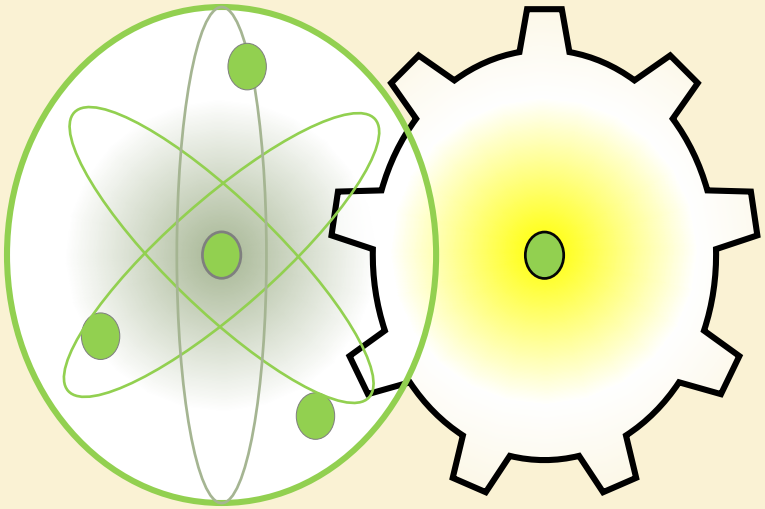
Technologist in Residence Program



Eli Levine, Program Manager, AMO

U.S. DOE Advanced Manufacturing Office
Technical Resources &
Networking Forum
Washington, D.C.
June 15, 2017

Program Introduction

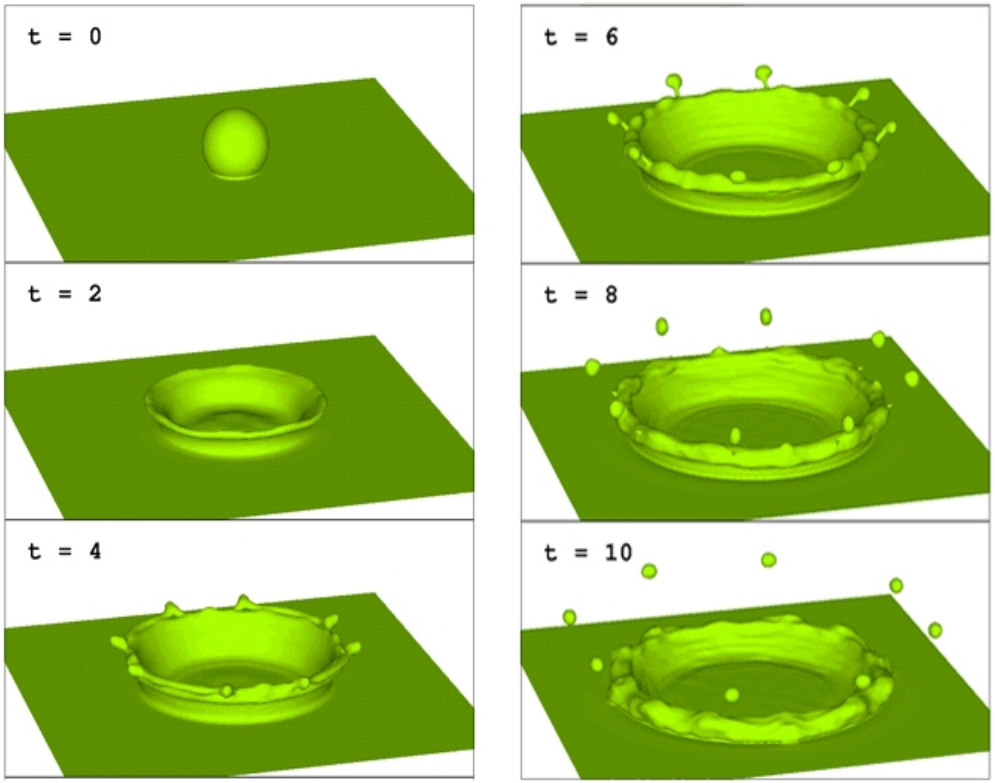
Opportunity Statement:

Many potential industry partners lack in-depth understanding of Lab expertise and resources, or how to work with the National Labs.

