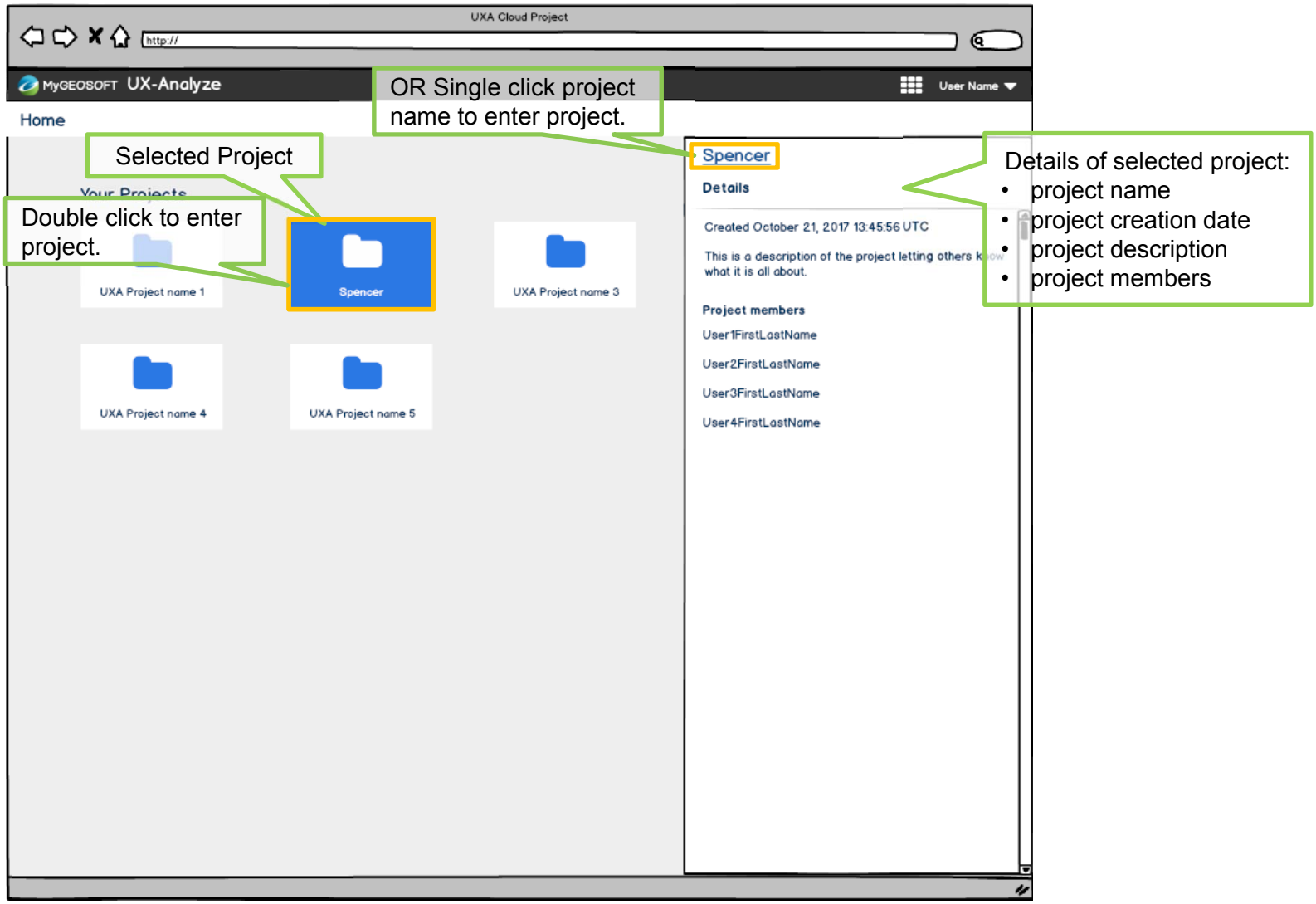


Technical Progress

Summary of accomplishment to date…

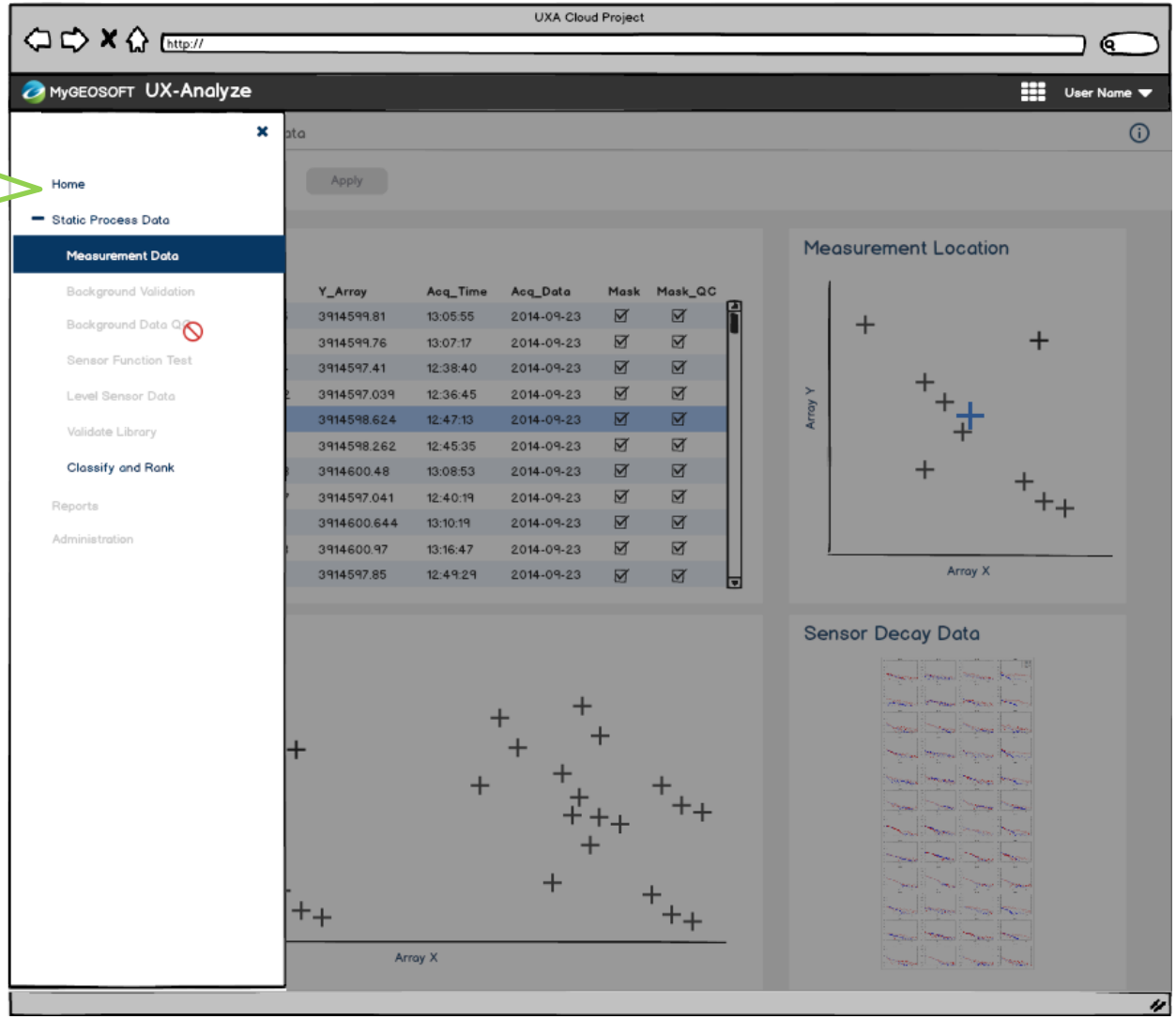
- Data Transfer GX: from Desktop OM to Cloud
- Graphical Look and Feel (cards, forms, etc.)
- System behavior and user notifications during events
- Workflow for Cued Data (Classify and Rank)
- Graphical displays for a variety of cards
- Linking tool between data displays
- User Interactive Capability
- Inversions + OM math (size and decay calculations)

