LEVCAP

A Lab-Embedded Venture Capital Access Program for Deep Tech Commercialization

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LEVCAP is a strategic model that bridges the gap between laboratory research and market deployment for deep technology. It embeds entrepreneurial ventures inside research laboratories and connects them with capital and industry resources at the same time. The model directly addresses the valley of death between discovery and market. A decade of evidence now supports the approach, and this edition reports that evidence deduplicated: the published totals of Activate, Cyclotron Road, and the Department of Energy's LEEP network overlap, and removing the overlap gives at most 375 companies, at most 6.6 billion dollars in follow-on funding, and at most 4,200 jobs, with roughly 29 percent of the funding attributable to one company. Computed on a denominator that includes overhead and failures, leverage is between 7.7 and 11.5 private dollars per public dollar rather than the 44 to 1 the literature repeats. This edition presents the model's structure, the roles and benefits for each stakeholder, one company traced from fellowship to power purchase agreement, a stated position on whether the sponsoring fund may invest in participants, the cost and output targets for a federated twenty-node national network, and the six ways the model fails.

CONTENTS

Executive summary

The Lab-Embedded Venture Capital Access Program (LEVCAP) is a strategic model that bridges the gap between laboratory research and market deployment for deep technology. The model embeds entrepreneurial ventures inside research laboratories and connects them with capital and industry resources at the same time. The result is a commercialization pipeline that is repeatable, sector-agnostic, and regionally adaptable.

LEVCAP addresses the “valley of death”: the phase between discovery and market where promising technologies stall for lack of funding, market validation, or strategic support [1]. The model guides breakthroughs through this gap with a capital-efficient financing structure, so that value which would otherwise stay locked in the lab reaches products, businesses, and society [2].

The evidence base for lab-embedded commercialization has grown every year since the first pilots, and this edition reports it differently from earlier ones. The flagship American programs publish cumulative outcomes that overlap, because Cyclotron Road is simultaneously a node of the Department of Energy’s Lab-Embedded Entrepreneurship Program and a program operated with Activate, so its results appear inside both parent totals. Adding the parents together double counts the child. Deduplicated, the American lab-embedded cohort as of July 2026 amounts to at most 375 companies, at most 6.6 billion dollars of follow-on funding, and at most 4,200 jobs [3][5][8]. That is a real and substantial record. It is also roughly 43 percent smaller on follow-on funding than the figure obtained by stacking the published totals, and it is heavily concentrated: a single company, Fervo Energy, accounts for about 29 percent of the deduplicated follow-on total on its own [8].

The widely cited leverage ratio of 44 private dollars per public dollar requires the same treatment. It was computed in a 2024 analysis against a follow-on base of about 3.6 billion dollars [2], and the base has since moved. More importantly, the ratio divides all downstream private capital by a narrow slice of public support, namely stipends and early research funding for selected fellows, while comparable public programs compute their ratios across every dollar awarded including the failures. NSF I-Corps reports 3.16 billion dollars of subsequent funding against roughly 300 million dollars of federal program cost, a ratio of 10.5 to 1 [11]. ARPA-E reports more than 11.4 billion dollars of private follow-on funding across 204 teams against more than 3.4 billion dollars provided, a ratio near 3.4 to 1 [13]. A leverage ratio is meaningful only alongside its denominator, and on a comparable denominator the lab-embedded model does not stand apart by a factor of four. It stands alongside the best of its peers.

None of that weakens the case for the model. It changes what the case rests on. The argument of this paper is not that lab embedding produces extraordinary multiples. It is that lab embedding is the only intervention that relieves two binding constraints at once, capital equipment and founder capability, and that it remains confined to four federal laboratories and one sector while comparable research assets across the country sit unconnected to any commercialization engine.

This paper therefore presents the model’s structure and operations, defines the roles and benefits for each stakeholder group, traces one company from fellowship to power purchase agreement, takes a position on the governance question a venture firm is uniquely obliged to answer, and specifies what a federated national network would cost and produce in terms a decision-maker can check. It also states where the model loses to its alternatives, how it fails, and what would happen to it under an administration that reprioritizes.

Context: the valley of death, still open

Deep tech innovations span advanced materials, life sciences, clean energy, microelectronics, quantum computing, and beyond. They are crucial to societal challenges and future economic growth [1]. These science-based technologies originate from years of laboratory research, and unlike digital startups they face long development timelines, high capital requirements, and complex validation processes. Regulatory approvals, manufacturing scale-up, and physical infrastructure extend the path further. Because the prevailing venture capital model favors rapid growth and quick exits, the mismatch produces a well-documented funding and support gap for deep tech startups [1].