Meanwhile, lab researches often do not know the most pressing industry problems. When industry and labs engage, it tends to be on a project-by-project basis, and lacks long-term strategic value for both sides.

TIR Vision: Catalyze strong Lab-Industry relationships that result in significant growth in high-impact collaborative research and development

History: Los Alamos's Industrial Fellows Program



$1 Billion Saved in MFG Costs

44% increase in plant productivity

30% increase in equipment reliability

This simulation of a droplet of liquid falling into a pool of liquid was modeled using Los Alamos National Laboratory's Computational Fluid Dynamics Library (CFDLib), and utilized by Procter and Gamble to simulate a manufacturing process.

Technologist in Residence Program

Technologist in Residence (TIR) pairs senior technical staff from national laboratories and manufacturing companies to work together towards impactful manufacturing solutions.

Immediate Objectives:

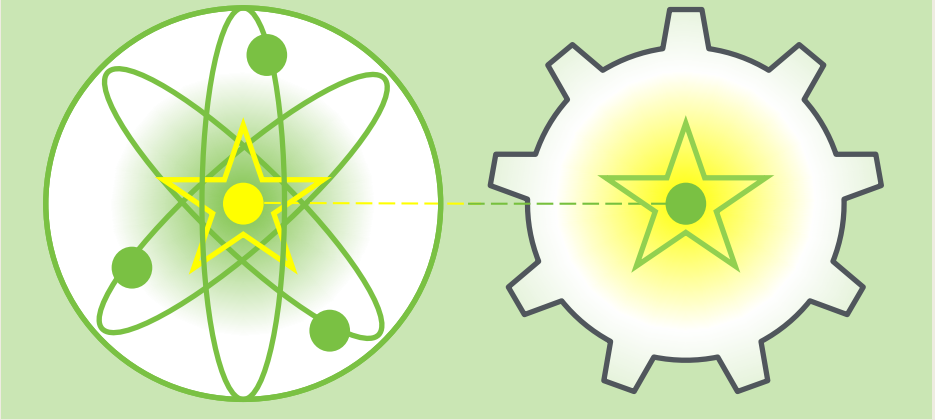
- Identify areas of collaborative R&D
- Develop a streamlined method for companies to establish long term relationships with laboratories that result in collaborative research and development
- Long-term, strategic public-private partnerships

Additional Objectives:

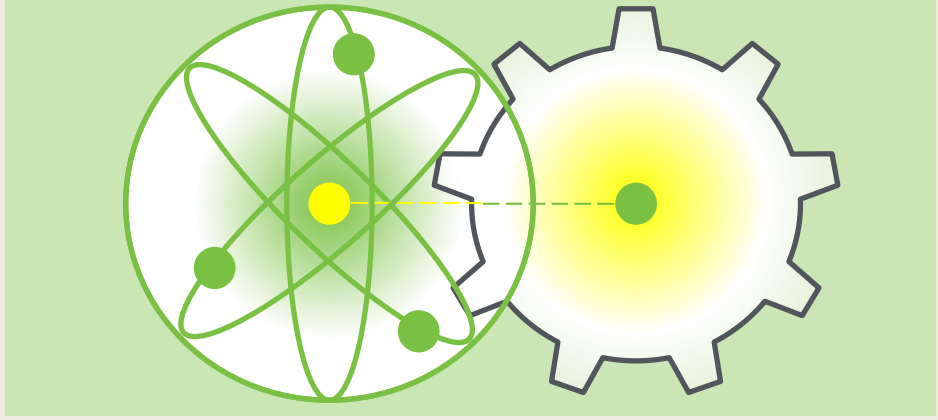
- Enhance transparency into the national lab innovation infrastructure
- Enhance awareness of high-impact industrially relevant technology challenges within the national laboratory system; and
- Broaden and strengthen networks of Technologists in national laboratories and in industry to more effectively support industry needs and leverage the national laboratory enterprise.

Technologist in Residence Summary: Model

Senior Technologists are identified within a National Lab and a manufacturing company. The Technologists work together…



…to identify new areas of collaborative research for industry and Lab, and create an agreement and specific scopes of work



Broadening beyond ‘one company – one lab’…

Through the Council of Technologists, program participants will work together to access/resources across the entire Lab enterprise. The Council will also help optimize the process for Lab collaboration.

