California Air Resources Board (CARB) REQUEST FOR INFORMATION Event Number: **2023CARB_SMMI-RFI001**

Project Title:	In Motion Mobile Platform Systems – commercially available deployed on existing State owned or Operated Vehicles
Proposing Company:	mAIRsure, LLC
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Request for Information:	

mAIRsure is responding to California Air Resources Board (CARB) REQUEST FOR INFORMATION Event Number: **2023CARB_SMMI-RFI001** specifically on **"In Motion Mobile Platforms"** for locating and quantifying emissions. Our expertise driven primarily by market demand is in the Industrial sector - with a focus on Oil and Gas primarily, in upstream, mid and downstream operations. Our approach has been proven in upstream oil and gas fields, refinery's and in the urban centers of China with locating leaks from urban pipeline systems.

We operate commercially with available off the shelf solutions centered around a proven highly accurate cloud based proprietary analytics at the core, coupled with sensors and controller installed in vehicle with a roof mounted anemometer.

The system is designed to be installed on existing operator or State owned vehicles and as such the data collected is incidental to the task the operator of the vehicle is normally pursuing in their day to day operations. No driver input is required. This means the cost of data collection is reduced to zero and no additional vehicles are put on the road.

Figure 1: mAIRsure methane sensors on work trucks in upstream Oil and Gas operations in Sweetwater County Wyoming.

With a focus on high sensitivity being below ARPA-e limits of <0.03g/s kg emission levels substantially less than most mobile alternative aerial or satellite modalities and therefore ideally suited for a range of emission sources from orphan, idle, abandoned or active wells.

At our core is our plume analytics which is appropriate to a wide variety of species of pollutants our current commercial activity had focused on client demand for solutions for methane. Wherever a client expresses a need additional species can be added simply by adding additional sensor packages as required. eg H2S was added to the refinery package due to client and plant requirement.

Our In Motion Mobile Platform can easily accommodate other sensors whether in a general sense or for specific industrial applications.

mAIRsure was formed out of academic research to develop technology to measure and locate emissions from industrial, Oil and Gas (OG), and urban contributors. We have worked extensively in the upstream OG sector measuring numerous well pads and pipeline emissions throughout the US and Canada. We have worked with BP, ExxonMobil, Encana and other operators across the US, Canada, and Europe.

We have developed mobile automated vehicle mounted quantification and location system to cost effectively and efficiently cover the large expanses of OG operations at the field and basin level where there is need to cover 1000's of sites with high frequency, with low sensitivity and at low cost. Our mobile detection method traces to accepted EPA OTM33 protocols.

We have worked extensively locating and quantifying emissions on active, idle, abandoned and orphan wells. mAIRsure completed a successful pilot program of several wells in Ohio for Ohio Department of Natural Resources (DNR) and Bureau of Land Management (BLM) in Wayne Forest Ohio in preparation for the Department of Interior (DOI) requirements for quantification of methane emissions to meet Infrastructure Investment and Jobs Act (IIJA) requirements.

Our team comprises scientists and engineers with experience in quantification of emissions throughout the OG upstream industry. Our work on abandoned wells follows the latest federal guidelines from the IIJA as well as from the American Carbon Registry (ACR) with regard to possible issuance of carbon credits. We have also demonstrated mobile methane detection in OG refineries and have approaches for multiple gas species including methane, hydrogen sulfide, benzene and related volatile organic compounds (VOCs).

Commercial Pricing as of October 2023 is $3,000 per month per vehicle system for methane only with a one-time installation/ sensor package fee of $35,000. Delivery is available typically within a month of contract.

