



**CALIFORNIA
ENERGY COMMISSION**



**California Energy Commission
April 12, 2023 Business Meeting
Backup Materials for Agenda Item No 14a:
Liminal Insights, Inc.**

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

1. Proposed Resolution.
2. Grant Request Form.
3. Scope of Work.

STATE OF CALIFORNIA
STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: Liminal Insights, Inc

RESOLVED, that the State Energy Resources Conservation and Development Commission (CEC) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

RESOLVED, that the CEC approves Agreement EPC-22-010 with Liminal Insights, Inc. for a \$2,750,000 grant to scale the manufacturing of EchoStat ultrasound-based Lithium-ion battery inspection system, transitioning from the predominantly manual assembly of testbench prototypes to mostly automated LRIP of factory-ready equipment. EchoStat is an advanced inspection and analytics platform that provides visibility inside batteries throughout the manufacturing process. This allows customers to detect and resolve design or production flaws in real-time, resulting in quick improvements in quality and productivity while minimizing the exposure to potential defects; and

FURTHER BE IT RESOLVED, that the Executive Director or their designee shall execute the same on behalf of the CEC.

CERTIFICATION

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the CEC held on April 12, 2023.

AYE:

NAY:

ABSENT:

ABSTAIN:

Dated:

Liza Lopez
Secretariat



GRANT REQUEST FORM (GRF)

A. New Agreement Number

IMPORTANT: New Agreement # to be completed by Contracts, Grants, and Loans Office.

New Agreement Number: EPC-22-010

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Misa Werner
3. MS-:51
4. Phone Number: 916.776.3477

C. Recipient's Information

1. Recipient's Legal Name: Liminal Insights Inc
2. Federal ID Number: 81-0682370

D. Title of Project

Title of project: Scaling up Production of Ultrasound-based Battery Inspection System

E. Term and Amount

1. Start Date: 4/13/2023
2. End Date: 12/31/2026
3. Amount: \$2,750,000.00

F. Business Meeting Information

1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 4/12/2023 .
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Michael Ferreira
5. Time Needed for Business Meeting: 5 minutes.
6. The email subscription topic is: Research (Energy RD&D / PIER program).

Agenda Item Subject and Description:

Liminal Insights, Inc. Proposed resolution approving Agreement EPC-22-010 with Liminal Insights, Inc. for a \$2,750,000 grant to scale the manufacturing of EchoStat ultrasound-based Lithium-ion battery inspection system, transitioning from the predominantly manual assembly of testbench prototypes to mostly automated LRIP of factory-ready equipment, and adopting staff's determination that this action is exempt from CEQA. EchoStat is an advanced inspection and analytics platform that provides visibility inside batteries throughout the manufacturing process. This allows customers to detect and resolve design or production flaws in real-time, resulting in quick improvements in quality and productivity while minimizing the exposure to potential defects.

G. California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?

Yes

If yes, skip to question 2.



If no, complete the following (PRC 21065 and 14 CCR 15378) and explain why Agreement is not considered a “Project”:

The project is categorically exempt from the provisions of CEQA pursuant to the Class 1 Categorical Exemption of the State CEQA Guidelines for Existing Facilities (14 CCR §15301). The project will be carried out in the fully permitted, existing 4,962 square-foot facility in Emeryville, California. No new permits are required for the operation of the project. Specifically, the project includes minor interior alterations and operation of facilities, mechanical equipment, and no change of use for the area. Additionally, the project will not add floorspace to the structure. Additional equipment will be set up for equipment quality control and production. The minor internal improvements to the existing facility interior will be non-invasive, and the project entails no construction.

2. If Agreement is considered a “Project” under CEQA answer the following questions.

a) Agreement **IS** exempt?

Yes

Statutory Exemption?

No

If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter “None” and go to the next question.

PRC section number: None

CCR section number: None

Categorical Exemption?

Yes

If yes, list CCR section number(s) and separate each with a comma. If no, enter “None” and go to the next question.

