

**Letter of Intent
Small Business Innovative Research (SBIR)
FY 2022 Phase I Release Proposal**

LabProbe Open Data Integration and Analysis Platform

Burge Environmental, Inc.



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**Phase I Submission
DE-FOA-0002554**

Topic 15a: FAIR DATA MANAGEMENT SOFTWARE TOOLS FOR USER FACILITIES

USDOE Office of Science (SC)

Technical Abstract

Modern science research centers, engineering R&D labs, and advanced manufacturing facilities have been limited in integrating their data due to multitudes of factors. Multiple generations of technology in these facilities makes any attempt at consistent data integration overly complex for a single institution to attempt due to various proprietary software, non-standard communication interfaces, and limited technical understanding of how these tools function. Considerable user-provided metadata and review is necessary to produce ML/AI-ready datasets. Few institutions have the resources, technical or financial, to successfully integrate these advanced instrumentation systems to even begin leveraging AI/ML.

Successful development of this platform requires deep understanding of how the instrumentation systems measurements work at the physical/optical level, communication protocols, busses, and data structures provided by the systems, and applied statistics, let alone actual material science and nanotechnology expertise. An interdisciplinary approach will be required along with deep feedback cycles with nano science research centers.

Most importantly, such a system must be built to be broadly adoptable and customizable as needed by each customer segment and persist beyond the lifetime of any one commercial entity requiring an open source approach. FAIR data principles are largely incompatible with historic proprietary software paradigms, but not with commercial hosting, custom hardware, software integration consulting, and AI/ML model development atop open source platforms. Decoupling the high-friction interoperability, connectivity, and management systems from the high-value AI/ML model development, customization, integration, and support services provides a path to sustaining revenue and rapid adoption.

Much of the complexity of integrating various microscopy instruments, real-time sensor data, real-time spectrophotometric data, user-supplied metadata, discrete lab analysis data, and initial user interfaces for data review has already begun for the MiProbe Cloud. This software platform, including networked data logging tools from custom instrumentation systems are in use at both Sandia and Los Alamos National Laboratories in collaboration with the Arizona Center for Algae Technology and Innovation.

The initial open source release of the platform for logging to cloud-based storage and databases was launched earlier this year¹. This will be integrated with the LabProbe project housing libraries for interfacing with proprietary instrumentation systems, data manager user interface tools, client-based networked data logging tools, and automation, scheduling, and statistical analysis. The scope of this work is to make a FAIR data platform and automated integration with network-based data loggers and custom web-based interfaces for instrumentation and analysis data submission systems.

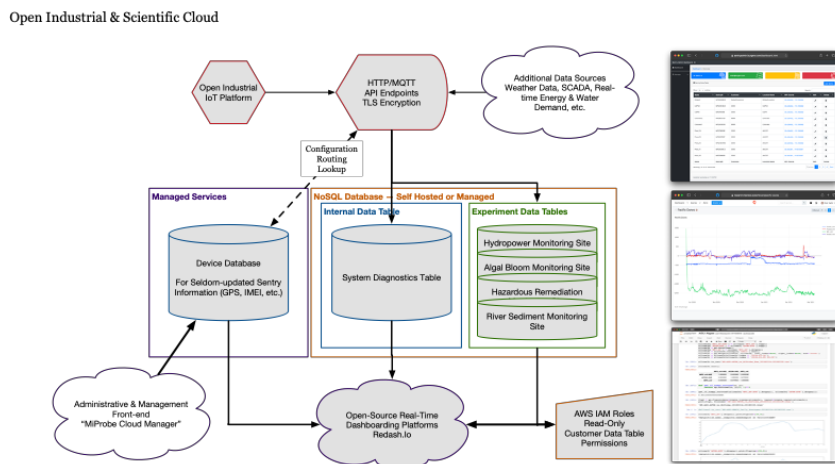


Figure 1 - Existing MiProbe Cloud Platform with Management, Real-Time Dashboard, and Data Analysis User Interfaces (right).

During the Phase I period, the existing Burge Environmental LabProbe project will be expanded in scope to support nanomaterials data from optical/Raman, scanning probe, and electron microscopy instruments, external materials databases and taxonomy systems, high-throughput indexing and storage of local networked imagery data, and proof-of-concept automated tagging of metadata based on ML/AI tools in addition to user-supplied metadata annotation systems focused on material science and nanotechnology applications. This will leverage the existing web-based annotation, network-based data logging, and cloud-based data analysis tools already developed for the MiProbe platform.

¹ <https://gitlab.com/evantaylor/miprobe>