This webinar will be recorded.

American-Made Challenges

E-ROBOT PRIZE

Phase 2 Team Webinar

U.S. DEPARTMENT OF ENERGY

Agenda

1. Phase 1 Winner Video
2. Phase 2 Overview
3. Phase 2 Technology Approach
4. Phase 2 Submission Elements
5. Phase 2 Demo Day and Winner Selection
6. Power Connector Support
6. Q&A

Housekeeping

This webinar will be recorded.

This webinar is being recorded and will be available on HeroX

Questions?

- There will be a Q&A session at the end of the presentation.
- To submit a question, please type it into the chat box.

Technical Issues:

- If you experience technical issues, **please check your audio settings under the "Audio" tab.**
- If you continue experiencing issues, contact **Webex support: +1 (866) 229-3239**

E-ROBOT Phase 2 Overview

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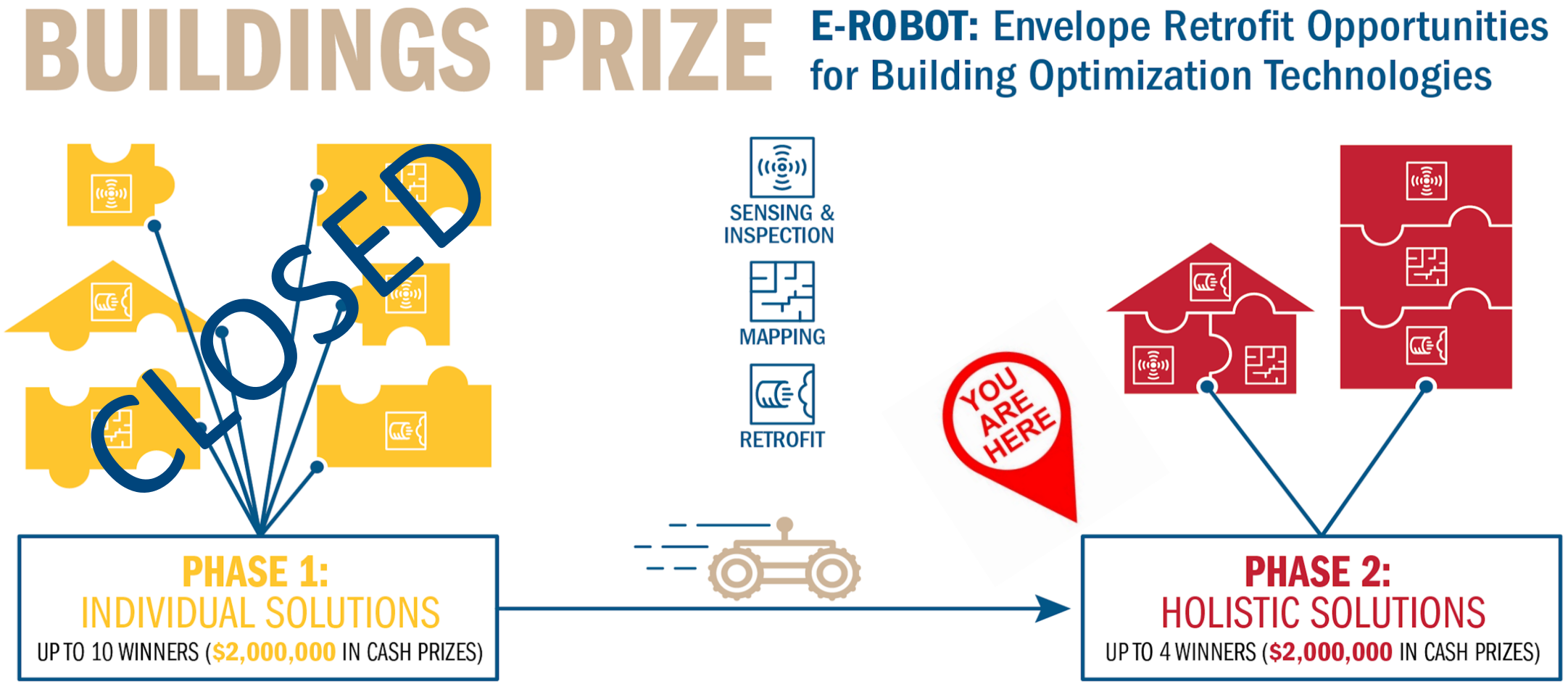
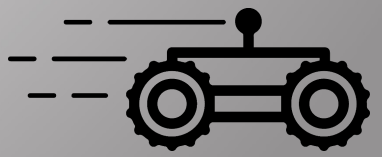
E-ROBOT Phases