CCR section number: Cal. Code Regs., tit. 14, § 15301

Common Sense Exemption? 14 CCR 15061 (b) (3)

No

If yes, explain reason why Agreement is exempt under the above section. If no, enter “Not applicable” and go to the next section.

b) Agreement **IS** exempt.

IMPORTANT: consult with the legal office to determine next steps.

The project is categorically exempt from the provisions of CEQA pursuant to the Class 1 Categorical Exemption of the State CEQA Guidelines for Existing Facilities (14 CCR §15301). The Project will be carried out in the fully permitted, existing 4,962 square-foot facility in Emeryville, California. No new permits are required for the operation of the project as it only includes minor interior alterations and operations of the facilities, mechanical equipment, and no change of use for the area, meaning the Project will not result in the addition to floorspace of the structure. Specifically, this project will involve setting up manufacturing work-benches with components, subassembly, and full equipment assembly stations, along with quality control test equipment. The plan is to set up pilot manufacturing space in 2023-24 utilizing ~1000 sq. ft. of the total 4962 sq ft. space. The LRIP manufacturing space will be further expanded to ~ 1700 sq. ft. in 2025 as per the RAMP proposal plan. The minor interior alterations include removing the



existing carpet, polishing the floor and extending a few additional electrical plug points. The additional equipment that will be set up for equipment quality control and production will be mechanical or electrical in nature and will not have any emissions. If yes, answer yes or no to all that applies. If no, list all as “no” and “None” as “yes”.

Additional Documents	Applies
Initial Study	No
Negative Declaration	No
Mitigated Negative Declaration	No
Environmental Impact Report	No
Statement of Overriding Considerations	No
None	Yes

H. Subcontractors

List all Subcontractors listed in the Budget (s) (major and minor). Insert additional rows if needed. If no subcontractors to report, enter “No subcontractors to report” and “0” to funds. **Delete** any unused rows from the table.

Subcontractor Legal Company Name	CEC Funds	Match Funds
Owens Design Inc.	\$ 0	\$420,000

I. Vendors and Sellers for Equipment and Materials/Miscellaneous

List all Vendors and Sellers listed in Budget(s) for Equipment and Materials/Miscellaneous. Insert additional rows if needed. If no vendors or sellers to report, enter “No vendors or sellers to report” and “0” to funds. **Delete** any unused rows from the table.

Vendor/Seller Legal Company Name	CEC Funds	Match Funds
No vendors to report	\$	\$

J. Key Partners

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter “No key partners to report.” **Delete** any unused rows from the table.

Key Partner Legal Company Name
No key partners to report

K. Budget Information

Include all budget information. Insert additional rows if needed. If no budget information to report, enter “N/A” for “Not Applicable” and “0” to Amount. **Delete** any unused rows from the table.



Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	21-22	301.001I	\$ 2,750,000

TOTAL Amount: \$ 2,750,000

R&D Program Area: EDMFB: EDMF

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

L. Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Shaurjo Biswas

Address: 1175 Park Ave

City, State, Zip: Emeryville, CA 94608-3631

Phone: 734-757-0131

E-Mail: shaurjo@liminalinsights.com

3. Recipient's Project Manager

Name: Shaurjo Biswas

Address: 1175 Park Ave

City, State, Zip: Emeryville, CA 94608-3631

Phone: 734-757-0131

E-Mail: shaurjo@liminalinsights.com

M. Selection Process Used

There are three types of selection process. List the one used for this GRF.

Selection Process	Additional Information
Competitive Solicitation #	GFO-21-304
First Come First Served Solicitation #	Not applicable
Other	Not applicable

N. Attached Items

1. List all items that should be attached to this GRF by entering "Yes" or "No".

Item Number	Item Name	Attached
1	Exhibit A, Scope of Work/Schedule	Yes



Item Number	Item Name	Attached
2	Exhibit B, Budget Detail	Yes
3	CEC 105, Questionnaire for Identifying Conflicts	Yes
4	Recipient Resolution	No
5	Awardee CEQA Documentation	No

Approved By

Individuals who approve this form must enter their full name and approval date in the MS Word version.