Technologist in Residence Program

Cohort One: Kicked off December 1, 2015

P&G Procter & Gamble

Los Alamos NATIONAL LABORATORY EST. 1943

OAK RIDGE National Laboratory

ARCONIC

Alcoa

Cummins

Argonne NATIONAL LABORATORY

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Hewlett Packard Enterprise

Capstone Turbine Corporation

Argonne NATIONAL LABORATORY

Argonne NATIONAL LABORATORY

bridg Bridging the Innovation Development Gap

Program Successes

ORNL – Arconic

Core Topics of Focus

- Additive Manufacturing
- Materials Discovery
- High-Performance Computing
- High-Entropy Alloys
- Ceramic Materials
- Heat Exchangers
- Ceramic Matrix Composites
- Data Analytics
- Water Utilization
- Lightweight alloys
- Joining

Labs Engaged

- Ames
- LANL
- ANL
- NREL
- LLNL
- NETL
- PNNL

Results

- 3 CRADAs at the Manufacturing Demonstration Facility
- 2 proposals funded by HPC4Mfg program
- Seedling proposal w/ ARPA-E
- 1 User Project at ORNL's Center for Nanophase Materials Science
- 2 Strategic Partnership Projects
- 1 License

Argonne – Cummins

Core Topics of Focus

Powertrain systems & energy storage technologies

- o Increased flexibility for fleet operators
- o Lower cost of vehicle ownership
- o Partnering with regional air quality goals

Additional Potential Technology Areas for Exploration

- o Better understanding of battery system parameters
- o Enhanced power electronics cooling technologies
- o Thermal storage and release technologies

Labs Engaged

- ORNL
- ANL
- NREL
- Sandia

Results

- 6 Statement of Work Proposals Developed Across Three Labs (NREL, ORNL, Argonne)
- 1 active CRADA

Technologist in Residence Program

Cohort Two: Rolling Acceptance and Kickoffs

LUMILEDS

Sandia National Laboratories

UOP A Honeywell Company

Argonne NATIONAL LABORATORY

Henkel

BROOKHAVEN NATIONAL LABORATORY

OAK RIDGE National Laboratory

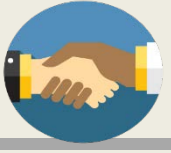
PIONEER NATURAL RESOURCES

kyma technologies

Argonne NATIONAL LABORATORY

DUPONT

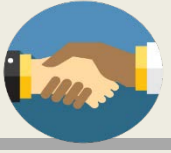
INL Idaho National Laboratory



How to Apply

Participant Selection

- DOE issues a call for proposals to the laboratories, posted on EERE Exchange.
- Applications evaluated on a rolling basis
- Applications will describe:
  - The broad area of technical focus to be explored by the Technologists in Residence and how the technical focus relates to CEMI objectives
  - The approach and activities the pair proposes to carry out to meet the pilot's and the pair's objectives
  - The specific workplan including a budget, metrics, and milestones
  - The background and capabilities of the individual Technologists and any additional support or resources provided by the participating companies and labs



Participating in the TIR program

Cost share: DOE will fund Lab Technologist and any potential other team members for up to $400k. Industrial partner agrees to fund full participation of Industry Technologist, as well as any costs for Lab above DOE's commitment.

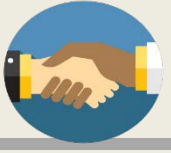
Participation: 18 – 24 months

Eligibility: Industrial partner defined as company or consortium involved in the production of clean energy technologies or implementing energy productivity measures.

Merit Review Criteria:

(1) Innovation, Technical Focus, Project Plan, and Approach (60%)

(2) Team and Resources (40%)



Metrics and Milestones

Milestones for technologist pairs include:

- Development of a framework partnership agreement that can be modified with statements of work as they are identified
- Creation of Statements of Work to be added to the agreement by the end of the pairs' participation in the Pilot

Technologist pairs may propose additional intermediary milestones.