$4M in Cash Prizes + $1M in Network Support

Prizes

Phase	Winners	Duration	Description
Phase 1: Concept and Design	Up to 10 winners: $200,000 each	6 months	In this phase, teams are expected to provide an innovative idea that solves a critical building envelope need and will serve as the foundation for the work in follow-on phases. In addition, a robust team of experts from both the robotics and buildings industries should be developed. This phase is focused on proving that the solution addresses a key envelope need, developing a design, and demonstrating that the team is capable of achieving success.
Phase 2: Build and Validate	Up to 4 winners: $2 million prize pool split equally between winners	6 months	In this phase, successful teams from Phase 1 will create a prototype for a single holistic and integrated solution, then validate that the solution will work during an in-person Demo Day. This could include partnering with other experts to take existing robotics hardware and software solutions and integrate those solutions to address building retrofit, repair, and remediation needs. Validating the working solution for technical viability and demonstrating a path toward commercial viability is required. In addition, field validating the working solution/prototype with a commercial partner is highly encouraged.

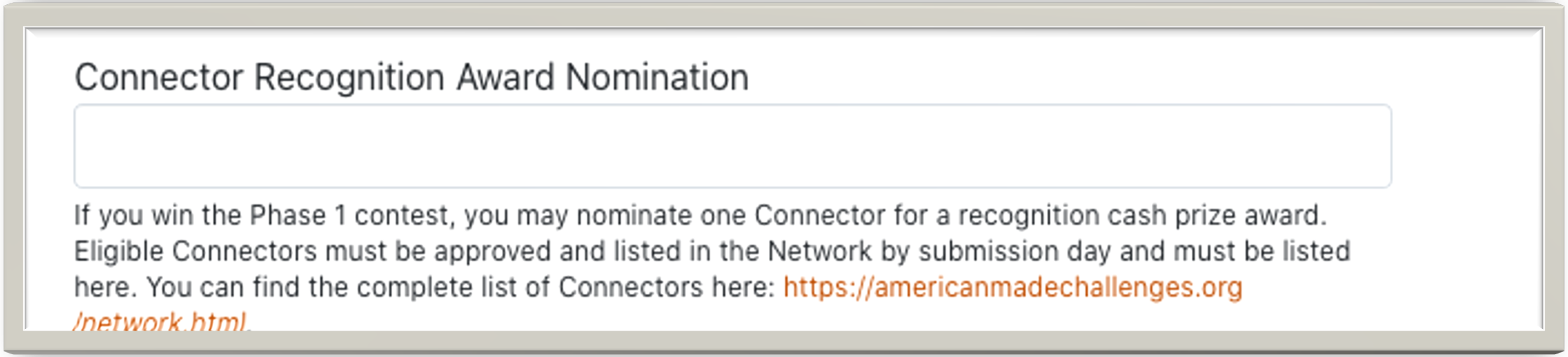


Connector Recognition Awards

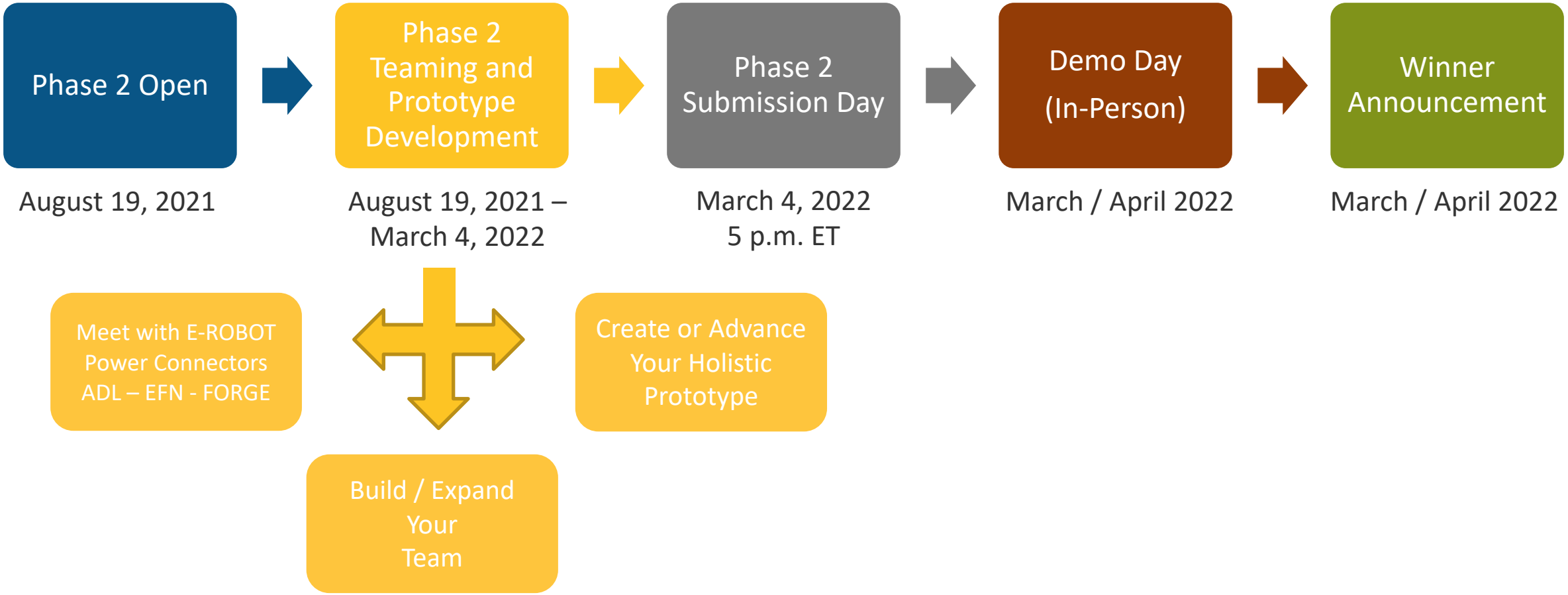