1. Background and Experience

1.1 Company Profile

mAIRsure is an emissions monitoring and quantification technology company that specializes in delivering precise and cost-effective solutions to the oil and gas (OG) sector. Our core focus revolves around addressing the critical need for accurate quantification, emissions monitoring, and source identification to enable reduction strategies by operators across a diverse array of assets within the industry. We have monitored field wide assets and quantified thousands of individual wells across the United States, Canada as well as a refinery in Europe.

mAIRsure was formed out of academic research in 2018 and is based in Fort Collins, Colorado. Our leadership team comprises leading experts in their fields with extensive academic and scientific backgrounds in the fields of emissions plume modeling and laser spectrometry. Their collective expertise brings a comprehensive understanding of atmospheric science, environmental engineering, and advanced spectroscopic techniques required to accurately measure emission sources both individually and in-aggregate for field wide estimates. Our team of ten staff comprises measurement specialists, scientific leadership for analytics protocols and sensors, engineering staff and management.

1.2 Company Experience in Methane Quantification

Emissions Monitoring and Quantification: mAIRsure's "sensor as a service" vehicle-based system combines highly accurate laser sensor technology with advanced plume analytics. The system is fully automated and allows operators to use their existing field vehicles as data collecting devices and requires no operator intervention or deviation form the field workers normal tasks. The sensor equipped vehicles collect the emission data as they drive their normal routes and data collected is sent to the cloud wirelessly, processed and made widely available in real time via a web-based dashboard. Through this approach, we enable operators to precisely locate, quantify, and analyze emissions across diverse assets. The analytics and reporting are available in near real time and delivered via cloud based dashboard, including relevant meta data. This system has been proven by operators and tested for accuracy in test facilities such as Colorado State University's Methane Emissions Test and Evaluation Center (METEC) as well as by operator's independent evaluations (Figure 1).

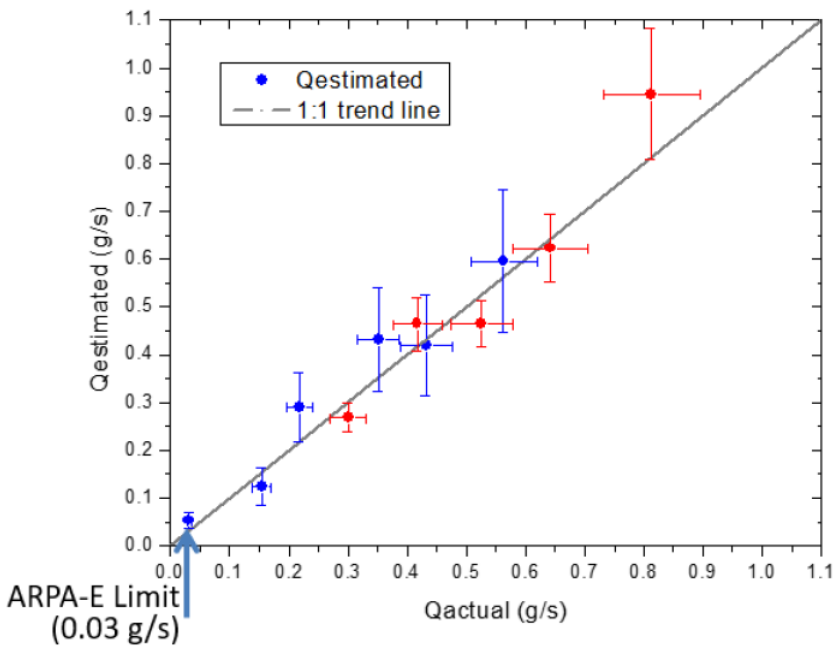

Figure 2: Comparison of inferred versus actual leak rates from study at METEC.

1.3 Orphan Well Quantification: Expanding the boundaries of our capabilities, mAIRsure addressed the need to locate and assess orphan wells by identifying emitters and providing quantification services. These wells demand precise quantification to adhere to the compliance standards of the DOI IIJA Act [1] and to secure Carbon Credits through the American Carbon Registry (ACR) using scientifically defensible protocols [2]. In 2022, we completed a pilot project for Ohio Department of Natural Resources (DNR) and Bureau of Land Management (BLM) in Wayne National Forest, Perry County OH as illustrated in Figure 2. The wells were measured with Static Flux measurements to American Carbon registry protocols. Wells for the pilot were selected by Ohio DNR officials in partnership with BLM staff, as the sites resided within National Forest. Flux chambers were installed over the well openings to capture and collect emitted methane. Using the concentration data and other relevant factors, including background CH_4, pressure, and temperature, the emission rates of methane from the abandoned wells were calculated. Methane concentrations from chamber measurements were measured using a commercial laser gas analyzer [1,2].