Agreement Manager: Misa Werner

Approval Date: 02/27/2023

Office Manager: Anthony Ng

Approval Date: 02/28/2023

Deputy Director: Anthony Ng for Jonah Steinbuck

Approval Date: 02/28/2023

EXHIBIT A
Scope of Work
Liminal Insights Inc.

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Derisk Supply Chain for Critical Components & Model Unit Cost
3	X	Develop Manufacturing Processes and Testing
4	X	Develop Low Rate Initial Production (LRIP) Line
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
DFMA	Design for Manufacturability and Assembly
ESS	Energy storage system(s)
EV(s)	Electric vehicle(s)
FAT	Factory Acceptance Test
FMEA	Failure Mode and Effects Analysis
KPI	Key Performance Indicator
SAT	Site Acceptance Test
TAC	Technical Advisory Committee
CM	Contract Manufacturer
LRIP	Low Rate Initial Production

II. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this Agreement is to fund the design and build out of a Low Rate Initial Production (LRIP) pilot line of an ultrasound-based battery inspection system. Achieving LRIP of the system will allow for rapid detection of issues on battery manufacturing lines to improve yield, quality, and safety of batteries used in electric vehicles (EVs).

¹ Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

EXHIBIT A

Scope of Work

Liminal Insights Inc.

B. Problem/ Solution Statement

Problem

The Li-ion battery manufacturing industry lacks a non-invasive measurement technique that can reliably detect process variation, defects, and cell quality issues while also being fast enough to inspect 100% of cells at production scale. As a result, cell manufacturers resort to electrical testing (which requires battery operation and is imprecise) or x-ray imaging (slow and expensive). Only samples per batch are tested, and it can take days to months for flaws to be detected and performance quality to be validated. Because of varying and unpredictable cell quality, cell integrators such as EV manufacturers and grid-storage providers overbuild their battery packs by up to 25% of extra capacity.

As the battery industry moves toward wider-area and higher-power cell designs, the efficacy of existing measurement technologies will continue to decline when fast, accurate inspection is most needed at several different insertion points in the battery manufacturing process. There exists a substantial opportunity for a new type of diagnostic technology that is sensitive to manufacturing defects and process variation, while also being fast and nondestructive.

Solution

The Recipient has developed **EchoStat**[®], an ultrasound-based battery inspection platform, to bridge a major gap in battery diagnostics by improving the speed, accuracy, and scalability of battery manufacturing inspection compared to electrical testing methods. With fast measurement times (<6 sec) and the ability to gather spatially-resolved information (which electrical methods are not capable of), EchoStat's non-invasive ultrasound-based diagnostic method will enable battery makers to screen every cell along multiple process steps in a production line and gain deep physical insights into their performance quality prior to deployment. EchoStat, comprising measurement hardware and advanced analytics, can be scaled to accommodate any battery size and geometry at production-line throughputs.

Because EchoStat can be applied at multiple process steps along a production line, manufacturers will be able to identify production drifts and defective cells much earlier in the production process, preventing waste and improving yield that would have otherwise gone unnoticed using traditional electrical testing methods.

When this project is successfully completed, the Recipient will have de-risked their ability to manufacture and deliver factory-ready products, allowing them to build upon early commercial traction with cell manufacturers such as Cuberg, Panasonic, and Natron. By demonstrating greater manufacturing readiness, alongside production-scale validation of EchoStat's economic value, by the end of this project the Recipient will be in a strong position to secure purchase orders for deployment across commercial cell factories. This, in turn, prepares the Recipient to raise funding to scale manufacturing and impact of their products, which can help overcome barriers to achieve California's statutory energy goals, including SB 350, AB 32, and AB 2514.

C. Goals and Objectives of the Agreement

Agreement Goals

EXHIBIT A

Scope of Work

Liminal Insights Inc.

