



ENERGY INSTITUTE

COLORADO STATE UNIVERSITY

ADED - Advancing Development of Emission Detection

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Prime: CSU

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Agenda

- Technical Status
 - What are next generation leak detection solutions
 - How will ADED accelerate adoption of those solutions
- Accomplishments to Date
- Lessons Learned
- Summary

<https://energy.colostate.edu/metec/aded/>



Technical Status



Next Generation Leak Detection Solutions

- Why?
 - Potentially faster, lower cost, and more effective than traditional leak surveys
 - Enabled by development of new, lower-cost sensors, communications and computational systems
- What:

Sensors

Concentration,
Line-concentration
Imaging, acoustic,
etc.

Deployment

Moving/stationary
of sensors
Frequency of
deployment, etc.

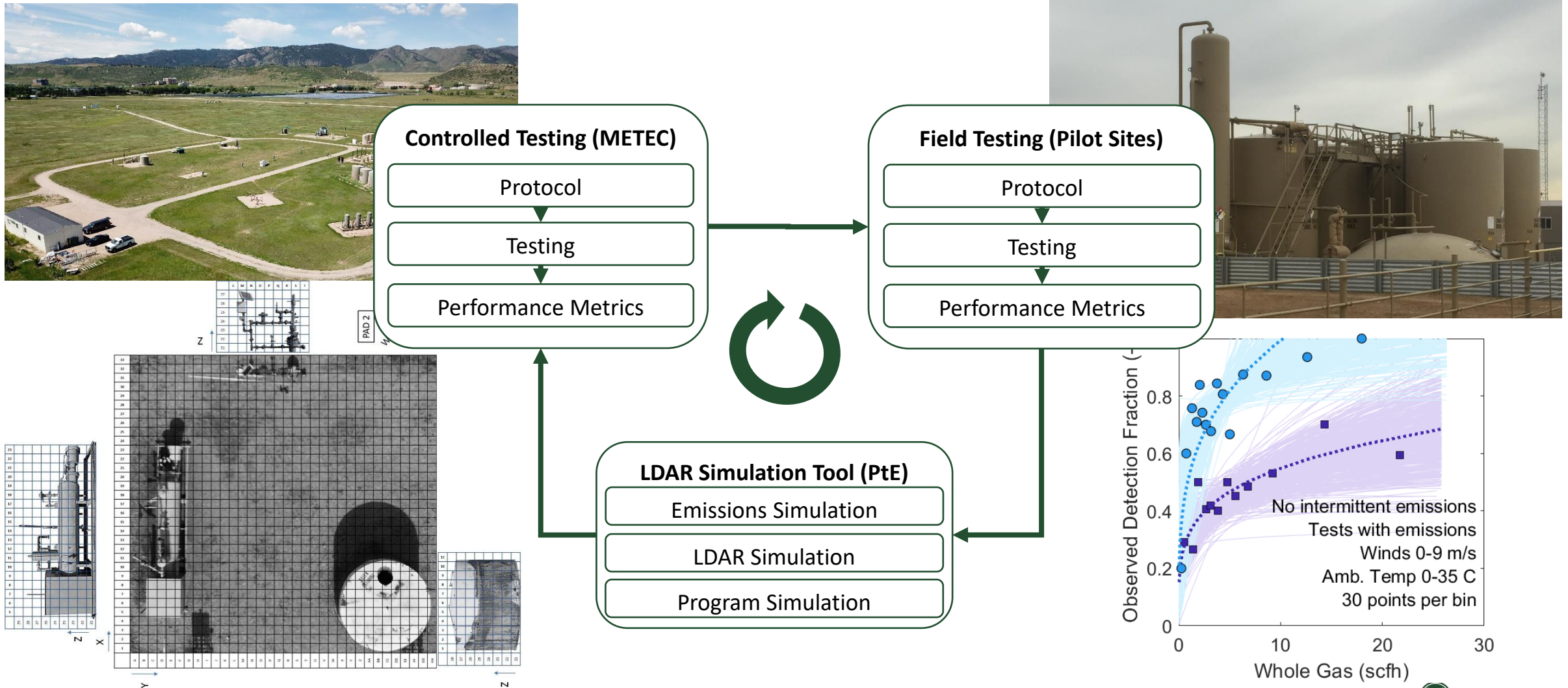
Analytics

Data acquisition, time
series analysis,
machine learning,
etc.