This gap is the valley of death. It follows basic research funding and precedes market readiness and revenue [1], and it corresponds roughly to Technology Readiness Levels 4 through 7. In it, companies must advance prototypes, demonstrate commercial viability, and build a business case, while traditional investors stay wary because technical and market uncertainties remain high [6]. As a result a large portion of scientific innovations never leave the lab, failing for lack of bridging support rather than for lack of potential [1]. Valuable intellectual property lies dormant, economic opportunities are missed, and society waits longer for breakthrough solutions [2].

Why capital fails in this specific band

The valley of death is usually described rather than explained, and the description invites the wrong remedy. If the gap were simply a shortage of money, more money would close it, and a decade of increased deep tech allocation would have closed it. The gap persists because three curves cross in the TRL 4 to 7 band in a way that makes the band structurally unattractive to the instruments that surround it.

The first curve is capital intensity, which rises sharply once a technology leaves the bench. Proving a concept costs a graduate student and an instrument. Proving a pilot costs a facility, a materials supply chain, and a team, and the step is often an order of magnitude rather than an increment.

The second curve is technical risk, which does not fall at the same rate. A device that works at bench scale has retired the physics and retired almost nothing else, because the failures that kill deep tech ventures tend to appear at scale-up: yield, contamination, thermal management, and the tolerance stack of a real supply chain. Risk therefore stays high while cost climbs, so risk-adjusted return reaches its minimum precisely in the band where the money required is largest.

The third curve is the horizon, and it interacts with fund structure rather than with technology. A venture fund typically commits capital over a ten-year life with reserves planned against that life. A technology entering TRL 4 may need eight years to reach revenue and twelve to reach an exit, which means the fund that finances the band cannot own the outcome. That is not a failure of nerve or of analysis. A general partner who invests at TRL 4 is making a commitment their own fund documents cannot honor, and the discipline that prevents it is the same discipline their investors demand.

Grant funding sits on the other side and fails for the mirror reason. Federal research awards are structured around research questions rather than around company formation, they generally cannot fund the commercial work that the band actually requires, and they do not buy the founder any time to discover whether a market exists.

Seen this way the gap is a structural mismatch rather than a shortage, and the remedy has to change the structure. What the band needs is capital that behaves like a grant in its dilution and like venture in its expectations: non-dilutive, patient over roughly two years, attached to facilities so that the capital intensity curve is flattened rather than funded, and accompanied by the market contact that a research award cannot supply. That combination is what lab embedding is, and stating the mechanism this way also sets the boundary of the claim. Where the binding constraint is not equipment access and not founder capability, a cheaper instrument will do.

Public research institutions were not built to bridge this chasm alone. The Department of Energy's national laboratories produced groundbreaking inventions but historically "placed less emphasis on commercialising those technologies" [4]. Technology transfer offices and licensing deals alone proved insufficient, and in recent years leading research organizations recognized that new public-private models are needed. They began to cultivate stronger relationships among researchers, industry, and investors, and they built novel mechanisms: accelerators, incubators, and fellowship programs embedded in labs [4]. The shift reflects a broader understanding that successful deep tech innovation requires an ecosystem approach aligning scientific research with entrepreneurial talent, market knowledge, and patient capital from the outset [1].

Pilot programs demonstrated the elements of this approach. The Department of Energy's Lab-Embedded Entrepreneurship Program (LEEP), launched in 2015, embeds entrepreneurs at federal labs on two-year fellowships [7]. Participants receive research support, facility access, and business mentorship. Cyclotron Road, founded at Lawrence Berkeley National Laboratory in 2015 and now operated in partnership with the nonprofit Activate, showed that targeted public investment in science entrepreneurs can yield outsized returns, and it also seeded innovation well beyond the usual hotspots, in dozens of cities across more than 25 states [2].

The context for LEVCAP is therefore an opportunity and a structural failure at once. The opportunity is the wealth of deep tech innovation emerging from laboratories. The failure is the gap in the innovation system that strands breakthroughs short of commercialization. As one analysis put it, "capital alone is not enough: The interplay between science and business requires an innovation ecosystem that rewards long-term thinking" [1].

The LEVCAP model

LEVCAP integrates entrepreneurial incubation inside research environments with aligned venture funding and industry partnership. It is general-purpose and sector-agnostic, supporting startups in any deep tech domain because it focuses on the process of commercialization rather than the specifics of one technology. At its core, LEVCAP hosts selected deep tech entrepreneurs inside a laboratory or research institution for an intensive residency of one to two years, during which the venture develops its technology and its business in parallel. Six features define the model.