The goal of the project is to scale the manufacturing of the EchoStat ultrasound-based battery inspection system, transitioning from predominantly manual assembly of testbench prototypes to mostly-automated LRIP of factory-ready equipment. The Recipient will also establish a robust supply chain, especially for critical components (ultrasound transducers and electronics), develop standardized manufacturing and quality control processes, create documentation for subsystems and full-system assemblies, and define factory and site acceptance testing criteria to validate production.

The goals of this Agreement are to:

- Design and build an LRIP pilot line capable of producing > 12 EchoStat systems per year using production-ready tooling and standardized manufacturing processes
- Achieve low cost (< \$400,000 per system), increased automation of system build (> 60% automation), decreased number of 1st pass non-conformances (< 2 per system), and similarity between system builds (> 85%)
- Validate manufacturing readiness of EchoStat with appropriate systems and processes in place (e.g., robust supply chain, supplier qualification processes, quality control, inventory management)

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of lower costs and increased safety. At scale, EchoStat will be able to reduce battery cell cost by \$17/kWh. The proposed project will enable lower cost EV batteries as well as reduced scale-up time for next generation battery materials. Additionally, efficiently storing excess daytime solar/wind energy generation through vehicle-grid integration decreases the need for expensive peaker plant generation during the morning and evening, decreasing overall cost to ratepayers.

In terms of safety, the technology detects manufacturing and inherent physical defects earlier and more robustly than standard electrical methods. This dramatically reduces the likelihood of safety incidents from unexpected battery failures in EVs and energy storage systems (ESS).

Technological Advancement and Breakthroughs: This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by reducing the cost of batteries and helping to improve cell manufacturing processes and yields for EV and ESS applications. Additionally, EchoStat will enable faster development of new or improved battery technologies by providing the same fast, accurate physical insight to researchers and process developers, accelerating the development and scaling of new processes and techniques.

Assuming the Recipient reduces the cost of EV battery cells by \$17/kWh, EV adoption in California will be sped up by at least 3 years, and net cost benefits for ratepayers and Californians will be realized by 2027 or earlier.

Agreement Objectives

The objectives of this Agreement are to:

² California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

EXHIBIT A

Scope of Work

Liminal Insights Inc.

- Establish a robust supply-chain for critical components and model the unit cost of each EchoStat system
- Construct, commission, and validate a LRIP pilot line in a facility that meets state and federal requirements
- Demonstrate the reliable production of the EchoStat system on an LRIP pilot line with consistent product quality

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations. All technical tasks should include product(s). Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

- Submit all data and documents required as products in accordance with the following:

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**

EXHIBIT A

Scope of Work

Liminal Insights Inc.

- Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the California Energy Commission's (CEC) software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick.

The following describes the accepted formats for electronic data and documents provided to the CEC as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

○ **Software Application Development**

Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
- Microsoft SQL Reporting Services. Recommend 2008 R2.
- XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the CEC's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other CEC staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

EXHIBIT A

Scope of Work

Liminal Insights Inc.

The administrative portion of the meeting will include discussion of the following:

- Terms and conditions of the Agreement;
- Invoicing and auditing procedures;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide *Kick-off Meeting Presentation* to include but not limited to:
 - Project overview (i.e., project description, goals and objectives, technical tasks, expected benefits, etc.)
 - Project schedule that identifies milestones
 - List of potential risk factors and hurdles, and mitigation strategy
 - Provide an *Updated Project Schedule, Match Funds Status Letter, and Permit Status Letter*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Kick-off Meeting Presentation
- Updated Project Schedule *(if applicable)*
- Match Funds Status Letter (subtask 1.7) *(if applicable)*
- Permit Status Letter (subtask 1.8) *(if applicable)*

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

The goal of this subtask is to determine if the project should continue to receive CEC funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the CEC and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will

EXHIBIT A

Scope of Work

Liminal Insights Inc.

include the CAM and the Recipient and may include the CAO and any other individuals selected by the CAM to provide support to the CEC.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the CEC, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare and submit a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* with a list of expected CPR participants in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a schedule for providing a Progress Determination on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)

CAM Products:

- CPR Agenda(s)
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with CEC staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

EXHIBIT A

Scope of Work

Liminal Insights Inc.