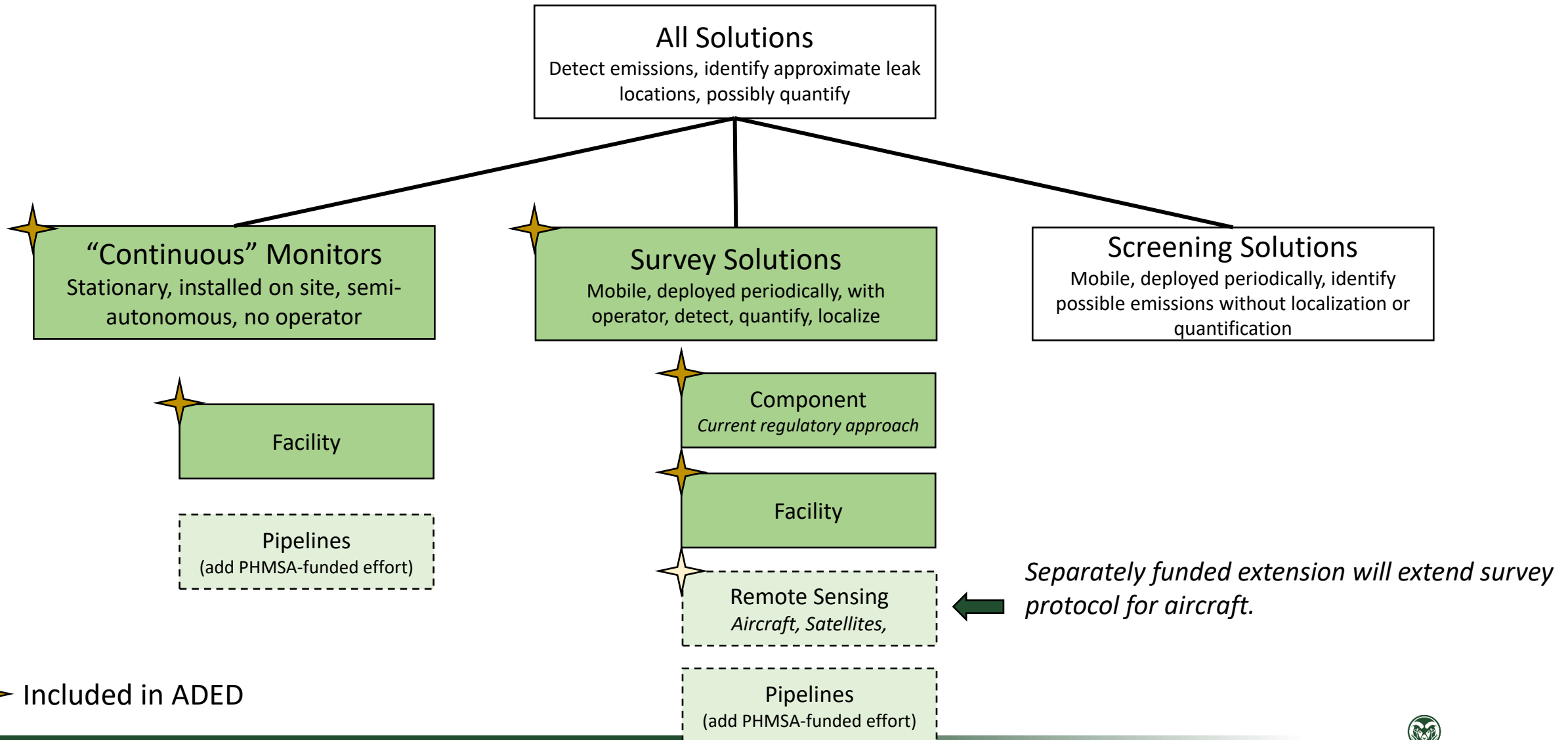
- In general – deployed more often, or more continuously, than traditional methods