Technical Progress

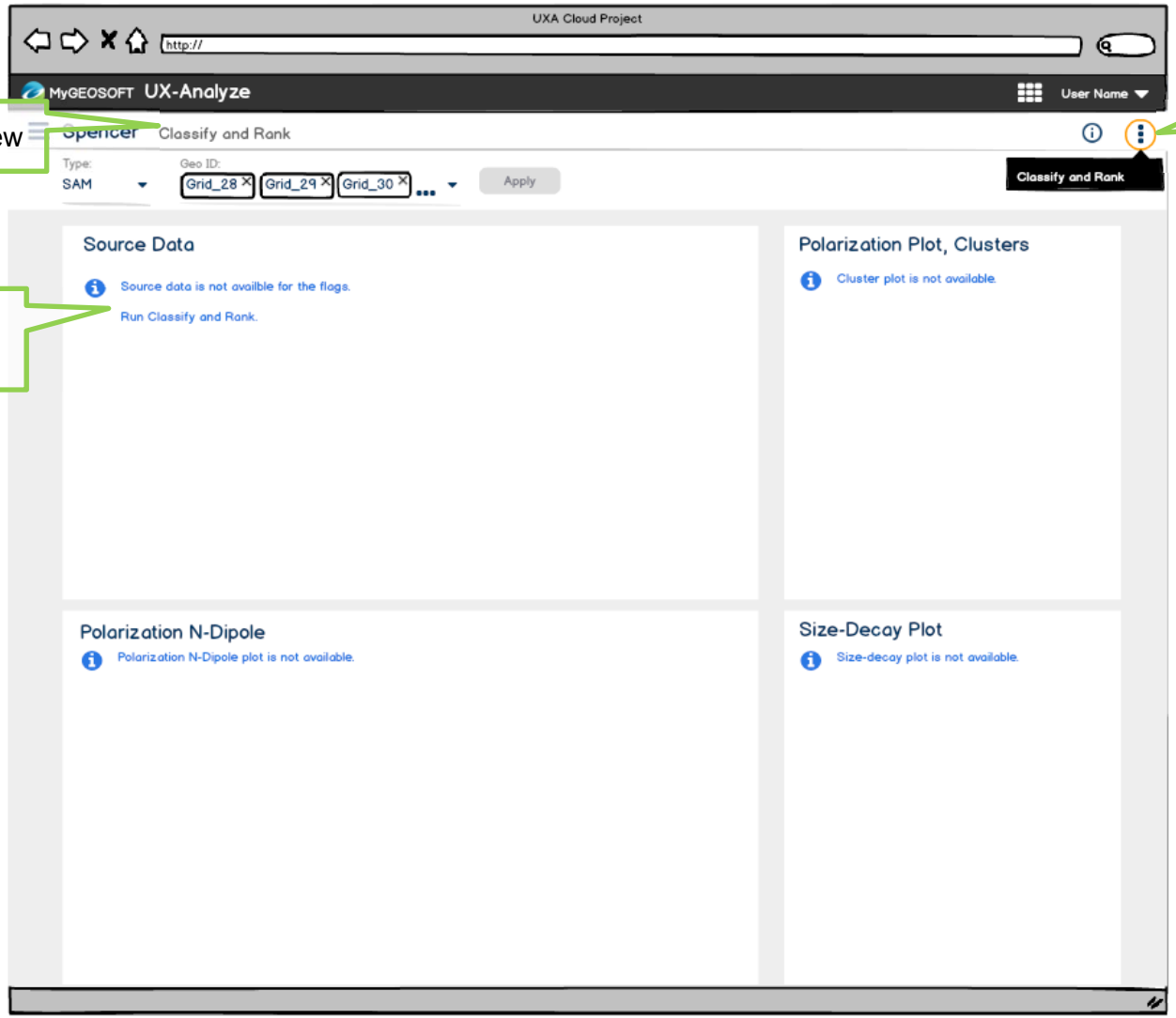


Technical Progress

Navigation, appears after clicking icon



Technical Progress

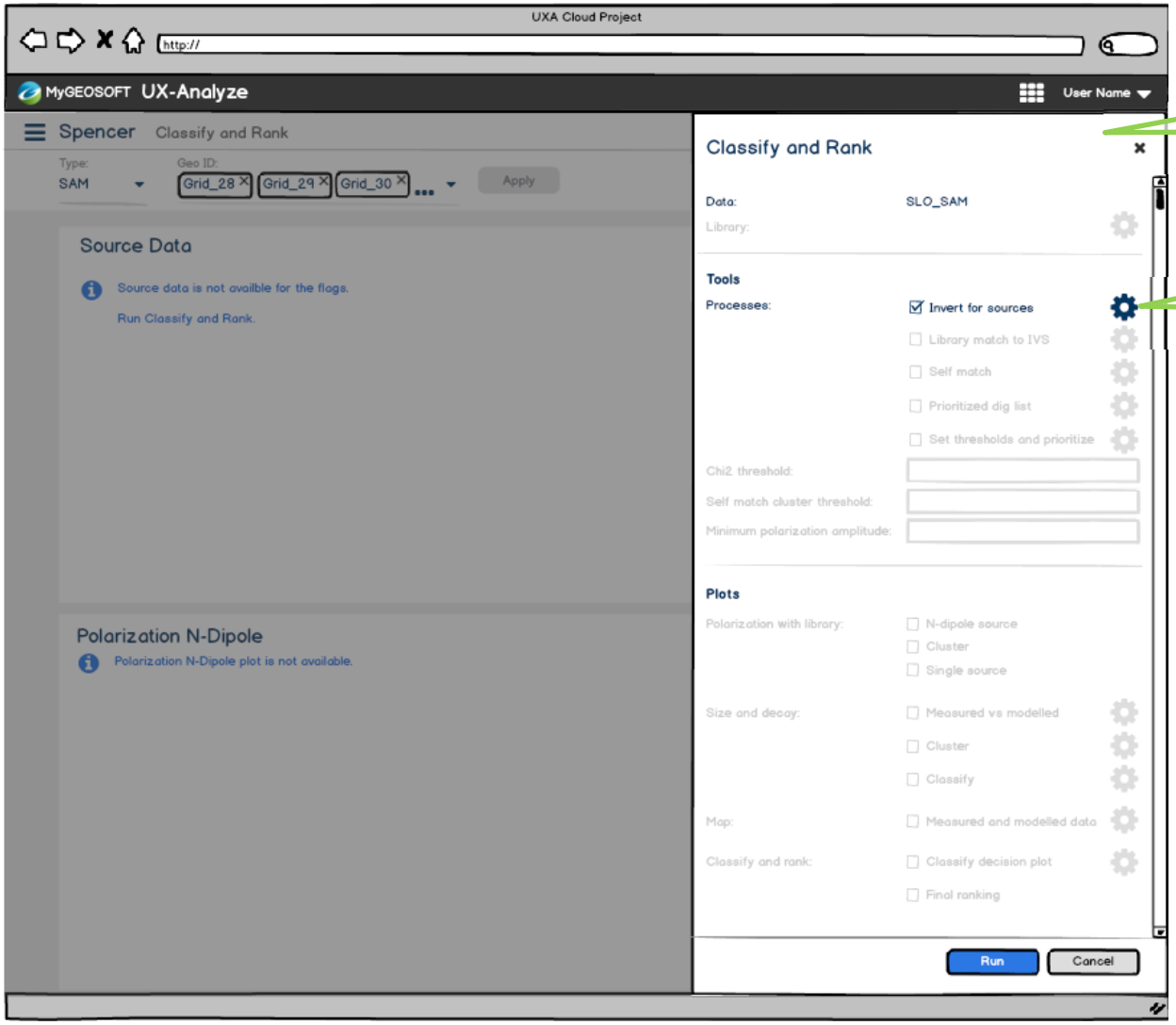


Classify and Rank view

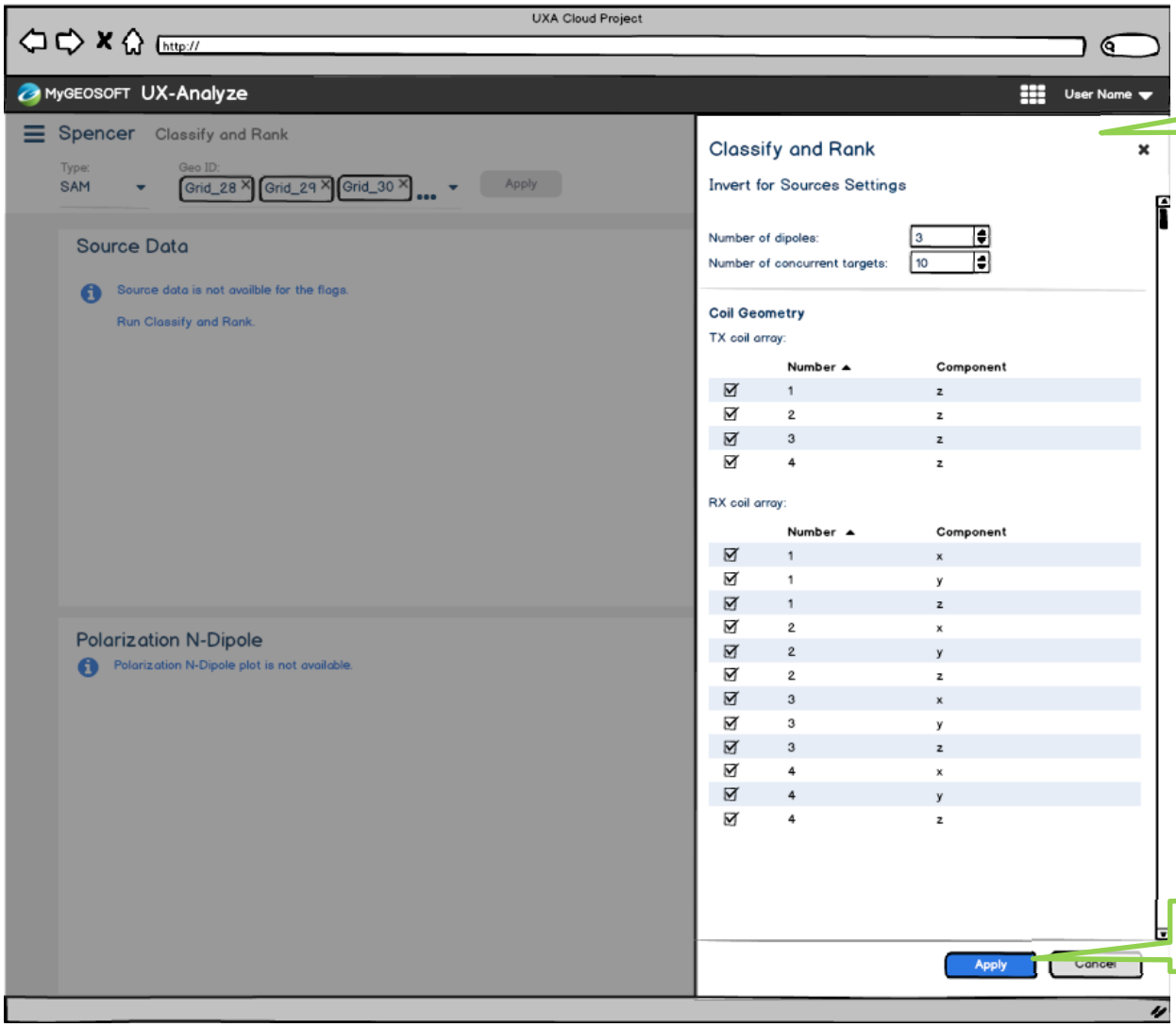