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any procured equipment.
 - The CEC's request for specific "generated" data (not already provided in Agreement products).
 - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Final Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions, including a financial report on Match Funds and in-state expenditures.

Products:

- Progress Reports
- Invoices

EXHIBIT A

Scope of Work

Liminal Insights Inc.

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. When creating the Final Report Outline and the Final Report, the Recipient must use the *CEC Style Manual* provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *CEC Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Products:

- *CEC Style Manual*
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, *CEC Style Manual*, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:
 - Cover page (**required**)
 - Credits page on the reverse side of cover with legal disclaimer (**required**)
 - Acknowledgements page (optional)
 - Preface (**required**)
 - Abstract, keywords, and citation page (**required**)
 - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
 - Executive summary (**required**)
 - Body of the report (**required**)
 - References (if applicable)
 - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
 - Bibliography (if applicable)
 - Appendices (if applicable) (Create a separate volume if very large.)
 - Attachments (if applicable)
- Submit a draft of the Executive Summary to the Technical Advisory Committee (TAC) for review and comment.
- Develop and submit a *Summary of TAC Comments on Draft Final Report* received on the Executive Summary. For each comment received, the Recipient will identify in the summary the following:
 - Comments the Recipient proposes to incorporate.

EXHIBIT A Scope of Work Liminal Insights Inc.

- Comments the Recipient does propose to incorporate and an explanation for why.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt.
- Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments were not incorporated into the final product.
- Submit the revised *Final Report* electronically with any *Written Responses to Comments* within 10 days of receipt of CAM's *Written Comments* on the Draft Final Report, unless the CAM specifies a longer time period or approves a request for additional time.

Products:

- Summary of TAC Comments on Draft Final Report
- Draft Final Report
- *Written Responses to Comments (if applicable)*
- Final Report

CAM Product:

- *Written Comments on the Draft Final Report*

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of CEC funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the CEC awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

If match funds were a part of the proposal that led to the CEC awarding this Agreement, then provide in the letter:

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.

EXHIBIT A Scope of Work Liminal Insights Inc.

- If different from the solicitation application, provide a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter (*if applicable*)
- Match Funds Reduction Notification Letter (*if applicable*)

Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
 - The schedule the Recipient will follow in applying for and obtaining the permits.

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)
- Updated Schedule for Acquiring Permits (*if applicable*)

EXHIBIT A

Scope of Work

Liminal Insights Inc.

- Copy of Each Approved Permit (*if applicable*)

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of each executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts (*draft and final if required by the CAM*)

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
 - Technical area expertise;
 - Knowledge of market applications; or
 - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.

EXHIBIT A

Scope of Work

Liminal Insights Inc.

- Advocate, to the extent the TAC members feel is appropriate, on behalf of the project in its effort to build partnerships, governmental support, and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

EXHIBIT A

Scope of Work

Liminal Insights Inc.

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

The TAC shall:

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.
- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

Subtask 1.12 Project Performance Metrics

The goal of this subtask is to finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic metrics that provide the most significant indicator of the research or technology's potential success.

The Recipient shall:

- Complete and submit the project performance metrics from the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics at the first TAC meeting to solicit input and comments from the TAC members.
- Develop and submit a *TAC Performance Metrics Summary* that summarizes comments received from the TAC members on the proposed project performance metrics. The *TAC Performance Metrics Summary* will identify:

EXHIBIT A Scope of Work Liminal Insights Inc.

- TAC comments the Recipient proposes to incorporate into the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- TAC comments the Recipient does not propose to incorporate with and explanation why.
- Develop and submit a *Project Performance Metrics Results* document describing the extent to which the Recipient met each of the performance metrics in the *Final Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- Discuss the *Project Performance Metrics Results* at the Final Meeting.