Need for “To Protocol” Assessment



Taxonomy of Solutions



Why Both Controlled & Field Testing

Controlled testing: No confusion about the ‘true state’ of the facility being screened

- Determine key parameters to evaluate effectiveness (i.e. “detection curve”)
 - Classify reported detections: True positives vs false positives
 - Identification of false negatives (non-detects)
 - Determination of “time to detect”

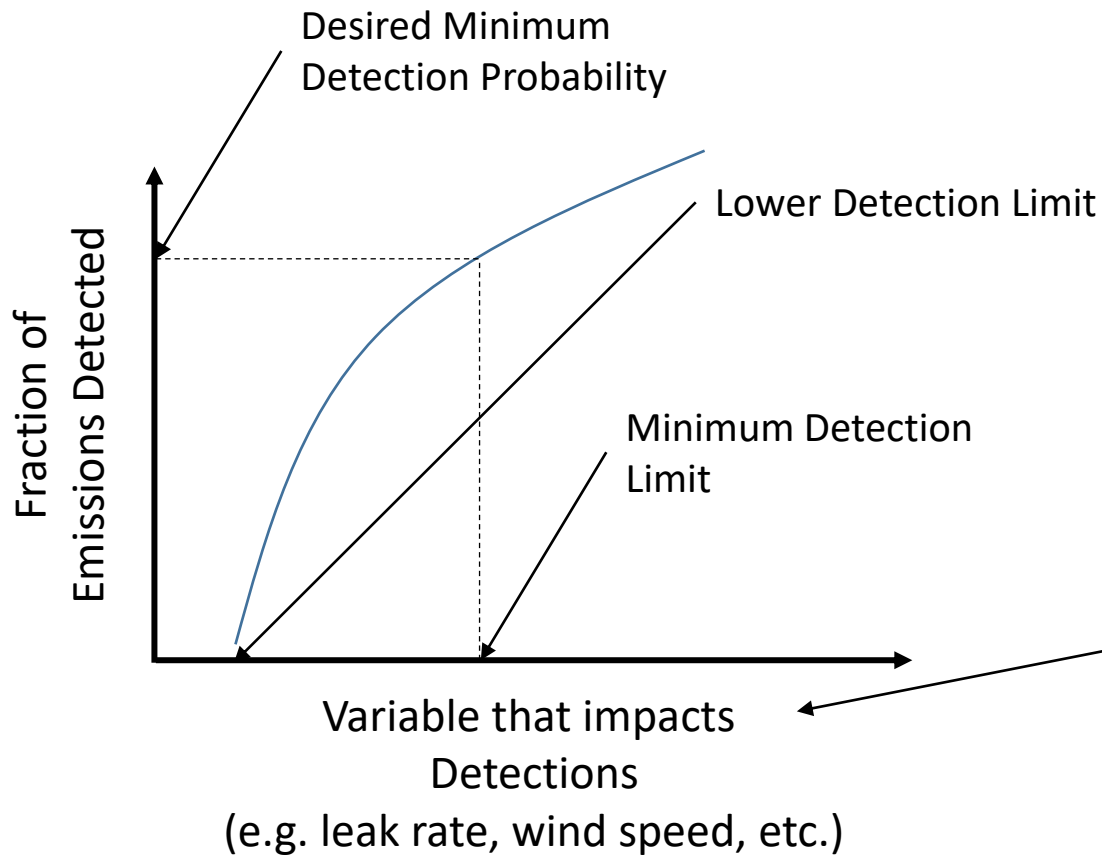
Field testing: More realistic ... but incomplete knowledge of ‘true state’ of facility

- More realistic environment to test *actual deployed behavior*
- Testing control is much more difficult
 - No ability to track everything that happens at the site ... no foolproof 24/7 monitoring
 - Slow quantification (relative to solutions) with substantial uncertainty
 - Difficult to test efficiently – i.e. encounter a large number of emitters during testing

Controlled testing characterizes the solution ... field testing qualifies the controlled testing protocol



What does Controlled Testing Produce?