Process Classify and Rank

Information messages appear on cards with no data.

Technical Progress



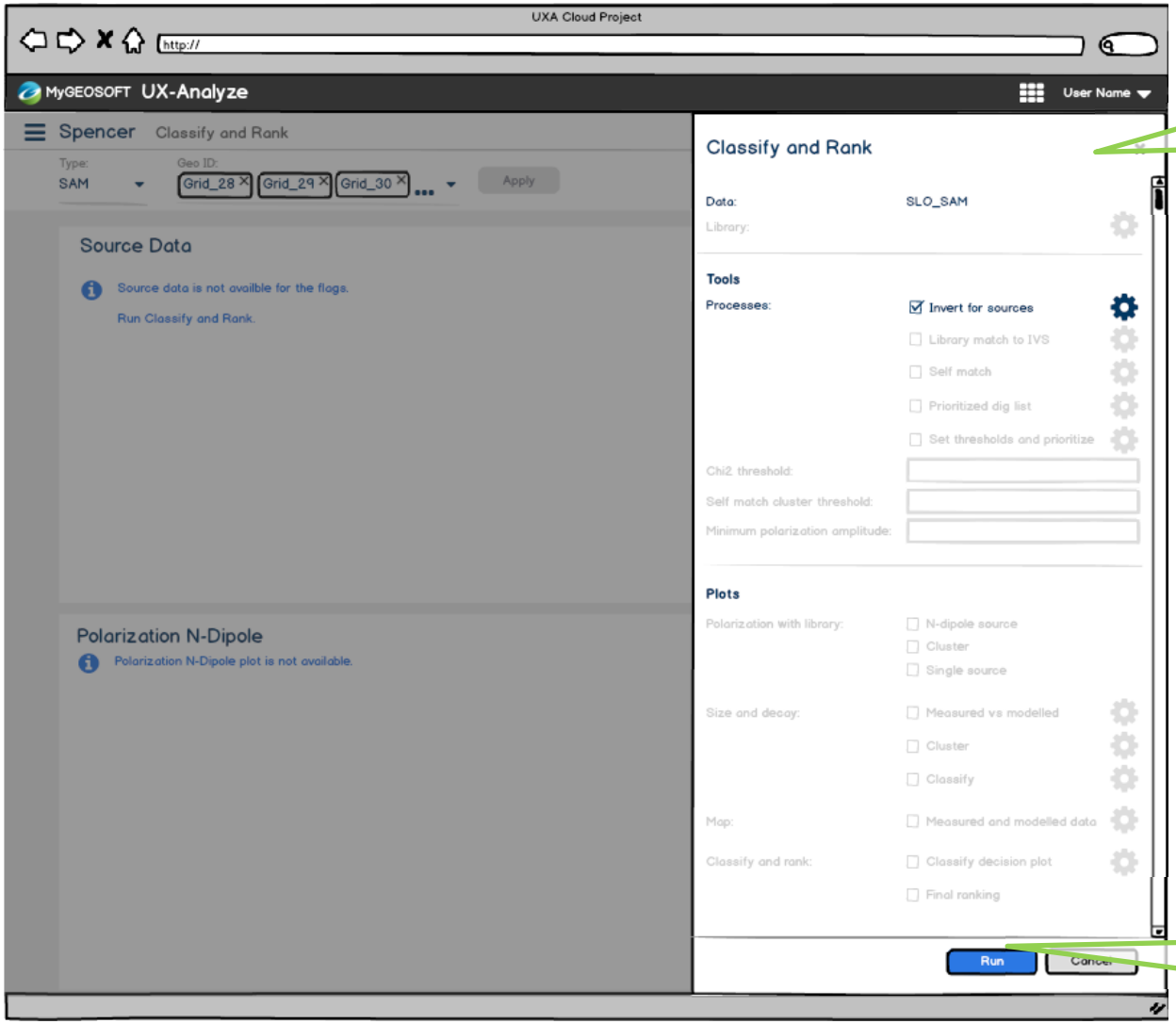
Technical Progress



Invert for Sources Settings

Applies changes made.