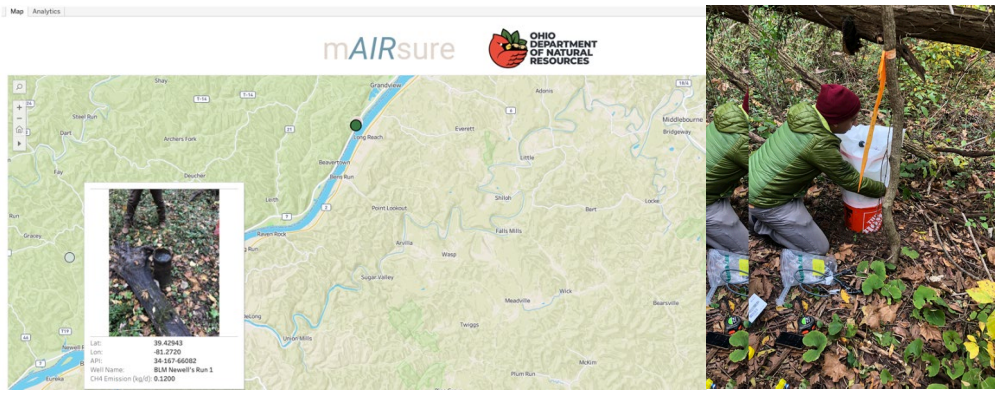

Figure 3: Left: Dashboard created by mAIRsure to display abandoned well measurements for Ohio DNR. Right: mAIRsure field team with static enclosure over an abandoned well in Perry County, OH.

1.4 Innovation and Technology for Mobile Sampling

Vehicle-Based System: Our breakthrough vehicle-based system offers unparalleled accuracy in emissions measurement, effectively covering disperse assets over vast distances. This innovative technology enables comprehensive monitoring and data collection even within the challenging conditions of oil and gas fields.

Laser Sensor Technology: At the heart of mAIRsure's innovation lies our highly advanced laser sensor technology. These sensors utilize sophisticated spectroscopy techniques to reliably detect and quantify a wide range of emissions, ensuring precise measurements.

Plume Analytics: mAIRsure's proprietary plume analytics software transforms sensor data into actionable insights. Our commitment to advanced data analytics enhances our clients' decision-making abilities, facilitating the implementation of effective emission reduction strategies.

1.5 Specialized Services

Emission Source Identification: mAIRsure's technology excels in pinpointing emission source points, enabling companies to accurately identify leaks and inefficiencies, thereby minimizing their environmental impact.

Regulatory Compliance: By furnishing accurate quantification and monitoring data, mAIRsure assists companies in meeting regulatory obligations, including those outlined by the DOI IIJA Act and carbon credit issuance through the ACR.

Industry Recognition: mAIRsure's distinguished track record encompasses the quantification of emissions from numerous wells across the United States and Canada, partnering with industry leaders such as BP and ExxonMobil. This recognition underscores our expertise and unwavering commitment to effective emissions management.

3.3 Reporting and Analysis Tasks

Results from all analyses are be regularly updated on a dashboard that will be available to WOGGC. An example dashboard, from methane measurements in Converse County, Wyoming, is shown in Fig. 3.

Figure 4: Example dashboard for well emissions for OG operator in Converse County, Wyoming.

Appendix B – Endorsements from Oil and Gas Clients

We want to do continuous monitoring and we looked at a lot of options. Stationary monitors are accurate but expensive. We only have 40 pads, but putting monitors on all the pads would be expensive. There are people who deploy drones, but that gets expensive too, even if you do it only every quarter which is our minimum requirement for leak detection. And, the drone operators and airborne operators do leak detection with cameras which can see whether there are leaks but don't measure the volume of a leak accurately. We have operations people driving on the pads every day. Being able to put sensors on their trucks makes a lot of sense. With mAIRsure, we can measure continuously and accurately at lower cost."