- Probability of Detection (PoD) curve
 - More robust representation of detection than MDL or LDL
 - Required input for emissions modeling for regulatory or responsible gas programs
- Protocols also support evaluation of quantification capabilities

Number of independent variables drives number of required tests

- Always 1, possibly 2, independent variables
- More variables requires many more tests



Associated Projects

Advancing Development of Emissions Detection (ADED)

Prime: CSU

Co-Investigators: UT Austin, UT Arlington, Harrisburg U.

Funding: U.S. Department of Energy & Operators

Characterize Methods

Field Trials

Controlled Testing

Characterize Emissions

Methane Emission Estimation Toolkit (MEET)

Prime: UT Austin

Co Investigators: CSU, SLR

Funding: CAMS

Simulate Method Performance

Pathway to Equivalency (PtE)

Prime: CSU

Co Investigators: Harrisburg U.

Funding: Operators & EDF

Emissions Mitigation or Control Efficacy

Open Process To Engage All Stakeholders

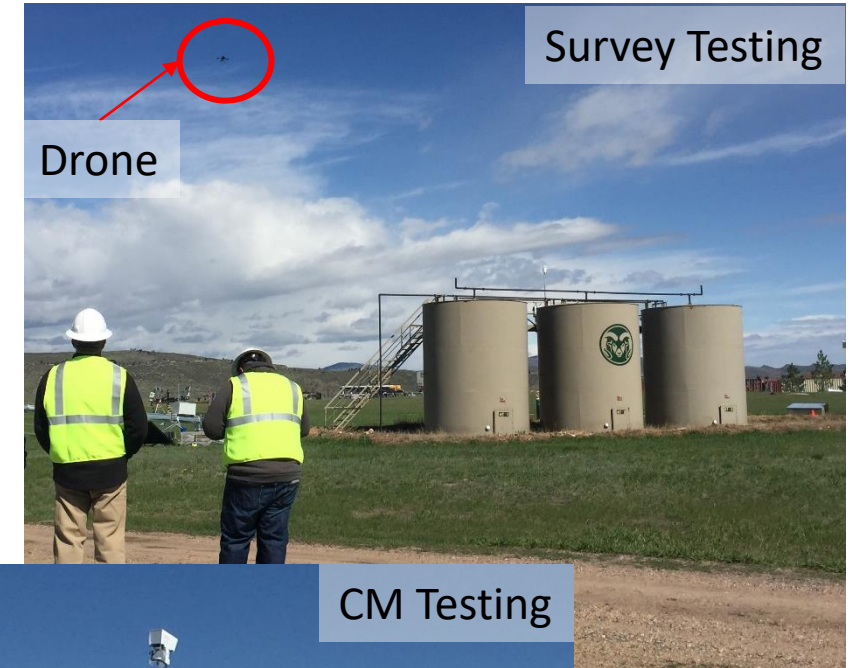


**Accomplishments to Date:
BP1 Complete 9/15/21**



Controlled Testing

- Protocol Development Committee (PDC)
 - Participation of over 75 stakeholder organizations
- Initial protocols developed & utilized in testing
 - Continuous Monitoring
 - Survey Systems
- Testing conducted
 - Continuous Monitoring – 4 Solutions
 - Survey Systems – 4 Solutions



Field Trial

- More operator participation than anticipated
 - 15 operators engaged in field trial
 - Denver Julesburg (DJ), CO
 - Marcellus/Utica, WV/OH/PA
 - Permian, TX
 - Green River, WY
- Over 30 LDAQ solutions currently being considered for field trial.
- Field trial plan will be submitted prior to end of budget period.