Embedded research and prototyping. Participants work inside the facilities of a lab or research university, with direct access to advanced equipment, specialized labs, and scientific expertise that a startup could not otherwise afford. Startups refine prototypes and run critical experiments without building their own infrastructure [7]. The approach accelerates technical progress and is capital-efficient, because it leverages sunk public investment in research infrastructure rather than duplicating it.

Mentorship and human capital. Each venture is paired with experienced technical mentors from the host institution and with business advisors. Mentors help the startup troubleshoot research challenges and make informed technical decisions [4]. The program also trains researchers who are first-time founders, through a structured curriculum covering product development, intellectual property strategy, regulatory navigation, customer discovery, and business models [7]. The goal is to turn capable scientists into capable company leaders, and one program leader stated the risk of omitting this plainly: without early help in entrepreneurial thinking, "they may always be researchers" [4].

Venture funding access. LEVCAP embeds capital access into the process rather than leaving startups to search for seed funding alone. The mechanism is concrete rather than atmospheric: regular pitch sessions with venture and angel investors are part of the curriculum, so that founders receive iterative feedback from the investor's perspective and build relationships well before an actual financing round. That sequencing matters because a deep tech founder meeting investors for the first time at the point of need is negotiating from weakness on both terms and timing. By graduation each venture has a refined value proposition, data generated at a respected institution, and a set of investors who have watched the technology mature for two years, which is the confidence bridge that answers the capital gap defining the valley of death.

Cross-sector collaboration. LEVCAP is a consortium rather than a single entity. It brings together labs and universities for technical resources, venture funds for capital, corporations for market access, government agencies for funding and policy alignment, and incubators for entrepreneur support. Ventures accordingly receive technical validation from scientists, market validation from industry partners, and investment validation from investors. Deep tech success depends on this integration, because the technology must align with real market needs, manufacturing channels, and regulatory environments from an early stage [1].

Capital-efficient financing. LEVCAP uses blended financing to maximize impact per dollar. Fellowship stipends or grants, often public or philanthropic, cover salaries and research costs during the residency [7]. The host lab contributes infrastructure and services in kind. Private venture capital enters after initial technical validation, where each dollar goes toward scaling rather than toward proving the science. The startup therefore survives the early phase without heavy equity dilution, the investor deploys capital at lower technical risk, and the public funder catalyzes a multiple of private investment. What that multiple is, and how it should be computed, is treated in the next section rather than asserted here.

A repeatable process. LEVCAP runs as an annual pipeline rather than an ad-hoc project. A competitive call identifies researchers with commercially promising ideas, and expert panels from labs, industry, and venture capital vet proposals for technical merit and market potential. The selected cohort enters the residency and progresses through defined checkpoints: proof of concept, prototype demonstration, market feasibility, and business model validation. At the end of the term, startups graduate by pitching to investors or by entering next-stage accelerators and corporate pilots. The process repeats each cycle, at one site or many, and knowledge accumulates across cohorts.

The 2026 program landscape, read carefully

The lab-embedded model is no longer an experiment. Reading its record correctly, however, requires more care than the published totals invite.

What the programs report

Activate. The national lab-embedded entrepreneurship nonprofit welcomed its twelfth cohort in July 2026, comprising 50 new fellows. Its cumulative outcomes stand at more than 275 companies created, more than 5.5 billion dollars in follow-on funding raised, and more than 3,000 jobs created. The 2026 cohort is supported by the National Science Foundation, the Massachusetts Clean Energy Center, NIST, and the Department of Energy's Cyclotron Road program [3].

Cyclotron Road. The founding node of the movement, run at Lawrence Berkeley National Laboratory in partnership with Activate, welcomed 11 new fellows and 9 new companies in its 2026 cohort, its twelfth year. Its cumulative outcomes are 100 companies advanced, 131 fellows, more than 4.9 billion dollars in follow-on funding, and more than 2,800 jobs [8].

The LEEP network. The Department of Energy's Lab-Embedded Entrepreneurship Program spans four nodes: Cyclotron Road at Berkeley Lab, Chain Reaction Innovations at Argonne, Innovation Crossroads at Oak Ridge, and West Gate at the National Laboratory of the Rockies. Program-wide, and as of 16 July 2026, LEEP reports launching more than 200 startups, attracting more than 6 billion dollars in follow-on funding, and creating nearly 4,000 jobs since 2015. In May 2026 the Department moved LEEP under its Office of Technology Commercialization "to strengthen connections across commercialization programs" [5].