Metrics to be reported by technologist pairs include:

- Number of National Labs visited to build relationships, explore ideas, and evaluate resources
- Time spent embedded at Lab or in Industry
- Number of scopes of work for R&D collaborations
- Meetings with leadership and staff from either Labs or industry to brief and consult about proposed potential ideas for R&D
- An assessment of how much a change (from Lab-push to commercial-needs pull) the partnership effected in the proposed R&D collaborations
- Scopes of work for proposed collaboration that have moved to contract negotiation or execution

Small Business Vouchers Pilot

U.S. Department of Energy

Tara Gonzalez, PhD
U.S. DOE Advanced Manufacturing Office

U.S. DOE Advanced Manufacturing Office Technical Resources & Networking Forum
Washington, D.C.
June 15, 2017

Program Mission

The mission of the Small Business Voucher (SBV) Pilot program is to significantly increase the industrial impact of DOE national labs on the U.S. clean energy sector.

1. Increase and enhance lab-private sector partnerships
2. Increase and streamline access to national lab capabilities
3. Demonstrate the value of lab-developed science and technology

Program Introduction

- Small business have difficulty accessing the lab capabilities
  1. Can not afford it
  2. Contracting process is long and difficult
  3. Lab system is difficult to navigate

- SBV pilot aims to address these challenges
  1. Make funding available for vouchers
  2. Streamline business practices to shorten the contracting process.
  3. Implement a support network to help small businesses navigate the entire lab system by technology area.

SBV designed to be one stop shopping

Program Introduction

Through the SBV Pilot, eligible small businesses can tap into the reserve of National Laboratory intellectual and technical assets to overcome critical technology and commercialization challenges such as:

- Prototyping
- Materials characterization
- High performance computations
- Modeling and simulations
- Intermediate scaling to generate samples for potential customers
- Validation of technology performance
- Designing new ways to satisfy regulatory compliance.