Broader Project Impacts

- Protocols influencing external controlled testing
 - Drafting appendix to survey protocol for application with remote sensing aircraft.
 - Stanford planning major field work utilizing this protocol for multiple aircraft.
 - CSU to conduct testing of 1 aircraft solution under protocol in Midland TX.
- Two additional proposals (1 submitted, 1 drafted) to adapt protocols for other external test programs.
- Protocols referenced by a “responsibly produced gas” standard



Lessons Learned



COVID-19 Pandemic Impacts

- Travel restrictions complicated logistics for controlled testing
 - Adapted testing program to support “rolling window” CM testing → substantial increase in labor required to support
 - More test periods with fewer solutions per period
- Field trial delayed due to travel restrictions and company policies.
 - Proceeding as planned
 - Increase in US Covid cases could impact scheduling further



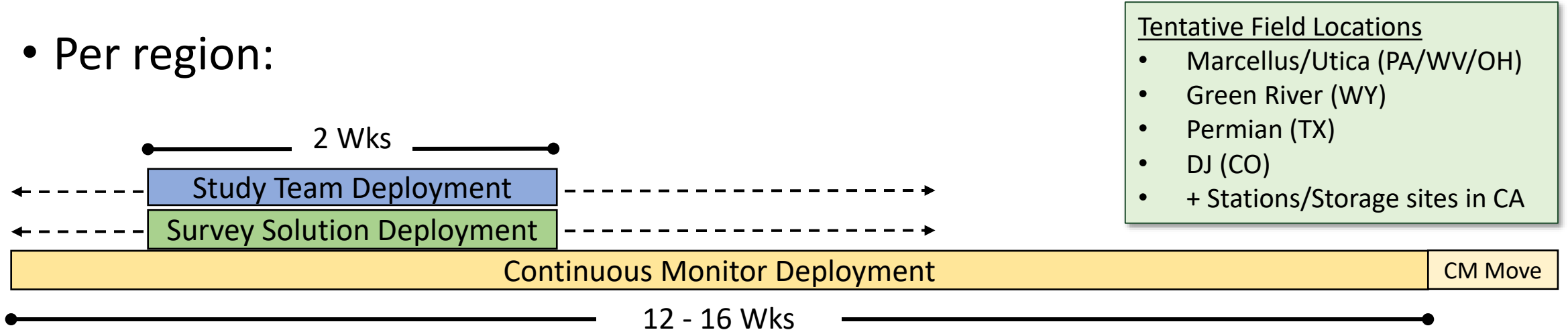
Other Learnings

- Greater operator interest in field trials than anticipated
 - Modify plan to include more basins and operators
 - Quarterly field tests, moving between basins
 - More variability in number & identity of solutions deployed each quarter
- Solution developers vary in acceptance of controlled testing
 - Some are 'selling services' and do not see 'being evaluated' as a necessarily positive
 - O&G operators are putting pressure on solution developers to test ... but are not yet withholding purchasing.