What the numbers do not say

Three corrections apply before any of this becomes evidence.

The totals overlap. Cyclotron Road is a LEEP node, and it is operated in partnership with Activate. Its 100 companies and 4.9 billion dollars therefore sit inside both parent totals. Adding Activate's 5.5 billion to LEEP's 6 billion yields 11.5 billion dollars, of which at least 4.9 billion is the same money counted twice. Removing the overlap once gives an upper bound of 6.6 billion dollars across at most 375 companies and at most 4,200 jobs. These are upper bounds rather than point estimates, because the intersection of Activate and LEEP may be larger than Cyclotron Road alone and neither organization publishes a reconciliation. An earlier edition of this paper stacked the parent figures and drew a conclusion about compounding from the stacked total. That was an error, and correcting it costs the paper 4.9 billion dollars of apparent evidence.

The record is concentrated. Fervo Energy, a Cyclotron Road alumnus, has raised 1.89 billion dollars and reached a valuation above 10 billion dollars [8]. That single company is about 39 percent of Cyclotron Road's reported follow-on total and about 29 percent of the deduplicated national total. Cyclotron Road's cumulative follow-on funding passed 3 billion dollars in December 2024 [9] and exceeded 4.9 billion by July 2026, an increase over nineteen months of the same order as one company's entire cumulative raise. Venture outcomes are always power-law distributed, so concentration is expected rather than damning. What it forbids is the inference that the aggregate demonstrates a reliable process. An aggregate carried by one company demonstrates that the program admitted one exceptional company, and a second node replicating the program will not thereby replicate Fervo.

Cumulative figures carry a vintage. These programs restate their totals upward as cohorts mature, and older program pages persist alongside newer ones with materially different numbers. Any figure quoted from them should carry its access date, as the citations in this paper do. A reader comparing two of these papers across two years without noting the dates will conclude the programs grew faster or slower than they did.

Leverage ratios and their denominators

The 44 to 1 figure is the most quoted number in this literature and the most easily misread. It comes from a 2024 analysis computed against a follow-on base of roughly 3.6 billion dollars [2]. The base has since roughly doubled on a deduplicated view, and the public denominator has also grown, but neither program publishes public input on a basis that permits recomputation, so this paper reports 44 to 1 as a 2024 figure tied to a 2024 base and does not restate it.

The deeper problem is comparability. Consider three public programs with published ratios:

Program	Public input	Private or subsequent capital	Ratio	What the denominator contains
Lab-embedded fellowships (2024 analysis)	not published on a comparable basis	3.6 billion dollars at the time	44 to 1	Stipends and early research support for selected fellows
NSF I-Corps	about 300 million dollars federal	3.16 billion dollars subsequent, of which 2.15 billion private, across roughly 1,400 startups from more than 2,500 teams	10.5 to 1	Entire program cost, all teams, including those that never formed a company
ARPA-E	more than 3.4 billion dollars provided since 2009	more than 11.4 billion dollars private follow-on across 204 teams, with 135 new companies formed	about 3.4 to 1	Every award dollar, including projects that failed technically

Read as published, lab embedding looks four times more efficient than I-Corps and thirteen times more efficient than ARPA-E. Read on comparable denominators it does not, because the 44 to 1 denominator excludes most of what the other two include. It counts the stipend of a fellow who was selected and omits both the cost of the selection apparatus and the fellows who were not selected, while ARPA-E's denominator contains every dollar spent on every project including the technical failures. A ratio computed on a screened subset with the failures outside the denominator measures the quality of the screen, which is worth knowing, and not the return on the program, which is what readers take it for.

A defensible statement is narrower and more useful. Lab-embedded programs return private capital at a multiple that is competitive with the strongest federal commercialization programs when computed the same way, and their distinguishing feature is not the multiple.

Where lab embedding wins, and where it loses

The model has alternatives, and a strategy document that does not compare them is advocacy.

NSF I-Corps delivers customer-discovery curriculum without residency or facilities. It has trained more than 2,500 teams, of which roughly 1,400 launched startups [11]. Per team it is far cheaper than a lab-embedded fellowship, and it scales through university nodes with an uniform curriculum. It loses precisely where the binding constraint is physical, because no amount of customer discovery gives a founder access to a beamline or a glovebox.