Products:

- TAC Performance Metrics Summary
- Project Performance Metrics Results

IV. TECHNICAL TASKS

*Products that require a draft version are indicated by marking “(draft and final)” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

TASK 2 DERISK SUPPLY CHAIN FOR CRITICAL COMPONENTS & MODEL UNIT COST

The goal of this task is to develop a robust supply chain for critical hardware components through qualifying alternate suppliers, developing custom critical components, and implementing formal supply chain processes. As the Recipient further derisks and stabilizes the supply chain, the Recipient will model the unit cost of each EchoStat sub assembly and system to identify high-leverage cost reduction targets.

The Recipient shall:

- Procure and qualify alternate sources of transducers and ultrasound electronics, and prepare a *Comparison Report* that compares performance and cost against the baseline. This document will be 2-10 pages, include graphics and figures, and have an executive summary written for a non-technical audience.
- Set requirements and test/evaluate custom transducers and ultrasonic electronics solutions.
- Validate final custom transducers and ultrasonic electronics solutions, and prepare a *Validation Report* that includes performance characterizations. This document will be 2-10 pages, include graphics and figures, and have an executive summary written for a non-technical audience.
- Conduct audits of suppliers of custom transducers and ultrasonic electronics, and summarize in *Validation Report*.
- Identify long lead time critical hardware and electronics components, and summarize in *Validation Report*.
- Secure supplier agreements for critical components, and summarize in *Validation Report*.
- Set up and validate inventory management system, and summarize in *Unit Cost Model Report*.
- Set up and validate supplier qualification process, and summarize in *Validation Report*.
- Secure supplier agreements of custom transducers and ultrasonic electronics solutions for LRIP, and summarize in *Validation Report*.

EXHIBIT A

Scope of Work

Liminal Insights Inc.

- Create *Unit Cost Model* and establish cost reduction targets.
- Implement changes to hit cost reduction targets.
Prepare a *Unit Cost Model Report* that includes the bill of materials, cost of goods sold, and labor for manufacturing EchoStat systems.

Products:

- Comparison Report
- Validation Report (draft and final)
- Unit Cost Model Report (draft and final)

TASK 3 DEVELOP MANUFACTURING PROCESSES AND TESTING

The goal of this task is to perform technology and product design and development with manufacturability considerations and to stabilize manufacturing processes. The Recipient will develop unit cost reduction targets using a Unit Cost Model created in Task 2.

The Recipient shall:

- Perform design for manufacturability and assembly (DFMA) through the design process to enable ease of manufacturing and assembly of the EchoStat subcomponents and system.
- Develop production Failure Mode and Effects Analysis (FMEA) to identify and address potential problems or failures during the production of the EchoStat systems.
- Develop manufacturing workflow processes.
- Validate and stabilize manufacturing workflow processes.
- Develop and validate pilot-ready tooling and test equipment.
- Develop and validate production-ready tooling and test equipment, and prepare a *QC Protocol Report* that summarizes the work above in this task and outlines testing protocols and tolerances for in-bound parts and key components, subassemblies, and final assembled product. This document will be 2-10 pages, include graphics and figures, and have an executive summary written for a non-technical audience.
- Validate contract manufacturer reproducibility and performance capabilities.
- Secure contract manufacturer agreements for LRIP.
- Develop, stabilize, and release manufacturing documentation for pilot line, and prepare a *Manufacturing Summary Report* that outlines physical and nonphysical manufacturing documentation (e.g., SOPs, travelers, system schematics, manufacturing workflow, packaging and shipping capabilities, operational performance tracking, etc.). This document will be 3-10 pages, summarize the work related to contract manufacturer agreements, include graphics and figures, and have an executive summary written for a non-technical audience.
- Iterate and release manufacturing documentation for LRIP (to be included as an appendix in the above report).
- Prepare a *CPR Report #1* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- QC Protocol Report
- Manufacturing Summary Report (draft and final)
- CPR report #1 (draft and final)

EXHIBIT A

Scope of Work

Liminal Insights Inc.