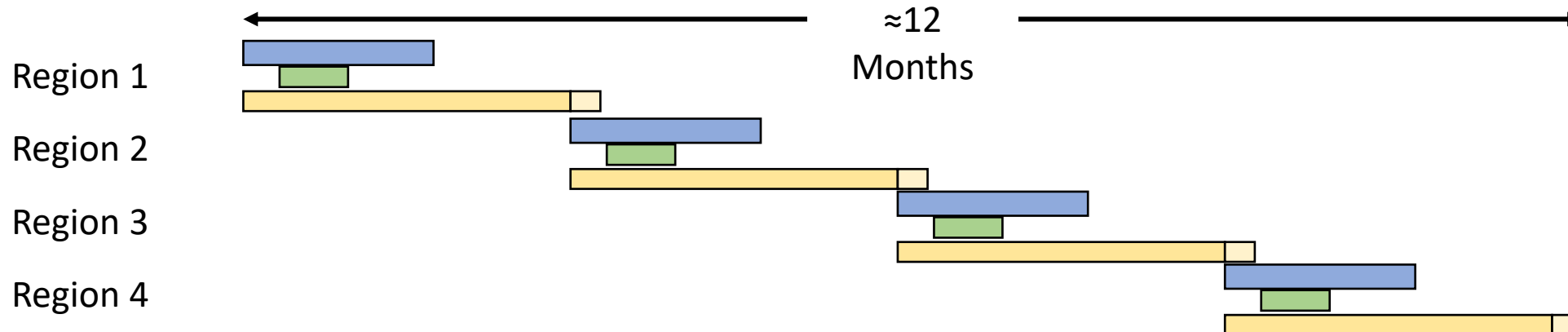


Accommodating 15 operators and 10+ solutions:

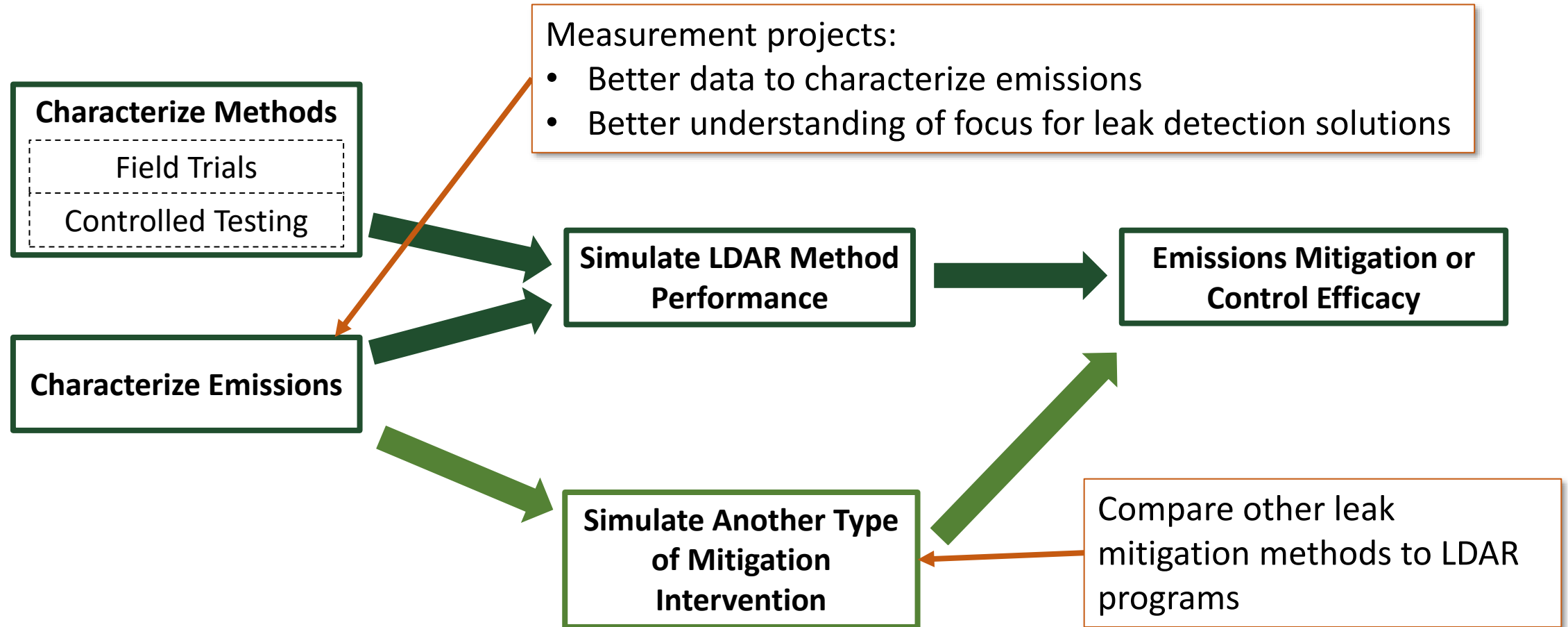
- Per region:



- Total field trial:



Synergy Opportunities



Project Summary

- There is substantially more interest in next-generation leak detection solutions than when the project was proposed.
- Broad buy-in to the protocols and approach
- A much more flexible testing program was needed to adapt to Covid and on-the-ground realities (and enthusiasm)
- A more diverse (regional and industry segment) testing program is now possible ... and will produce better results.