PHASE 2 CONNECTOR AWARDS			
Award Name	**Prize Pool**	**Number of Awards**	**Details**
Team Support to Winning Teams	$200,000	Up to 4; at $50,000 each	Each winning team may list one Connector to receive an award. Must be registered as a Connector before Phase 2 closes to receive an award.
Team Support to Non-Winning Teams	$150,000	Split evenly among Connectors submitted; up to $25,000	This award goes to Connectors who helped the eligible applications that did not win. Each team may list one Connector to receive an award. Must be registered as a Connector before Phase 2 submission closes to receive an award.

Attention Competitors – Remember to List your Network Connector

- Remember to list the American-Made Network Connectors that supported your team in the Phase 2 Contest.
- Connectors are eligible for cash awards for supporting both winning and non-winning competitors!



Phase 2 Process and Timeline



E-ROBOT Phase 2 Technology Approach

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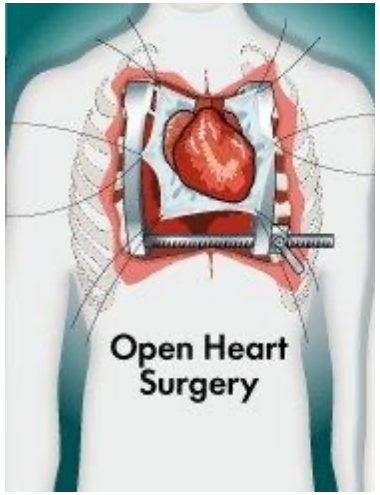
Breakthrough Envelope Retrofit Approaches are Needed

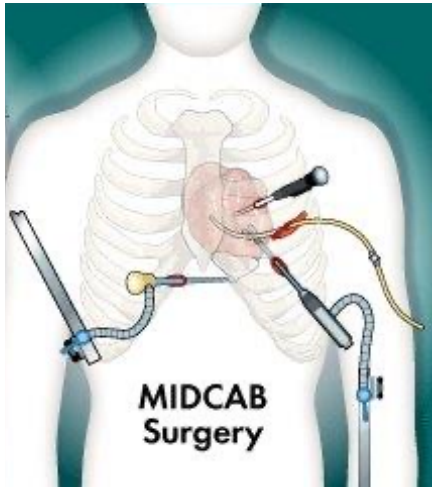
Faster, easier, and scalable envelope retrofit tools and methods are needed to dramatically increase the deep energy retrofit rate to mitigate climate change and ensure economic growth.

Retrofits of Today
(Slow, invasive, costly)



How do we get from here to there?