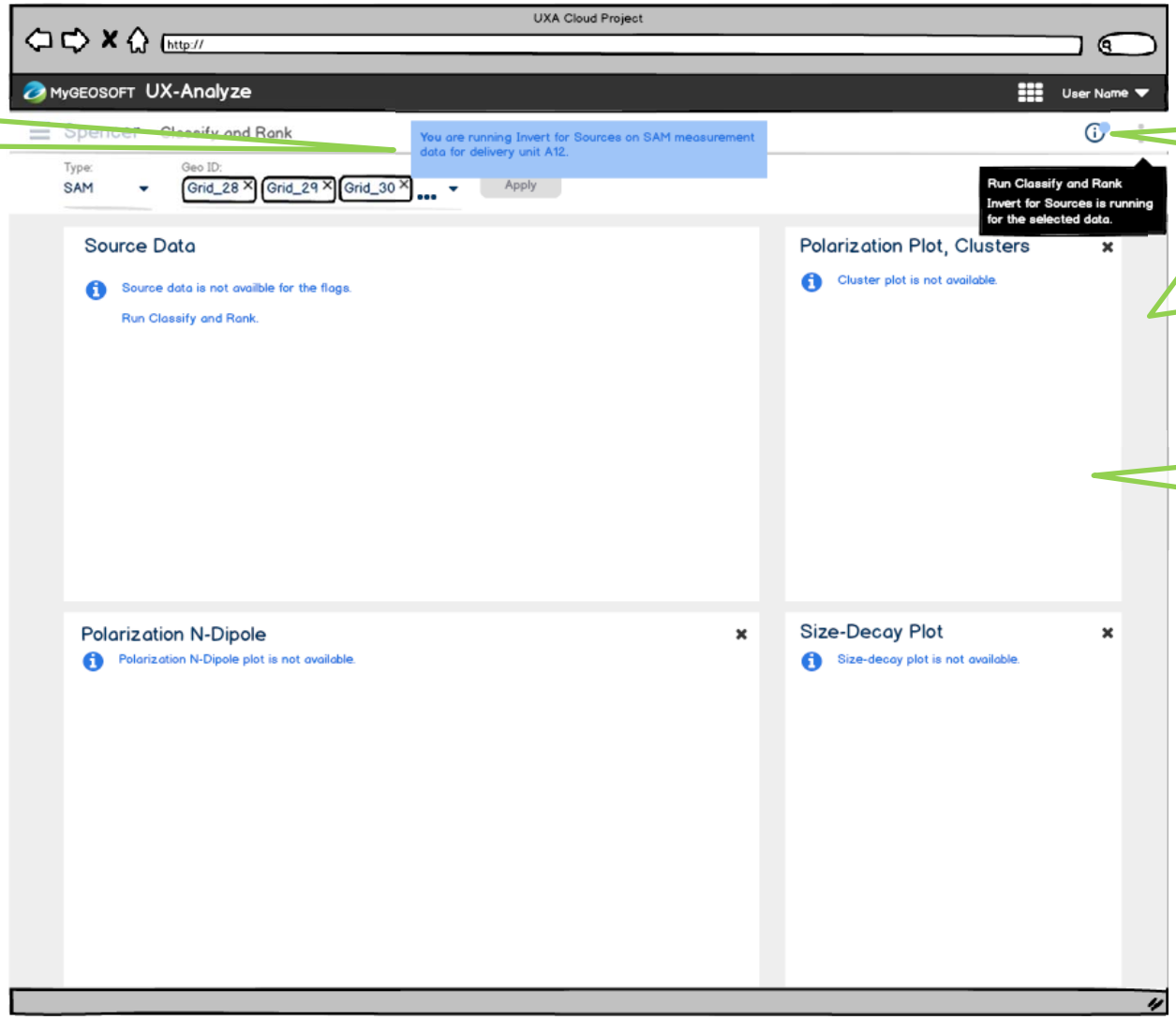
Technical Progress



Classify and Rank Bundler re-appears

Clicking Run, runs process in the cloud.

Technical Progress



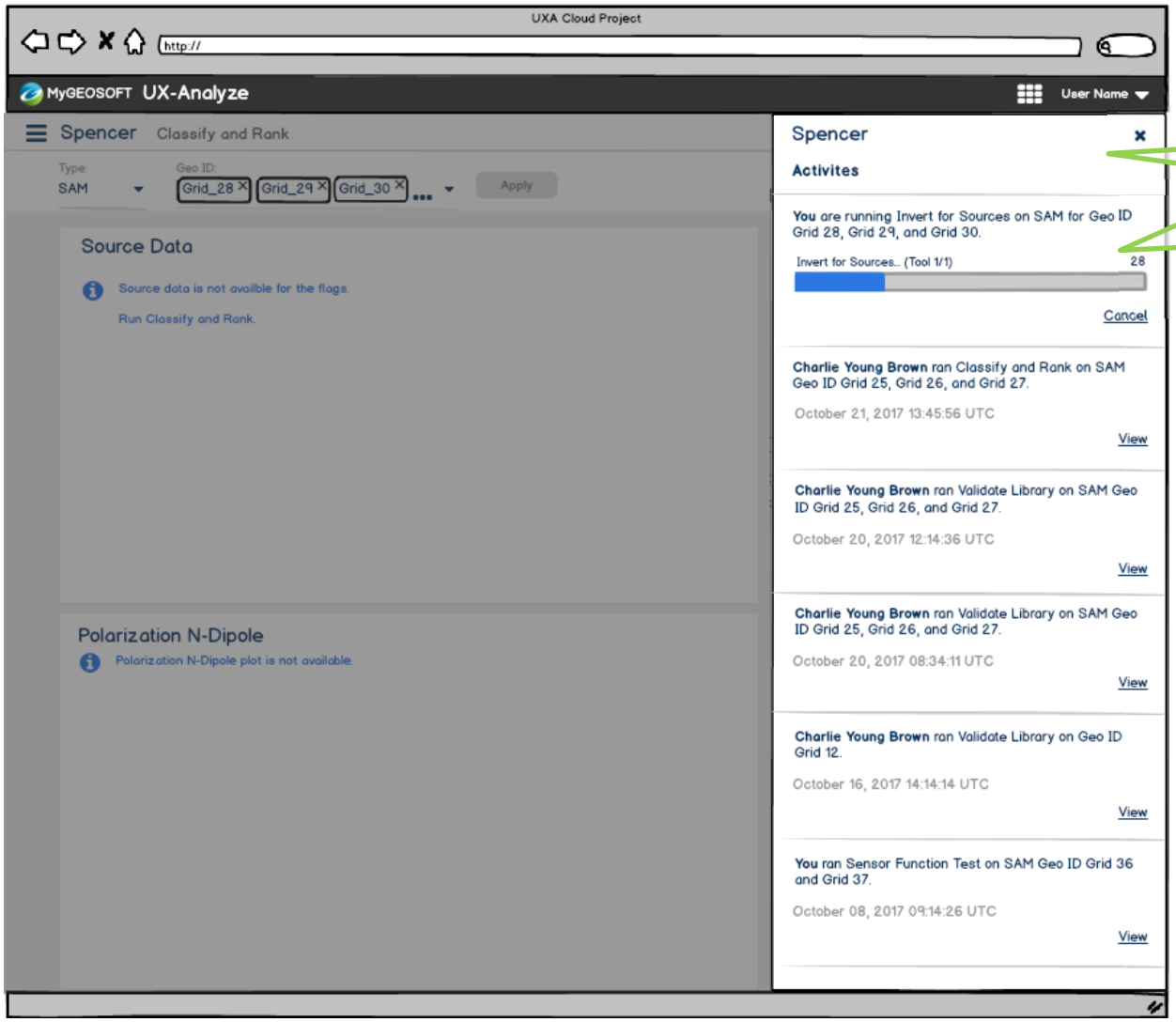
An info message box appears for 10 seconds.