Thank You

Contact



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Appendix



Program Benefit

- Accelerate the adoption of next-generation leak detection solutions, lowering the cost and increasing the efficacy of leak detection of industry, regulators and general public.



Project Objectives

Success Criteria	Budget Period	Decision Point	Status
Five (5) LDAQ solutions identified and committed to testing during first year of controlled testing.	BP 1	Go/No-Go to Begin Field Trial	Eight (8) LDAQ solutions tested during first year of controlled testing.
A minimum of one (1) field trial site used for testing in each of production, gathering and distribution sectors.	BP 1	Go/No-Go to Begin Field Trial	15 operators participating in field trial including at least one each in production, gathering, and distribution sectors
Protocol revisions completed as defined in the SOPO and reviewed by the Protocol Development Committee.	BP 1 & 2	Go/No-Go to Continue Field Trial	Initial protocols developed and reviewed by Protocol development committee (PDC)
Three (3) protocol development workshops/teleconferences conducted with 30 or more attendees at each.	BP 1 & 2	Go/No-Go to Continue Field Trial	Protocol development committee (PDC) includes >75 participating organizations at end of BP1. One (1) virtual PDC meeting hosted for initial protocols.
Equivalency simulations completed for >80% of LDAQ solution tested in the field trial (some may drop out).	BP 3	End of Project	
Two (2) peer-reviewed publications submitted.	BP 3	End of Project	
Protocols and test results presented at >5 industry conferences or meetings	BP 1 – 3	End of Project	Protocols presented at AGU 2020 Fall Meeting