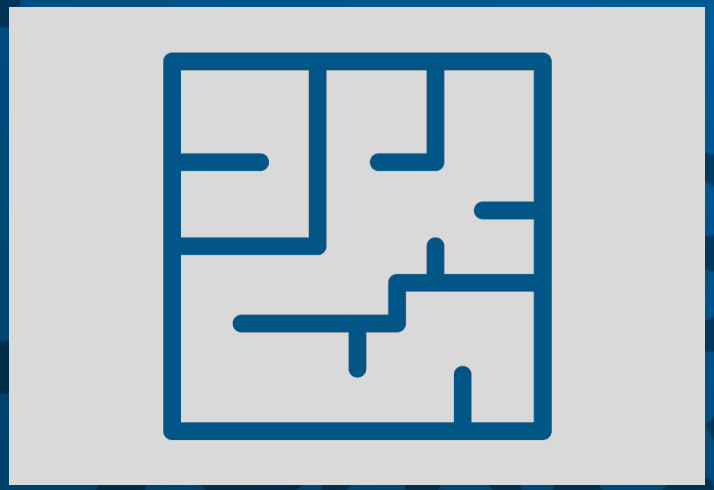
Retrofits of the Future
(Smart, non-invasive, inexpensive)



Holistic E-ROBOT Solutions Sought For Phase 2

Sensing and Inspection Tools

Non-destructive and fast inspection techniques to assess and identify envelope defects (e.g., excessive air infiltration, missing insulation, etc.) for pinpointed retrofit, and to verify the results post retrofit.



Mapping Tools

Mapping of building envelope geometry and envelope defects to be retrofitted with spatial relationships to support the retrofit process is needed.

Retrofit Tools

Semi or fully autonomous robotic deposition tool to apply minimally invasive techniques to rapidly retrofit building envelopes including, but not limited to, air sealing areas identified by the sensing and inspection tools.

E-ROBOT Technology Goals

Successful Phase 2 teams must develop holistic solutions that are:

- **Holistic:** The solution must include mapping, retrofit, sensing, and inspection in Phase 2. For Phase 1, teams were allowed to focus on one, or several, of these topics.
- **Low cost:** The solution should reduce costs significantly when compared to current state-of-the-art solutions. (Target is 50%+ less than current costs of a fully implemented solution.)
- **Minimally invasive:** The solution must not require building occupants to vacate the premises or require envelope teardown or significant envelope damage.
- **Utilizes long-lasting materials:** Retrofit is done with safe, nonhazardous, and durable (30+ year lifespan) materials.
- **Completes time-efficient, high-quality installations:** The results of the retrofit must meet common industry quality standards and be completed in a reasonable timeframe.
- **Provides opportunities to workers:** The solution enables a net positive gain in terms of the workforce by bringing high tech jobs to the industry, improving worker safety, enabling workers to be more efficient with their time, improving envelope accessibility for workers, and/or opening new business opportunities or markets.

Teaming and Partnering Approach

Successful teams will develop a holistic team that includes stakeholders such as:

- **End Users and Labor Unions**
- Technology Incubators
- Investors
- Buildings and Robotics Industry Leaders
- Regional Energy Efficiency Offices
- Academia and Think Tanks
- Manufacturing Partners

A holistic partnering approach will provide technical and market insight, marketing expertise, product validation, and other support needed to successfully commercialize and scale your solution.

Phase 2 Submission Elements

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Read the Rules

Official rules of the E-ROBOT Prize are available online

https://americanmadechallenges.org/EROBOT/docs/E-ROBOT_Prize_Official_Rules.pdf

or

E-ROBOT HeroX Page > Resources Tab

Phase 2 Submission Elements

The following items constitute the submissions package and must be submitted through the HeroX platform:

- **Cover page (to be made public)**
- **Summary slide (to be made public)**
- **Three-minute video (to be made public)**
- **Technical narrative (up to 10 pages using a font that is at least 11 point)**
- **Design specifications (up to 12 pages using a font that is at least 11 point)**
- **Test plan and validation report (up to five pages using a font that is at least 11 point)**
- **Business plan*: (up to five pages using a font that is at least 11 point)**
- **Optional: Letters of commitment or support (see scoring guidelines).**

Required ☑
Scored ☒
Public ☑

Cover Page

Cover Page: List basic information about your submission (will be made public)	
• Title • Short description	• Key project members (names, contact information, links to their professional profiles) • Your city and state • Other partners (if any)

Required ☑
Scored ☑
Public ☑

Summary Slide

Summary Slide (will be made public)

Make your own public-facing, one-slide submission summary that contains technically specific details but can be understood by most people. The recommended template for the slide includes:

- **Need/Challenge**
  What is the critical envelope retrofit need being addressed? Why is that an important problem?
- **Proposed Solution**
  Include a picture and/or graphic that best captures the solution, innovation, and/or approach with short description.
- **Business Plan**
  Include a general description of your business plan (e.g., target market, potential market opportunity, business model, price point).
- **Partnering/Team**
  Describe your team and why your team has a competitive edge.