Impact Exploration and Production, LLC

"BP tested the mAIRsure technology, along with others, on well pads in Wyoming over several months. We tested drones, satellites, ground sensors, and mAIRsure. mAIRsure came out on top in terms of accuracy and feasibility. They drove around a significant number of facilities and we found they could identify issues from hundreds of meters away.

We looked at BakerHughes, Schlumberger, ChampionX, Project Canary, etc. They are either fixed sensors or airborne. None have worked as well. They are less accurate and if the plume doesn't pass the fixed sensor or the airborne system doesn't catch it when it passes, they don't work.

Principal Advisor, Digital Innovation, BP

General Questions

1.What scale of operation would be required to bid on a future RFP of the concept described here? Are there any minimum requirements necessary at which below you would not be interested in bidding on a proposal of this nature?

NO LIMITATION- we can provide and deliver 1 system or 100's.

2. What types of monitoring objectives have you explored using your company's mobile monitoring approaches?

Precise geo-locating and quantification of emissions to source points to enable reduction in emissions and reporting. Monitoring of active, idle, abandoned and orphan wells where low emissions are typically found. Pipelines, OG faculties, Refinery's, and gas distribution systems including complex city wide distribution systems in China.

3. What are the advantages and limitations of your company's mobile monitoring services?

Sensitivity, deployment and costs. Using existing vehicles owned and deployed by company/state agencies decreases data collecting costs and increases frequency of data collection. Using existing deployed vehicles also reduces added traffic on roads increasing safety.

II. Engagement and Coordination

1.Describe your interpretation of what community engagement should look like throughout the process of conducting mobile air monitoring in communities.

2. What experience do you have with community and public engagement? Is any of this experience directly related to air monitoring activity and data dissemination?

Our client base are industrial companies and our experience is disseminating to their internal users. We have worked with OHIO DNR and other Federal agencies (BLM) in disseminating emission data to web.

3. What is your experience coordinating with community members, CBOs, regulated industry, academia, and governmental agencies when planning monitoring objectives and data analysis and communication?

Extensive experience with EPA, academia, and certain industry groups (primarily OG)

4. Please provide the number and size ($) of technical projects previously managed for coordination and communication with both community and technical contractors.

5. How would you apply your engagement and coordination model on a statewide scale?

Primarily through data reported to web portals

III. Mobile Monitoring Technologies and Capabilities

1.How many mobile monitoring platforms do you currently own and operate? How long have these platforms been in operation? a. What areas/sources/locations do you have experience conducting mobile monitoring?

We supply to industry – first installation in 2018. O&G operations upstream downstream midstream. Experience in US, Canada, China and Europe.

b. Has collected data been used to support community emission reduction, enforcement, or other actions? Please provide examples.

OG industry primarily self reports emissions. Our system operating on CALGEM vehicles with their supervisors can provide excellent enforcement tools, policing self reported data from operators.

To date very little enforcement or other actions have been undertaken commercially due to lack of market demand.

2. Please provide operational information on your company's current mobile monitoring capabilities. This should answer the following questions:

a. What frequency can platforms be deployed?

The system can be deployed on as many State owned or accessible vehicles as are available. There are no limitations on deployment

b. What days/hours are the platforms generally in use?

No limit.

c. What pollutants can be monitored and with what frequency?

We would be operating in CARB terminology, "In-motion mobile platforms". Deploying on existing State available (owned / operated) vehicles .

Our current focus has being driven by commercial demand, primarily from the OG industry primarily CH4, C2H6, VOC's and H2S (refinery)

Our modality and modular nature of our system "analytics first" means additional species suited for in motion mobile platforms would include:

$PM_{2.5}$, PM_{10}, O_3, CO, CO_2, NO and NO_2, CH_4, H_2S and NH_3

d. What types of instrumentation do you use? Describe all relevant methodologies.