Blue badge appears.

Classify and Rank icon is disabled for the selected Type and Geo ID that is running in the cloud.

Clicking on Activities icon opens a panel.

Technical Progress

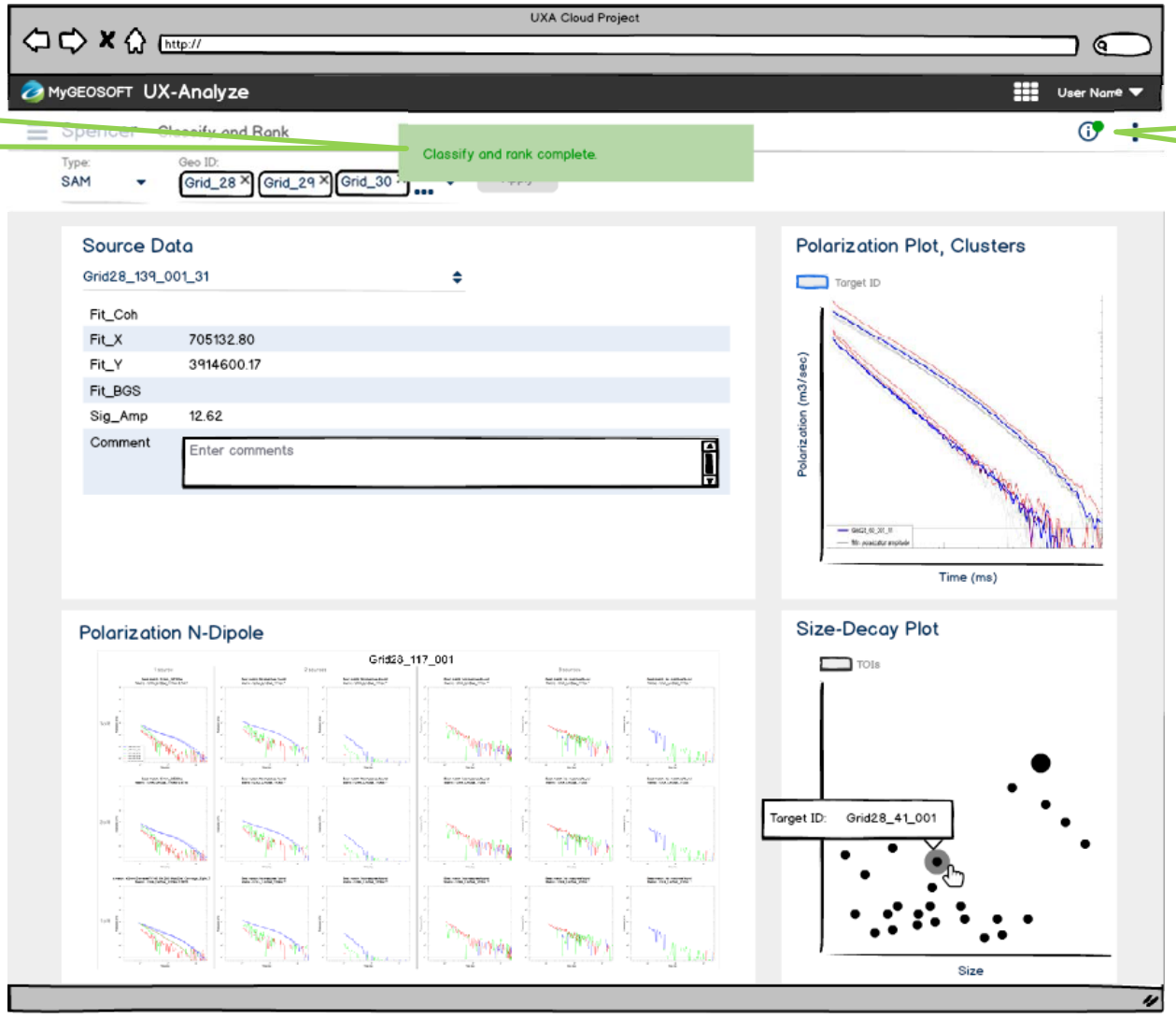


Activities Panel

Progress of process running in the cloud.