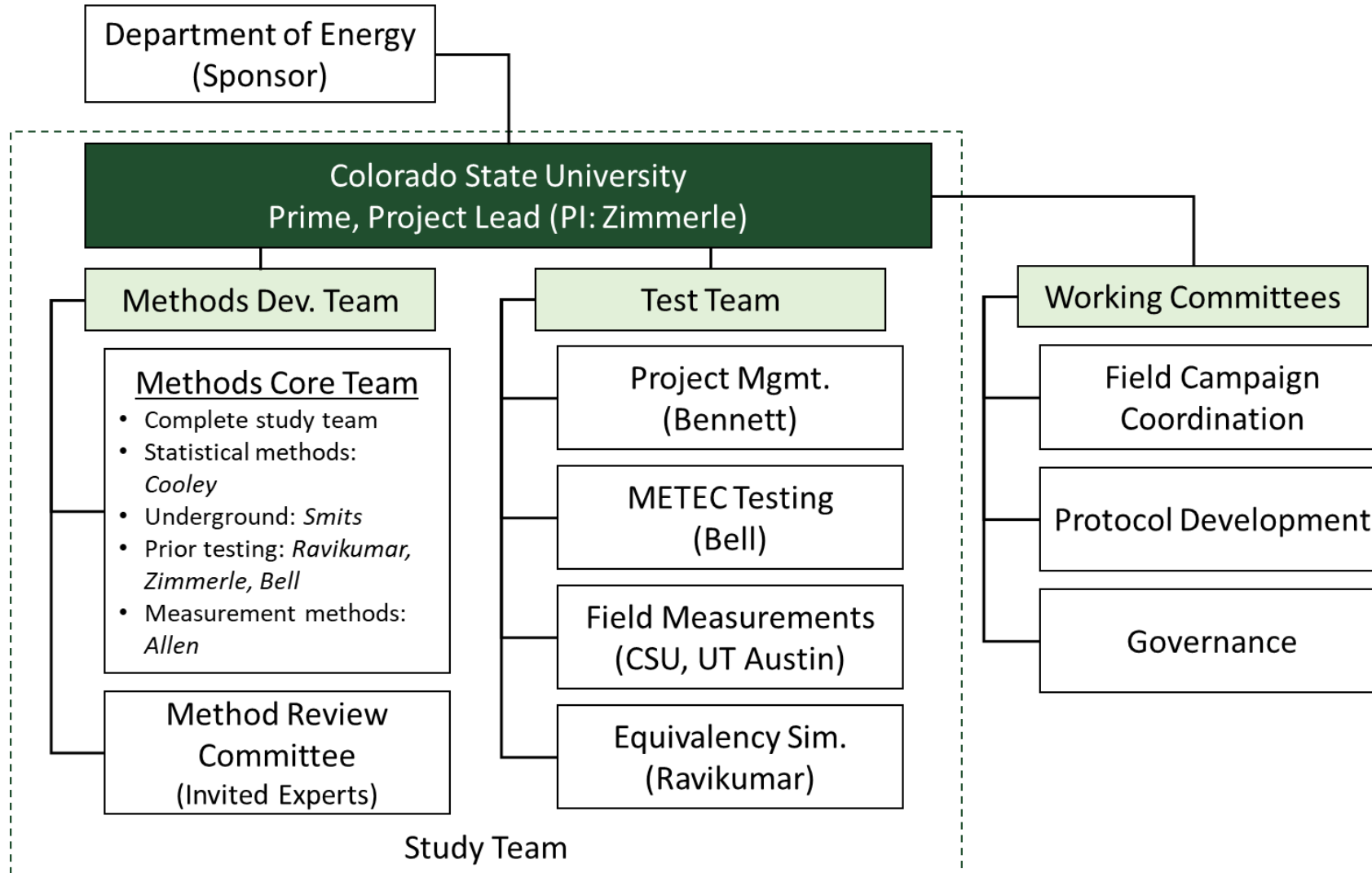
Additional Success Criteria

- SOPO indicates 3 additional success criteria for the continuation application

Success Criteria	Status
Field Trial Plan (Deliverable 3.4) has been received and reviewed by NETL Project Manager.	The field trial plan will be completed and submitted to the NETL Project Manager by the end of BP1.
Industry partners have provided letters of commitment identifying specific field sites selected for inclusion in the field trial.	Given the larger number of partners and regions, it has become clear that it is impractical to select sites many months in advance. Therefore, specific field sites will be selected 8-12 weeks prior to each deployment. Although specific field sites have not yet been selected as stated in the SOPO, a plan exists to select sites for each deployment period.
LDAQ solutions have been selected for inclusion in the field trial and paired with specific field test site(s).	The study team is engaged with over 30 LDAQ solutions in the field trial planning. While not all these solutions will meet the requirements for participation in the field trial (market-ready, and tested, or committed to testing, under controlled protocol), and not all qualified solutions will choose to participate, we expect approximately ten solutions to participate in the field trial.



Org Chart



Schedule Overview

5/15/2020

9/15/2021

9/15/2022

3/15/2023

BP 1	BP 2	BP 3
Project Management and Planning		
Controlled Testing		
Field Trial Planning		
	Field Trial	
	Result Analysis and Reporting	



Gantt Detail for BP2

Task 4 – Field Trial

- Subtask 4.1 – Baselineing Field Trial Site(s)
- Subtask 4.2 – Collection of Partner Data
- Subtask 4.3 – Deployment of Continuous Emissions Monitoring Systems
- Subtask 4.4 – Deployment of Survey Solutions
- Subtask 4.5 – Deployment of Ground Truth Teams

- Subtask 2.2 – Controlled Testing at METEC
 - Testing will continue including continuous monitors and survey systems
 - We expect more solutions to commit to releasing results and utilize the METEC testing budget from ADED
- Subtask 2.4 – Protocol Revision
 - Incorporating learnings from first round of testing
 - Extending protocols to support other solution types