While Sensor agnostic typically we use Laser CRDS Spectrometry -ruggedized for in field OG operations

e. What level of coverage or scale of monitoring can be accomplished within a community? (For example, how would you approach characterizing emissions from a source or identifying a leak? How long would that take?)

In OG we can measure emissions form up to 1km distance to low <0.03g/s . Measurements made while in motion so solely dependent on driving past assets under surveillance. Frequency dependent on how many vehicles the system is installed on.

f. How do you determine that you've adequately characterized a given area?

g. What workflow processes or software do you have for managing mobile monitoring?

The system is fully automated, updating data directly to the cloud for procesing

3. Describe your usual approach or strategy to mobile monitoring. Include, if possible:

a. Drive plan and operational logistics

No drive plan necessary – although we can provide drive plans if required.

b. Staffing

None – utilizing existing operators and vehicles

c. Power requirements (e.g. battery powered, requires generator, etc.)

Runs off standard vehicle systems

d. Consumables

Occasional filter changes 1 per month

e. Quality control procedures

Extensively proven in field and with operators. Data constantly QA/QC'ed

f. Performance and acceptance criteria (e.g. precision, bias, limit of detection)

g. Data logging and storage

Cloud based Saas utilizing AWS or private cloud

h. Notifications and communication

Alerts for pre determined emissions available via text to vehicle operator

4. Please provide an estimated cost to operate all applicable mobile monitoring platforms as a function of time (e.g. 1 week of monitoring) deployed and/or measurements taken. a. These cost estimates should include all costs associated with mobile monitoring operation. This includes but is not limited to:

i. Direct costs – instrumentation consumables and repairs, vehicle operation costs, staff cost to operate platforms, recharging requirements.

$3,000 per month per vehicle equipped plus one time set up fee of $35,000

ii. Indirect costs – support staff costs, associated insurance for operation, administrative overhead, any required permits.

None

iii. Data Management – costs to move data from raw data collected by instrumentation to the final data products requested by CARB.

We collect data to AWS Cloud – presented to web accessible dashboard interpreted and highlights on Traffic Lights approach Hi/Med/Low or no emissions.

b. How often are invoices and payments typically required?

Normal 30 days

5. If an RFP is developed based on the information provided here, how much preparation time is required to deploy the platforms and begin monitoring? a. Do you have recommendations for a minimum timeline to achieve potential monitoring objectives described here?

RFP- time limit not an issue.

Timeline for achieving objective immediately -30 days

b. What is the maximum number of platforms that you could deploy by early 2025?

No practical limitation

6. Do you have experience developing Community Air Monitoring Plans (CAMPs) as defined by the CARB Community Air Protection Program Blueprint5 or similar? Please provide examples of community-focused monitoring plans or similar.

7. Do you have existing standard operating procedures (SOPs) or quality assurance project plans (QAPPs) for your mobile monitoring approach?

Yes

5 CARB Community Air Protection Blueprint (https://ww2.arb.ca.gov/capp-blueprint)

IV. Data Collection, Storage, Reporting

1. In what format do you generally provide data to your clients? What is your final data product?

2. Do you have off-the-shelf, or modifiable-off-the-shelf, data management products compatible with mobile monitoring data?

Yes

3. What is your experience in mobile monitoring data analysis and visualization? Specifically, do you have any experience using ESRI products to manage and visualize data?

WE have extensive experience and standard packages including ESRI

4. What is your experience in public dissemination of complex information? To what extent have you generated data visualization for the public?

For Orphan wells and integrating data from State Oil and Gas databases

5. What suggestions do you have for handling large amounts of data from a variety of sources (e.g. multiple mobile monitoring platforms) into cohesive data visualizations?

V. Feedback

1. Provide input on the requirements or areas listed in this RFI. Specifically, CARB is looking for: a. Availability of existing systems that perform all or a portion of the requirements in Section II – C. New systems cannot be built using funds in a potential RFP.

b. Questions, suggested modifications, or additions to the proposed environment that would allow or encourage potential bidders. Please include justifications for any suggested changes and concept modifications.