Please make any text readable in a standard printout and conference room projection. Do not include any proprietary information, as this slide will be made public.

Yellow Highlight – Phase 2 Rules Modification

Required ☑
Scored ☑
Public ☑

Video

Online Public Video (will be made public)
Suggested Content You Provide (3-minute max limit) • Description of your team, the solution, and what it will do to overcome a building envelope retrofit challenge. • **Show us your working prototype** by recording the performance tests and/or validation process. • Tell us about your next steps to technically advance your solution. • What are the next steps to commercialize your product for performing building envelope retrofits?

Required ☑
Scored ☑
Public ☒

Technical Narrative

Technical Narrative: You should answer each of the following questions with information that addresses the evaluation criteria outlined in Section 7.

Questions to Guide the Content You Provide

1. Problem: What building envelope retrofit challenge does your solution address and how does it work?
2. Holistic: How did you develop either a single tool, or suite of compatible tools, that includes sensing, inspection, mapping, and retrofit?
3. Cost: What is the current cost for this type of retrofit, and how will the proposed solution achieve a 50% cost reduction when compared to the current state of the art?
4. Invasiveness: Describe the occupant experience during the retrofit and how your robot accesses the impact to building occupants?
5. Materials: Please list the materials your solution includes, along with a statement regarding their availability and durability. How are you sure that your materials will meet the 30+ year lifespan?
6. Productivity: How long will it take for your robot to apply your solution to what area/square footage and how easy is it to train users?
7. Energy Efficiency: What level of energy efficiency improvements are expected after applying your solution (e.g., air leakage reduction, insulation performance, and so on)? Please quantify these metrics.
8. Quality: Is the solution of sound quality, will it mitigate any underlying envelope deficiencies related to bulk moisture and vapor control, and will it ensure durable envelopes post retrofit?
9. Worker Benefits: Does your solution offer benefits to workers such as improved on-site safety, improved time efficiency, or increased access to areas previously unavailable?

Yellow Highlight – Phase 2 Rules Modification

Required ☑
Scored ☑
Public ☒

Design Specifications

Design Specifications
Provide graphics, digital drawings, and technical specifications that show the design of your solution and how it works. Hand drawings are specifically prohibited. Material submitted beyond 12 pages will not be reviewed.

Required ☒
Scored ☑
Public ☒

Letters of Support

Letters of Commitment or Support (Optional)
Attach one-page letters commitment from relevant entities (e.g., potential users, pilot partners, manufacturing facilities, and so on) from entities that you believe are critical to the success of your proposed solution. Please do not submit multipage letters. One-page letters from multiple sources should be combined into a single .PDF document.

Yellow Highlight – Phase 2 Rules Modification

Required ☑
Scored ☑
Public ☒

Test Plan and Validation

Test Plan and Validation Report: You should summarize the process for validating the robot's performance and include results from your validation efforts.

Please submit your test plan and documentation showing the performance of the robot. Results may be obtained from field validations, lab testing, or simulations. Field or lab validations are preferred.

Limit: Five pages using a font that is at least 11 point.

Yellow Highlight – Phase 2 Rules Modification

Required ☑
Scored ☑
Public ☒

Business Plan

Business Plan

The business plan should detail a roadmap for advancing the technology toward a commercially viable and market-ready product. The plan should identify your commercialization pathway(s), as well as explore and evaluate market, manufacturing, intellectual property, and next-stage resource factors. It will target positioning the technology for commercial viability, private sector investments, and market impact. The team should review the business plan with relevant industry advisors during the competition and incorporate their feedback.