Program Reach

Round 1: March 2016

Round 2: August 2016

Round 3: April 2017

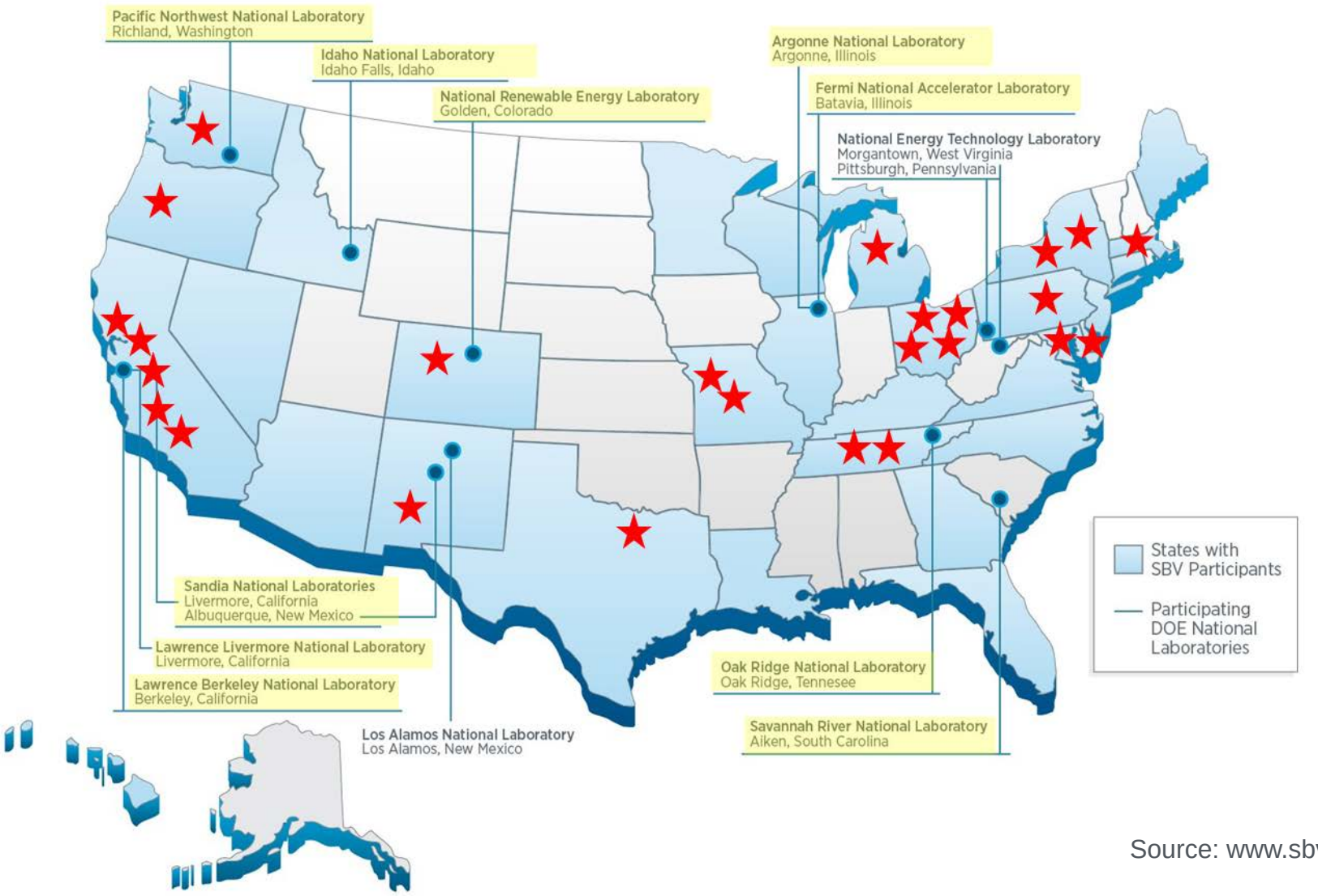
In the pilot AMO has

- Received 25% of all applications
- Awarded 22% of all vouchers
- Contributed 27% of all SBV funding

	Round 1	Round 2	Round 3
Total Applicants	459	390	419
Total Awarded	33	43	38
Total Funding	$6.7 M	$8.4 M	$7.1 M
AMO Applicants	135	95	90
AMO Awarded	6	8	11
AMO Funding	$1.5 M	$2 M	$2.4 M

Program Reach

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



Source: www.sbv.org

SBV Participation Rounds 1 – 3

Program Success

Round 1

6 Projects, March 2016

- 1 completed project
- 2 projects near completion

Highlights

- Possible product launch next year
- Project has allowed the lab to provide services closer to industry specs and could have a significant impact on how they engage with for-profit partners moving forward

Round 2

8 Projects, August 2016

- 1 project near completion

Highlights

- Possible new invention disclosure

Round 3

11 Projects, April 2017

Application Process

Small businesses must certify that they will adhere to the following:

1. Unique Lab Capabilities: Request assistance that is not reasonably available in the private sector.
2. Cost Share: Commit to a 20% cost share, which can be in-kind.
3. Agreements: Sign a non-negotiable agreement that governs intellectual property and other terms
4. Reporting: Commit to providing results during the project and for up to 5 years after the project start date.
5. Release of Information: Agree to allow non-proprietary information about your business and the success of the assistance to be featured in publicly available stories by DOE and the labs.

Application Process

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Eligible small businesses can request a voucher for use at a National Laboratory valued between $50,000 and $300,000.
- Submit the application package on EERE Exchange.
- Requests for Assistance (RFA) are 4 pages, and must include:
  1. Company Overview
  2. Problem Definition
  3. Project Impact
  4. Use of Project Results
  5. Team *(may include up to 3 additional pages of resumes, etc.)*
  6. Cost Share
- Package also includes a summary slide, and short questionnaire.

Application Process

The SBV team will employ a 3-phase review process:

- **Phase 1:** An external (non-lab) merit review committee will review each RFA and make the first down-selection.
  - RFA will be evaluated for their Potential for Impact (33%), Problem Definition (33%) and Team and Resources (33%)
- **Phase 2:** Labs will work with DOE to determine semi-finalists, who are matched with a lab researcher and have approximately 4 weeks to work together to develop a brief statement of work and budget for final review by DOE.
- **Phase 3:** DOE Technology Offices will select SBV projects to enter into final award negotiations.
- Application requirement details, timelines and deadlines for applications will be posted online at www.sbv.org

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Lab-Embedded Entrepreneurship Programs

Arlington, VA

June 15th, 2017

Peter Winter

AAAS S&T Policy Fellow

Advanced Manufacturing Office

www.manufacturing.energy.gov

Topics

- What are the Lab-Embedded Entrepreneurship Programs?
- What are the guiding principles for the programs?
- How do the programs work?
- What are the impacts so far?

What are the Lab-Embedded Entrepreneurship Programs?