TASK 4 DEVELOP LOW RATE INITIAL PRODUCTION (LRIP) LINE

The goal of this task is to develop LRIP over two stages: (1) build out a pilot line, and (2) expand the pilot line to meet low-volume production rates.

The Recipient shall:

- Draft and review detailed site plan to add low-volume production to existing facility.
- Prepare facility for construction and retrofit.
- Construct required infrastructure.
- Install pilot production line equipment.
- Commission and validate pilot production line, and prepare a *Commissioning and Validation Report* that outlines performance of pilot production line and summarizes the detailed site plan and other construction described above in this task. This document will be 2-10 pages, include graphics and figures, and have an executive summary written for a non-technical audience.
- Expand/ramp pilot line into low-volume production rates, and prepare a *Production Key Performance Indicator (KPI) Report* that discusses the improvement in quality of goods produced and factors that contributed to product quality and manufacturing KPIs, specifically production rate, degree of automation during build, and system consistency. This document will be 2-10 pages, include graphics and figures, and have an executive summary written for a non-technical audience.
- Develop non-conformance reporting process for quality assessment.
- Establish system build quality processes, Factory Acceptance Test (FAT), Site Acceptance Test (SAT) protocols, and prepare a *Quality Assessment Report* that reports on metrics and tolerances for each production system, variation between system builds, and FAT and SAT. The FAT and SAT involve testing and reporting of EchoStat system build quality and reliability performed at the Recipient and customer sites, respectively.
- Refine system build quality processes, FAT, SAT protocols
- Prepare a *CPR Report #2* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Commissioning and Validation Report
- Production KPI Report (draft and final)
- Quality Assessment Report (draft and final)
- CPR report #2 (draft and final)

TASK 5 EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete the *Initial Project Benefits Questionnaire*. The Initial Project Benefits Questionnaire shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* by January 31st of each year. The Annual Survey includes but is not limited to the following information:
 - Technology commercialization progress

EXHIBIT A Scope of Work Liminal Insights Inc.

- New media and publications
- Company growth
- Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The Final Project Benefits Questionnaire shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

Products:

- Initial Project Benefits Questionnaire
- Annual Surveys
- Final Project Benefits Questionnaire
- Documentation of Project Profile on EnergizeInnovation.fund
- Documentation of Organization Profile on EnergizeInnovation.fund

TASK 6 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to ensure the learning that resulted from this project is captured and disseminated so that similar efforts build on the lessons learned.

The Recipient shall:

- Develop and submit a *Project Case Study Plan* that outlines how the Recipient will document the planning, establishment, and operation of the project. The *Project Case Study Plan* should include:
 - An outline of the objectives, goals, and activities of the case study.
 - The organization that will be conducting the case study and the plan for conducting it.
 - A list of professions and practitioners involved in the project's development.
 - Specific activities the Recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
 - Presentations/webinars/training events to disseminate the results of the case study.
- Present the Draft Project Case Study Plan to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the draft *Project Case Study Plan*. This document will identify:
 - TAC comments the Recipient proposes to incorporate into the *Final Technology Transfer Plan*.
 - TAC comments the Recipient does not propose to incorporate and explanation why.

EXHIBIT A
Scope of Work
Liminal Insights Inc.

- Submit the final *Project Case Study Plan* to the CAM for approval.
- Execute the final *Project Case Study Plan* and develop and submit a *Project Case Study (draft and final)*
- When directed by the CAM, develop presentation materials for a CEC sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC Symposium(s) sponsored by the CEC.
- Provide at least (6) six High Quality Digital Photographs (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

Products:

- Project Case Study Plan (draft and final)
- Summary of TAC Comments (on draft Project Case Study Plan)
- Project Case Study (draft and final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.