The plan should define a reasonable path for the proposed technology toward commercial viability and success. The business plan could include components from the following:

- **Value Proposition**: Describe the value proposition of your solution. To achieve this, competitive technologies should be surveyed and evaluated, competitive advantages should be assessed, and how/where the technology can best be inserted should be addressed.
- **Customer/Stakeholder Discovery**: Stakeholder interviews should be conducted that involve key players in the technology space such as end users, homebuilders, remodelers, trade unions, or manufacturers. This includes understanding the interaction of players and stakeholders in the value chain; who these players/stakeholders, competitors, customers, end users are; and how buying decisions are made. Lessons learned from stakeholder engagement should be clearly articulated and incorporated into your solution.
- **Market Opportunity**: Quantify the market opportunity and competitive differentiation. Include an explanation of why the proposed solution would be commercially relevant. Special consideration should be given to identify specific target markets, regions of focus, and/or building types of focus.
- **Financial Pro Forma**: The business plan should include revenue/cost estimates, cashflow analysis, and outline pathways to scale.
- **Cost-Performance Model**: Identify the key cost and performance drivers for the proposed technology, as well as use cases for buildings. Payback analysis for the solution should also be analyzed and evaluated.
- **Manufacturing and Scalability Analysis**: This analysis should include a plan to mitigate factors that may significantly affect production costs or the ability to scale-up the technology. Analysis should reflect different complementary perspectives offered by engaged industrial advisors on the team.
- **Commercialization Pathway(s) and Distribution Plan**: Define your paths to market and plan for commercial entry subsequent to the end of the competition (e.g., creating a startup, licensing the technology to a partner).
- **Marketing and Distribution Plan**: A description of the value chain and distribution channels may be included. Describe pathways to reach with your target markets, and plans to achieve effective market penetration within the building industry. Innovative or successful models to communicate to and/or market the solution to the end user should be considered.
- **Risk Mitigation Strategy:** Identify techno-economic challenges to be overcome for the proposed technology to be commercially relevant and discuss any scalability, regulatory, cost, intellectual property, or integration risks and considerations associated with the technology. Describe your strategy to address and/or mitigate these challenges. Discuss any other factors key to the successful realization of energy savings potential, cost reduction targets, installation time targets, as well as any known or perceived barriers to market adoption/dissemination and your plans for enhancing or mitigating these.

Yellow Highlight – Phase 2 Rules Modification

Phase 2 Scoring Criteria – HeroX Submission

Three Categories:

- Technical Impact & Viability (40% weighted)
- Commercial Viability (40% weighted)
- Teaming and Stakeholder Engagement (20%)

Judges give a score of 1 to 6 for each statement below:

Technical Impact & Viability (40% weighted)

1. The proposed solution represents a holistic solution to an important challenge in building envelope retrofits and significantly advances the state-of-the-art.
2. The proposed solution is free of any major technical flaws and includes mapping, sensing and inspection, and retrofit capabilities. The risks or limitations associated with the proposed solution are well understood and articulated.
3. The cost of the solution is at least 50% less than today's solution.
4. The solution is minimally invasive to occupants and the building during an on-site installation and/or renovation.
5. The solution delivers high-quality on-site retrofits that improve the efficiency of the building envelope more than or in a better way than today's solutions.
6. The quality of the on-site retrofit is adequately assessed and ensured, the solution will mitigate any underlying envelope deficiencies related to bulk moisture and vapor control, and the solution ensures durable envelopes post-retrofit

1	2	3	4	5	6
Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree

E-ROBOT Phase 2
Demo Day and Winner Selection

U.S. DEPARTMENT OF ENERGY

Required ☑
Scored ☑
Public ☑

Demo Day

Demo Day (in-person)
At least one team member must participate in an in-person demonstration event that will feature a panel of judges who will weigh in on the final decision. The event may involve a pitch, a question-and-answer session, and a technical demonstration of your working prototype. Judges will review and score your submitted materials before the demonstration event and then, based on your Demo Day performance and deliberation with the other judges, will finalize their recommendations for winners. The prototype must be functional and operational at Demo Day to be eligible to win a Phase 2 prize.

Yellow Highlight – Phase 2 Rules Modification

What to Expect at Demo Day

More specific information about Demo Day will be provided to teams over the next few months. We expect that Demo Day will be held in late March / April 2022.

At Demo Day, Teams can expect to:

- Attend an in-person event (pending COVID travel restrictions)
- Give a live pitch or presentation
- Host a table/poster session with a live demonstration of the team's working prototype
- Participate in a Q&A session with DOE, NREL, and the Expert Review Panel

Demo Day (Pass/Fail): Teams must be able to operate their solution at the Demo Day Event to showcase how it meets the technical objectives of the prize and operates as intended. Successful operation of your solution at Demo Day is required to win a cash prize.