1. **Cyclotron Road @ Lawrence Berkeley**
   - Launched mid-2014
   - Partnership with Activation Energy, Sept 2016
   - Cohort 3 on-boarded early May 2017

2. **Chain Reaction Innovations @ Argonne**
   - Launched mid-2016
   - Partnership with Polsky/Purdue
   - Cohort 1 fully on-boarded early April 2017

3. **Innovation Crossroads @ Oak Ridge**
   - Launched mid-2016
   - Partnership with LaunchTN
   - Cohort 1 on-boarded early May 2017

Lab-Embedded Entrepreneurship Programs

The U.S. Department of Energy's Lab-Embedded Entrepreneurship Programs are funded by the Advanced Manufacturing Office (AMO) and co-managed with the Technology-to-Market Program within the Office of Energy Efficiency and Renewable Energy (EERE).

FOR MORE INFORMATION GO TO:

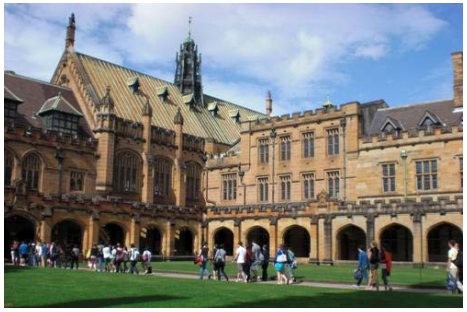
energy.gov/eere/technology-to-market/lab-embedded-entrepreneurship-program

Guiding Principles

1. Focus on the innovators, and on providing a pathway for top scientists and engineers to become clean energy entrepreneurs outside conventional financing pathways that are insufficient.
2. Focus on “hard-tech” at a nascent stage that can significantly impact the energy sector. These technologies require high capital intensity and long development cycles.
3. Integrate the innovators into a world-leading technical environment coupled to a broader ecosystem to support venture development.
4. Maintain a focus on how to best leverage the host institution to serve entrepreneurs.
5. Maintain a commitment toward bottom-up execution with senior leadership support.
6. Utilize entrepreneurship efforts in the regional ecosystem (e.g. Cyclotron Road proximity to the Silicon Valley entrepreneurship community).
7. Secure a high-intensity and top-notch execution team that is fully committed to the Lab-Embedded Entrepreneurship Program.

Creating a Home for Science-Based Innovators

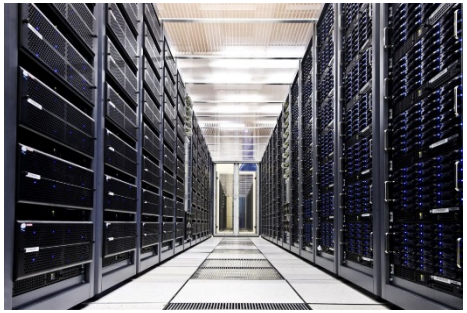
Where can innovators go to develop disruptive new technology?



Academic R&D

INTEREST:

New ideas, fundamental R&D



Corporate R&D

INTEREST:

Technologies core to business model

Tech Startup

INTEREST:

Later stage, proven businesses

Focus on Innovator for a "Win-Win" with the National Lab

1. Recruit the best energy technology innovators

2. Leverage expert mentorship and world-class facilities at the national lab on a win-win basis

Berkeley Lab Scientists on Benefits

- Lets me diversify knowledge, network, and research portfolio
- Excited to work with "all-in" innovators & drive real-world impact
- They are enhancing my equipment and capabilities
- They may bring funding into my research group
- I'm learning about industry needs and from different perspectives
- I may have an opportunity to be part of a startup