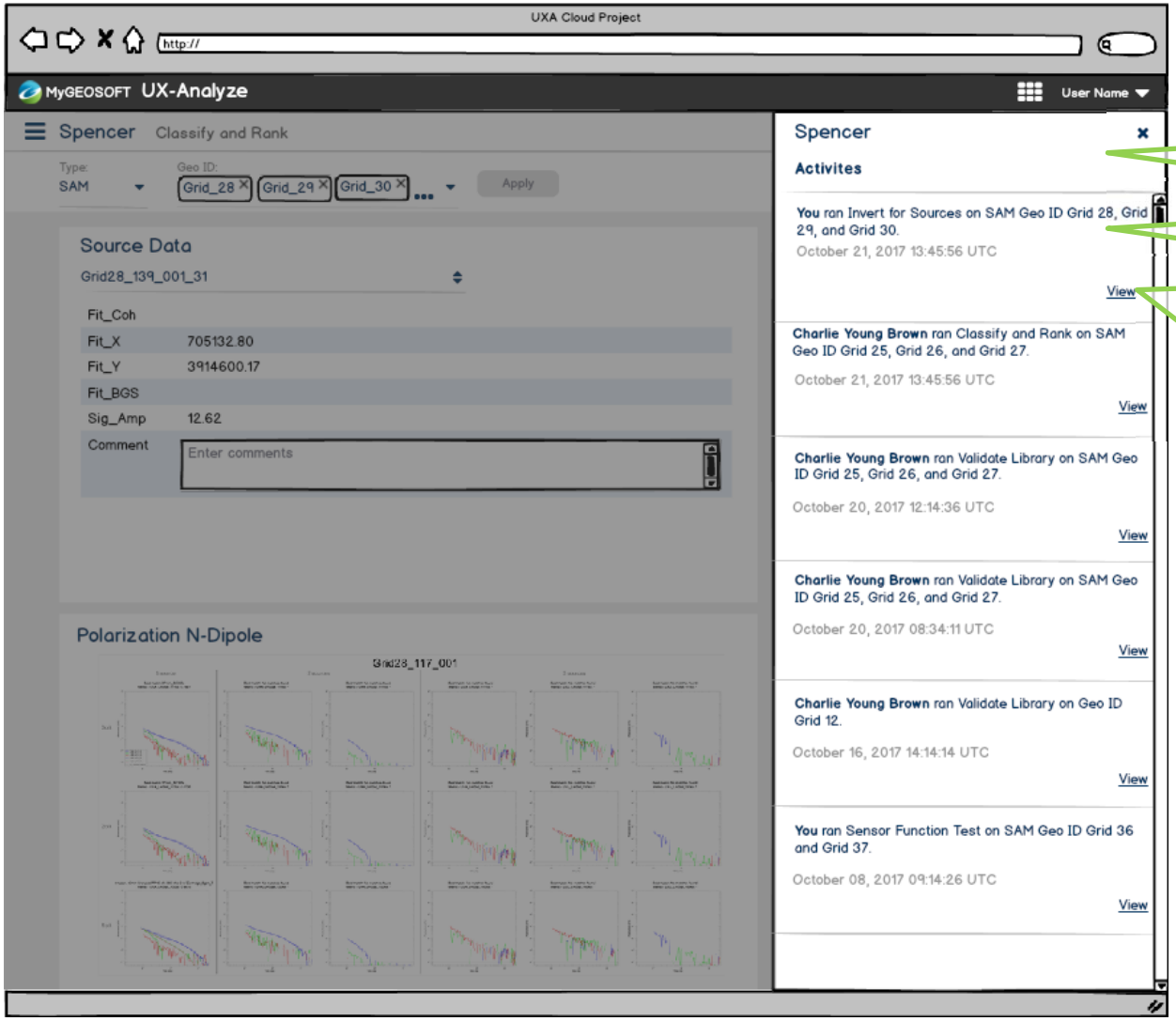
Technical Progress

A success message box appears for 10 seconds.



Green badge appears.

Technical Progress

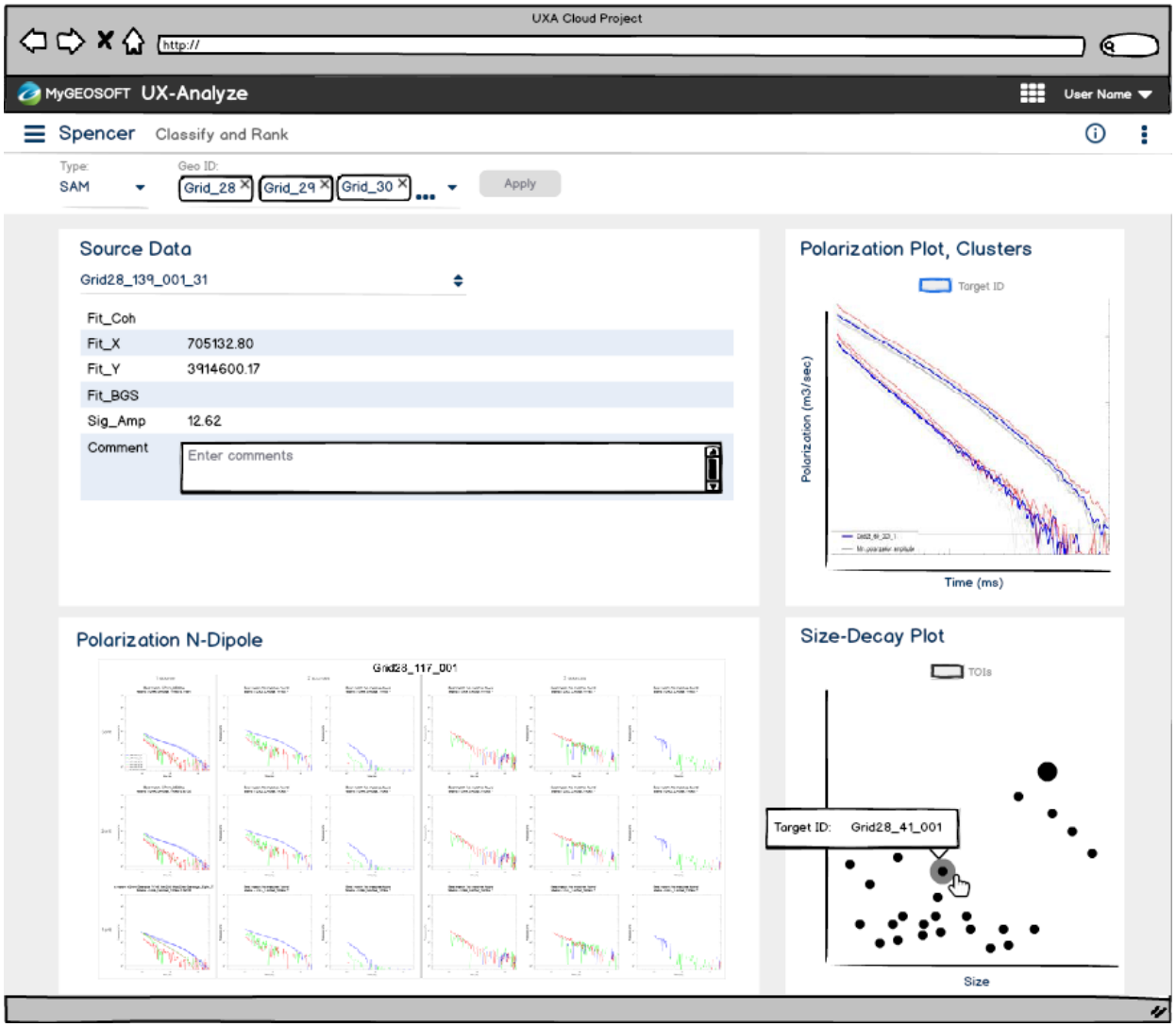


Activities Panel

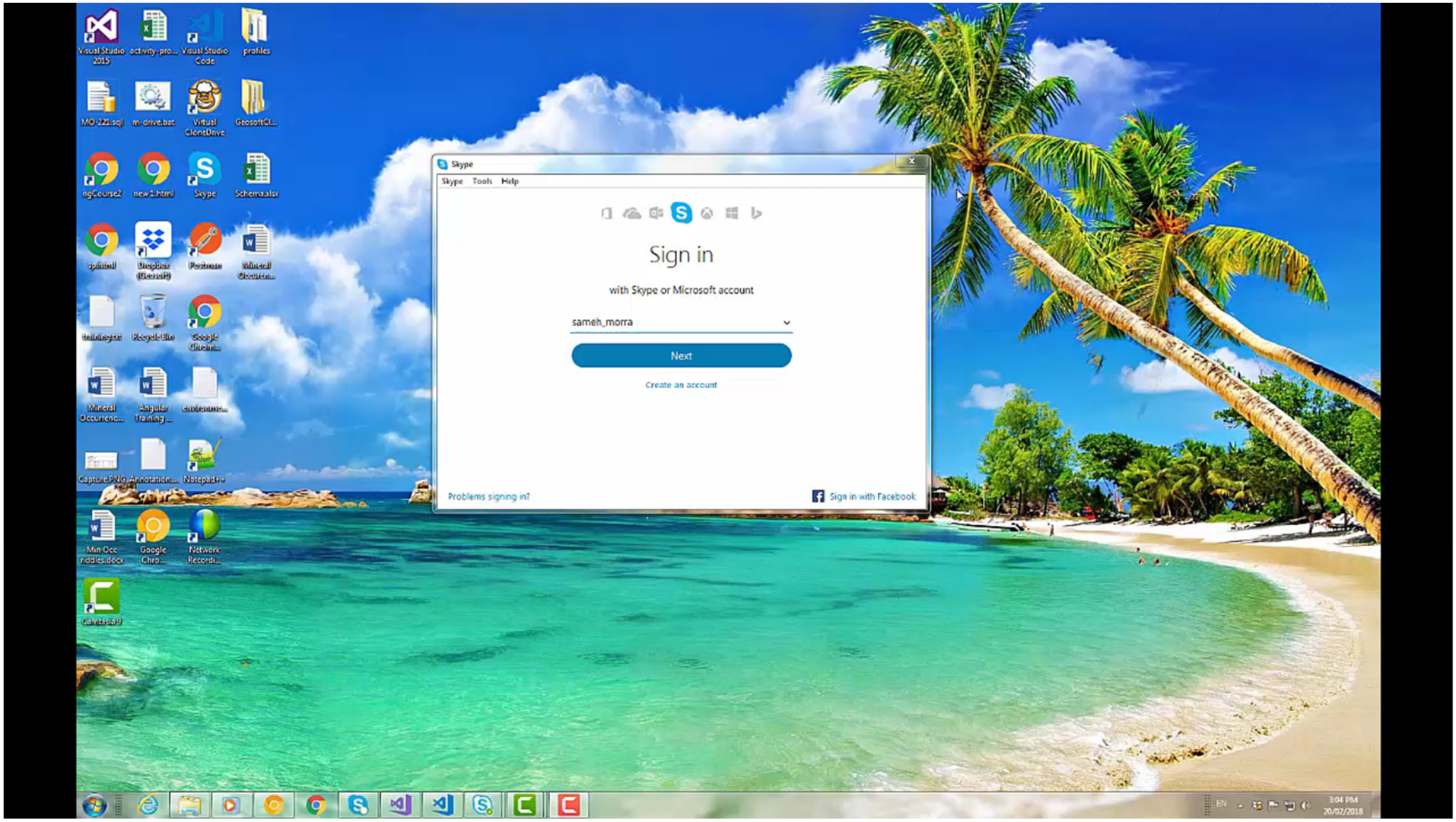
Log of activities for project Spencer.