Overall Submission Assessment & Announcement

1. Expert Reviewers will score submissions based on the judging criteria (Judges will sign an NDA).
2. The final score from an individual Expert Reviewers for a submission package equals the total sum of the scores for all the bullets.
3. All Expert Reviewers' scores will then be averaged for a final score for the submission package.
4. Teams participate at Demo Day to demonstrate their prototype and receive a pass/fail score.
5. DOE Prize Administrators review HeroX Submissions, Demo Day Performance, and Program Policy Factors.
6. Winners will be Announced.

E-ROBOT Phase 2
Power Connector Support

U.S. DEPARTMENT OF ENERGY

Phase 2 Power Connectors

ADL Team

Frank Yang

- Partner at ADL
- Founder / CEO of Liatris, an advanced insulation materials startup that received SBIR award this year
- 10+ years in the solar industry as a co-founder of Stion, a US solar panel manufacturer and systems integrator

Diana Fisler

- Principal at ADL
- Chair of ASHRAE TC 4.4 Building Materials and Building Envelope Performance
- Vice Chair of ASTM C16 Thermal Insulation
- Advisory board member the Wells Fargo Innovation Incubator (IN²).
- PhD in Geophysics from Penn State

Yan Yan

- Senior Associate at ADL
- Experience with accessing and analyzing new technology
- Received master's degree in mechanical engineering from MIT in 2019

ADL VENTURES

Goals of the E-ROBOT Phase 2 Power Connector Team:

- Understand teams' technology development status and needs
- Connect teams to resources in the American-Made Network or beyond to drive further technology development
- Provide on-going support for questions throughout Phase 2 and Demo Day.