Time and Space to Develop Technology

Joint Focus on Technology and Business Development

DEVELOPMENT	STAGE 1 (Q1)	STAGE 2 (Q2-Q3)	STAGE 3 (Q4-Q5)	STAGE 4 (Q6)	STAGE 5 (Q7-Q8)
TECHNOLOGY • research • engineering • product design • manufacturing • techno-economics • intellectual property	RESEARCH • concept definition • literature review • state of the art • leading researchers • industry leaders • provisional patents	CONCEPT • proof-of-principle • application id • tech performance req • key tech risk id • tech dev plan • zeroth order TEA • IP landscape • blocking IP assessment	FEASIBILITY • components demo • tech risk mitigation • first product defined • basic engineer design • engineering analysis • process flow diagram • prelim bill of materials • first order TEA • IP strategy	ENGINEERING DESIGN • safety studies • solid models • equipment layout • P&IDs • installation plan • major equipment list • IP position secured • detailed bill of materials • TEA sensitivity analysis	PROTOTYPE DEMO • detailed design • site evaluation • commissioning • field demo • failure mode analysis • fit-for-purpose
MARKET • market • business • customer • sales • marketing	OPPORTUNITY • market survey • market opportunity • key differentiator • opportunity hypothesis • risk assessment • potential benefits • value prop hypothesis	MARKET • secondary research • competitive landscape • market segmentation • market entry point • value chain analysis • busin model hypothesis • value prop validation • cost-performance reqs	BUSINESS MODEL • primary research • first market/customer • price-performance trade • busin model validation • regulatory risks • market risks • product spec validation • min viable product	VOICE OF CUSTOMER • customer use cases • test plan • supply chain analysis • demo partner id	CUSTOMER VALIDATION • customer feedback • quality assurance plan • product design reqs
TEAM • team • advisors • partners • investors • suppliers	ADVISORS • advisory board (3-8) • founders	TEAM NEEDS • hiring plan • relationship gap analysis	CORE TEAM • first customer • core team hires • key relationships	PARTNERS • supplier contracts • co-developers	PRODUCT TEAM • product team hires • management team • sales channel id
FUNDING • budget • financial statements • government grants • investment • revenue projections	SCOPING • accounting system • funding sources review • grant applications	NON-DILUTIVE • 3-year budget • financial statements • grant applications • pitch deck	SEED FUNDING • seed financing • joint develop agreement	PROJECTIONS • seed financing • joint develop agreement • revenue projections • funding plan • pitch deck	SERIES A FUNDING • series A financing • commercialization plan

How do the programs work?

Innovator financial support:	National lab program support:	Early-stage R&D support:
Oak Ridge Associated Universities (ORAU) administered ORISE fellowships for two years.	Full program administration provided by National Labs.	AMO-funded support to National Lab for the innovator's R&D projects.

Innovator Financial Support

Innovators are ORISE fellows for two years at the National Lab:

- Living stipend
  - 80% time appointment (32 hours per week)
  - Stipend level based on experience
  - One year appointment with expectation of renewal for year 2
- Travel and education allowance
- 100% coverage under ORAU health plan

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION
Managed by ORAU for DOE

National Lab Program Support

AMO funds program staff in the National Labs:

- High touch innovator recruitment, selection, and mentoring
  - Best, and most diverse, applicants through directed outreach
  - Deliberate, merit-based selection process
  - Personalized mentoring
- Collaborate with non-exclusive business mentor organizations

An essential component of these programs is "bottom up" execution with support and cover from senior National Lab leadership

Early-Stage R&D Support

Funding:

- AMO provides initial CRADA funding for each project
- National Lab (often) provides discretionary funds
  - Highest impact use by innovator: Government grant cost share
  - Challenge: Difficult to preserve long-term

Pre-negotiated, program-wide CRADA essentials:

- Background intellectual property management
  - Scope and planning phase: IP management plan
  - R&D phase
- Modified U.S. Competitiveness clause with net benefit statement

What are the impacts so far?

Early successes from Cyclotron Road pilot

- **Follow-on Funding:** Cohort 1 (6 projects) catalyzed over $15 million of foundational research funding and initial private investments. The more than $5 million initial private funding came from diverse sources including philanthropy, angel investors, venture capital, and strategic investors. All teams graduated from Cyclotron Road with 12-18 months follow-on runway.

- **Job Creation:** 30 high tech manufacturing innovation jobs already supported by new companies founded by Cyclotron Road innovators.

- **Advisory Network:** Over 100 advisers volunteered to help innovators take technology from idea to impact. (Advisor expertise: scientific, grant funding, market advisory, and equity financing.)

- **National Lab Interest:** 20+ Berkeley Lab scientists supported projects by cohort 1 innovators.

- **Continued Interest from Innovators and Better Talent Pool:**
  - 150 applicants to cohort 1 – selected 8 innovators on 6 projects
  - 200 applicants to cohort 2 – selected 8 innovators on 6 projects
  - 100 applicants to cohort 3 – selected 10 innovators on 10 projects

- **Efficient Use of Funding/Avoided Costs:** Interviews suggest ~$1M and 6-12 months of development cost/time can be avoided through participation in Cyclotron Road.