Clicking View brings the user to that view with the Type and Geo ID selected.

Technical Progress



Technical Progress

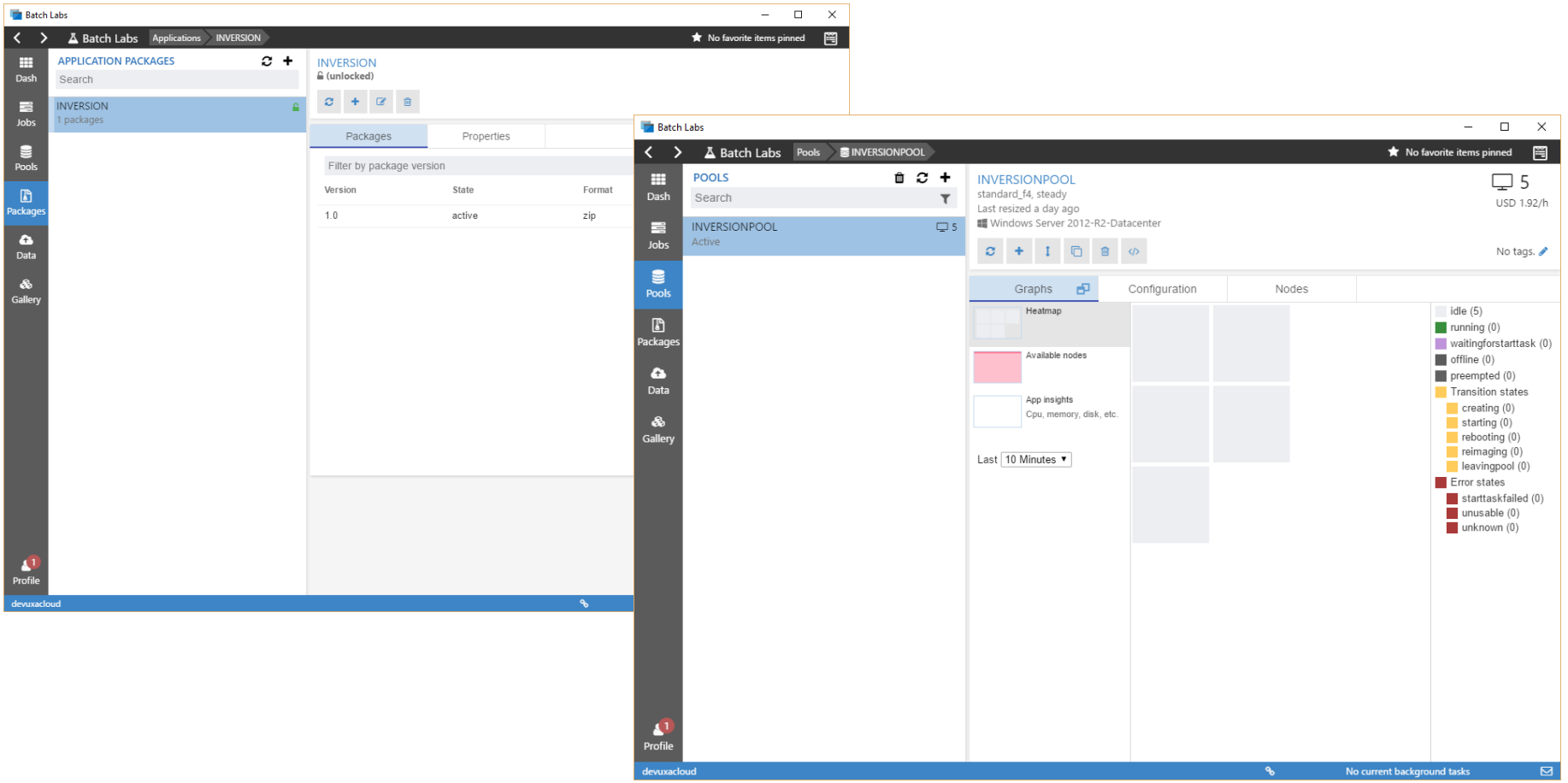


Technical Progress

Parallel batch jobs…

Application package (inversion DLL, instructions, IO Azure)

Procure the Application pool (collection of virtual machines)