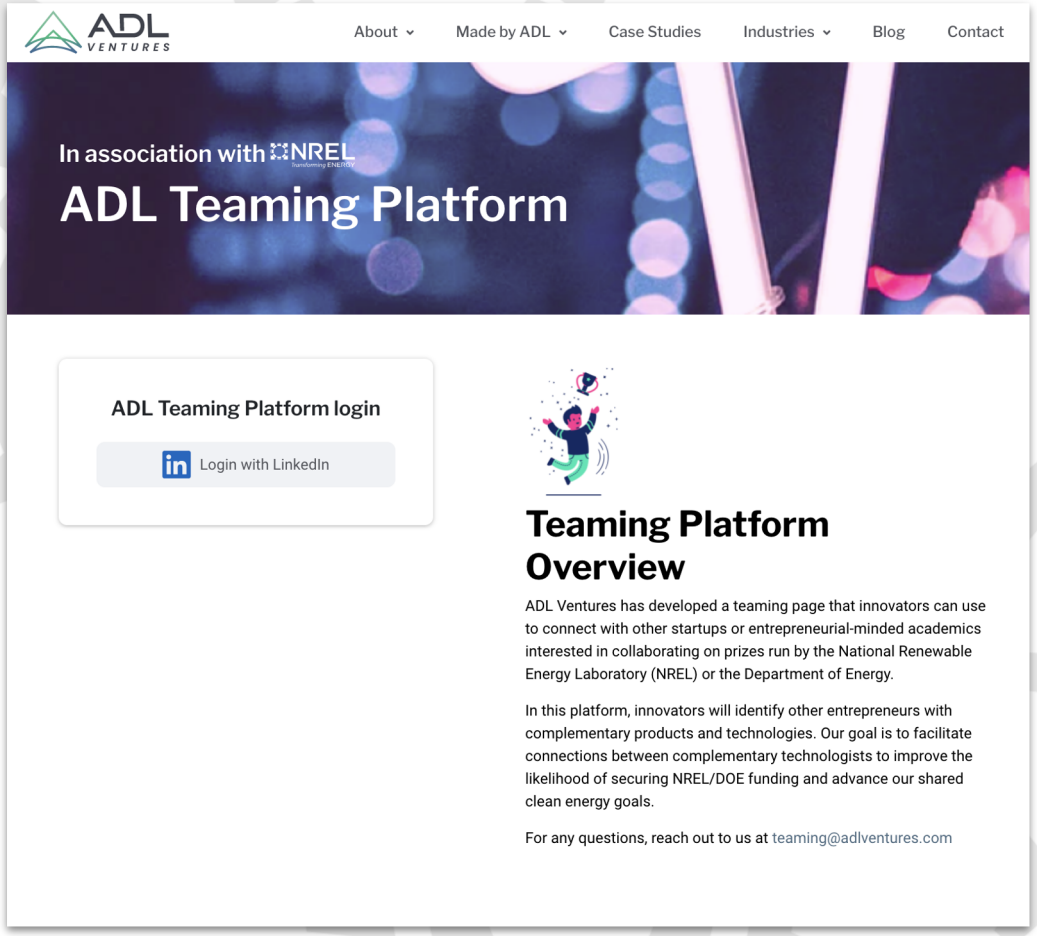
ADL VENTURES

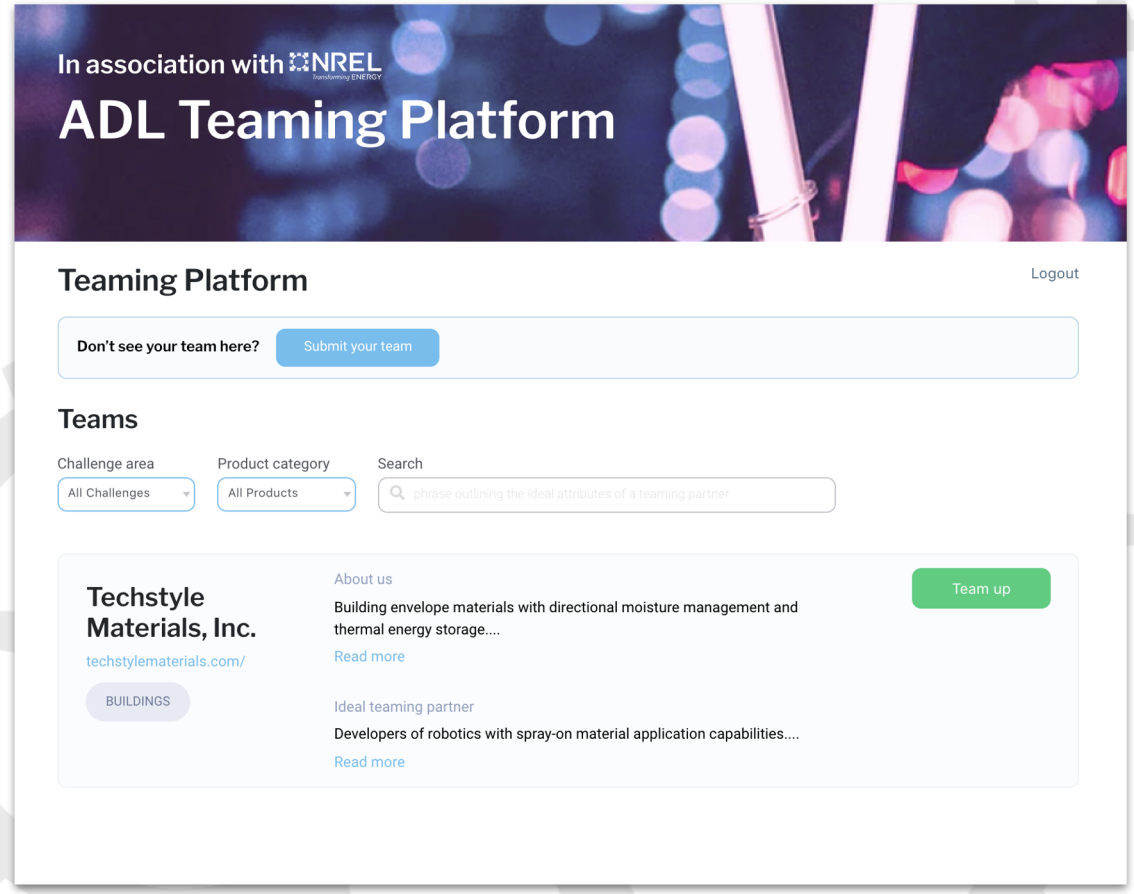
Action Items and Next Steps for Teams:

- If you haven't already, meet with the Power Connector team for an initial needs assessment.
- Sign-up on teaming platform for partnering opportunities
  - Open to anyone
  - Both winning and non-winning teams from Phase 1 can create an entry
- Reach out directly to ADL or individual Power Connectors with non-administrative questions

ADL VENTURES

A Teaming Platform for Startups & Innovators





https://adlventures.com/adl-teaming-platform-login/

Next Steps
Q&A

U.S. DEPARTMENT OF ENERGY

Questions?

Next Steps for Teams

- Read the Rules
- Review Phase 1 Feedback
- Access HeroX and ensure that you have access to the Phase 2 submission form
- Meet with E-ROBOT Power Connectors
- Keep an eye out for information about Demo Day
- If you have any questions, email the Prize Administration Team – EROBOT.Prize@nrel.gov

Thank You and Good Luck!