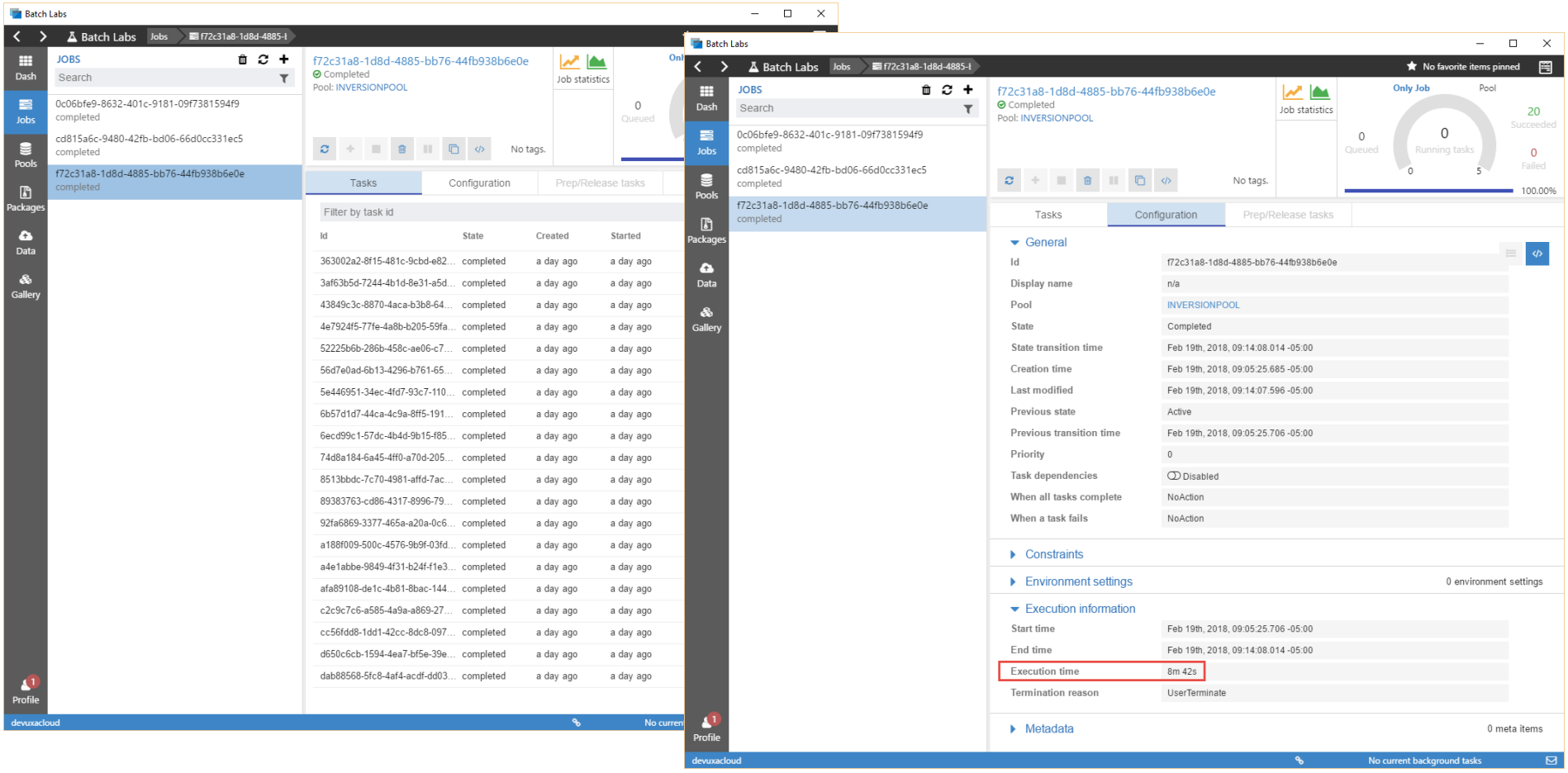
Technical Progress

Parallel batch jobs…example run

1000 cued data collections

20 VM's procured, each processed 50 measurements

Execution time < 9 minutes



Technical Progress
Demonstration Site

We proposed an initial system shakedown test, followed by the analysis of a complete, canned data set; processing the data in the same sequence as it was collected.

The data of opportunity are TBD and will be selected in consultation with the Program Office. The data recently collected the Former Lowry Bombing and Gunnery Range by Parsons may be a strong candidate.

The planned demonstration is one year out.

How will the service be consumed – high-level vision

- **Implementation of UX-Analyze Cloud Service**

Managed Service by Geosoft (initially)

- Provisioned cloud service, security, software and storage
- Infrastructure/framework & System configuration
- UX-Analyze deployment
- Project decommissioning

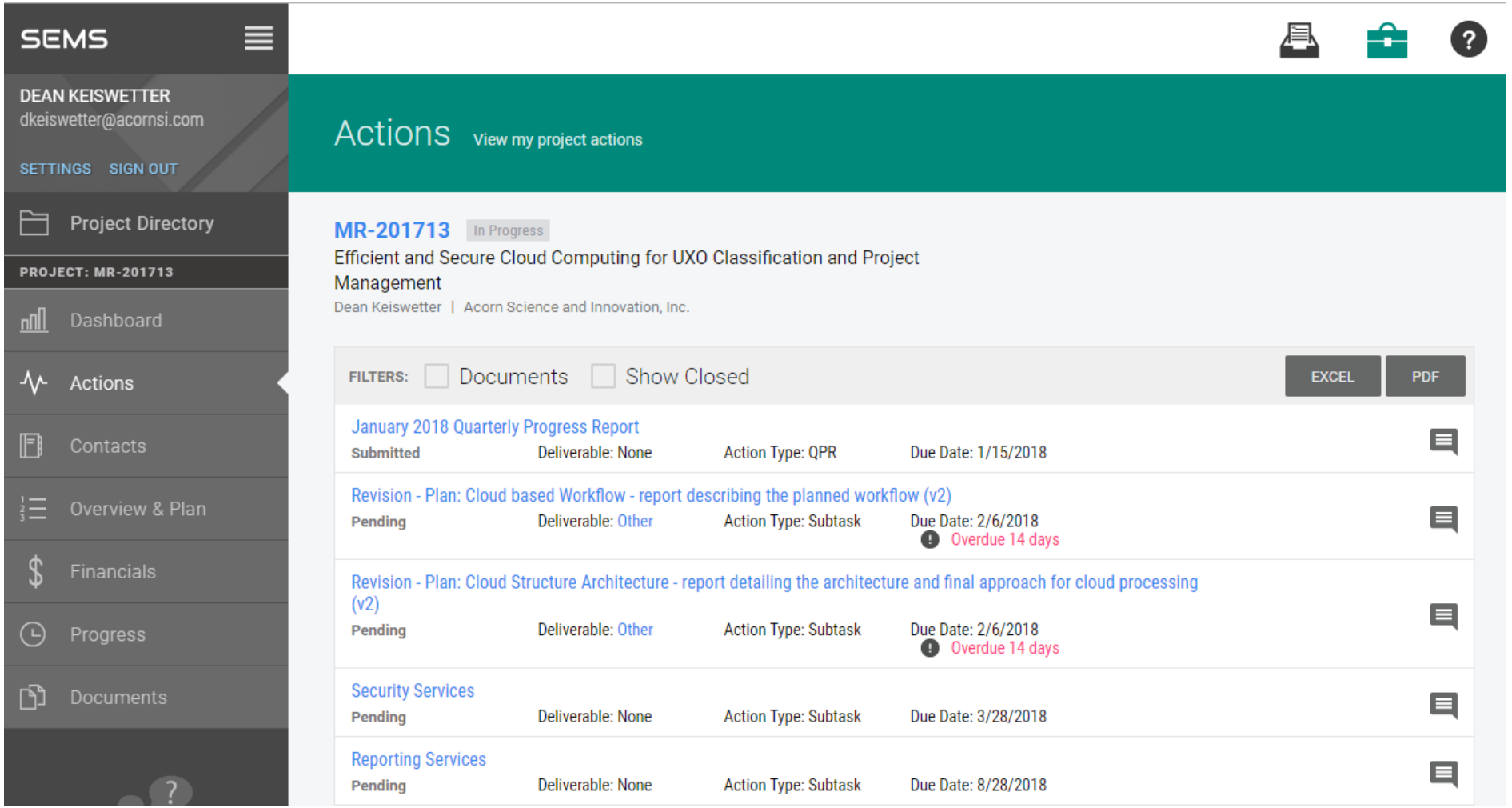
Administered Service by project prime contractor

- Manages user and project permissions
- UX-Analyze - data processing and analysis
- Overall project management
- Archiving and project completion

How will the service be consumed – high-level vision

- **Subscription/Project fees**
  - ♦ Provided as a service per project - rather than purchasing computers, software, IT services etc.
  - ♦ Service fees based primarily on:
    - – Project size
    - – Project duration and scope
    - – Number and type of users
    - – Extendable if project is modified or expanded

Action Items



Technology Transfer

- Technology transfer is a critical part of this project.

- The primary technology transfer component of this specific effort is our report detailing the UX-Analyze Cloud and the direct, hands-on participation of a contractor, a Corps of Engineers geophysicist, and a State regulator in the final demonstration.

Technology Transfer

- Upon successful completion of this program, we will solicit funding to aggressively pursue a number of technology transfer approaches targeting multiple audiences

- Suitable technology transfer approaches will likely include:
  - Training workshops, live or via webinar
  - Presentations at key conferences
  - Web-based tools (see example at link)
  - Technology fact sheets