ARPA-E, including the SCALEUP program introduced in 2019, funds the technology rather than the founder, and it moves far more capital per project than any fellowship [13]. It loses on founder formation, because it awards to teams that already exist and can win a federal solicitation, which selects against the first-time founder still inside a lab.

University proof-of-concept and gap funds sit closest to the invention and cost the least. They are weakest on market contact and on the size of capital available, and they rarely change who is running the company.

The Fraunhofer model in Germany is the durable comparator and the least like the others. Fraunhofer operates contract research institutes rather than fellowships, and it draws no more than about one-third of its contract research budget from federal and state base funding, raising at least two-thirds competitively from industry contracts and public project funding [14]. It loses on new-company formation, because its purpose is to strengthen existing industry rather than to create startups. Its funding architecture, however, is directly relevant to LEVCAP and is taken up below.

Lab embedding wins in one specific situation: when a venture needs simultaneous relief from two constraints, access to capital equipment it cannot buy and a founder who has never run a company. That is a real and underserved situation. It is not most deep tech, and the honest scope of the model is narrower than a paper advocating for it would prefer.

Choosing among the instruments

Because the instruments are not substitutes, a region deciding what to build should diagnose its constraint before selecting a remedy. Four questions separate the cases, and they should be asked in this order.

Does the technology require instruments the venture cannot buy or rent? If it does not, a node is the wrong instrument, because the largest single line in a node's budget pays for proximity to equipment that the venture does not need. Software-adjacent and design-stage ventures fall here, and so does a surprising share of what gets labeled deep tech. If it does, the choice narrows to a node or a facility-access voucher scheme, and the voucher is cheaper wherever the venture already has a capable founding team.

Is the founding team already capable of running a company? If it is, the founder-formation half of the fellowship is being paid for and not used. ARPA-E-style technology funding or a direct venture round will move that company faster, and the evidence for this is that ARPA-E's denominator contains teams which had already formed and could win a federal solicitation [13]. If it is not, the training and mentorship half is the binding relief, and this is where the model has no close substitute.

How deep is the region's private capital? A node graduating companies into a region with no seed investors produces companies that leave, which serves the national interest and not the regional sponsor paying half the bill. Where local capital is thin, the sequence matters: build the demand side first through I-Corps-style training and gap funds, which are cheap and fast, and add a node once there is capital to graduate into. A node is a poor first intervention and a strong third one.

Is the goal new companies or stronger incumbents? This is the Fraunhofer question and it is asked least often. A region whose economic problem is that its existing manufacturers are technologically stagnant does not need startups, and a fellowship program will not help it. Contract research institutes address that problem directly, they are more durable because most of their revenue is competitive [14], and they are a different instrument for a different diagnosis.

The resulting rule is unglamorous. Build a node where capital equipment access and founder inexperience bind together, where a local seed market exists to graduate into, and where the goal is company formation rather than incumbent upgrading. Everywhere else, something cheaper is better, and a strategy that recommends nodes universally is selling rather than advising.

One case, traced

Cumulative outcome paragraphs establish that something worked somewhere. Tracing one company establishes what the intervention actually provided.

Fervo Energy develops enhanced geothermal systems, applying horizontal drilling and completion techniques from oil and gas to geothermal reservoirs. Jack Norbeck, its co-founder alongside Tim Latimer, entered the Cyclotron Road cohort in 2018. The fellowship supplied four things: two years of research funding, a living stipend, entrepreneurial training delivered with Activate, and access to Berkeley Lab's facilities and multidisciplinary research staff [10].

The relevant question is which of those four mattered, and the answer is not the one the model's advocates usually give. Fervo's technical thesis was not a laboratory discovery awaiting translation. It was the transfer of a mature and well-capitalized industry's techniques into an adjacent resource, and its founders came from that industry rather than from the lab. What the fellowship supplied was runway and credibility during the period when the thesis was unfinanceable: a salary and research budget that did not require a priced round, and a national laboratory affiliation that made a geothermal claim legible to counterparties who had watched geothermal disappoint for four decades.

The commercial milestones came later and came from the market. In 2023 Fervo partnered with Google on a commercial geothermal pilot supplying Google's Nevada data centers. In 2024 it signed a fifteen-year power purchase agreement with Southern California Edison sufficient to power roughly 350,000 homes. Cumulative capital raised now stands at 1.89 billion dollars against a valuation above 10 billion [8].

Two conclusions follow, and the second is uncomfortable for the model. Lab embedding was necessary in the sense that the company would not have reached its first demonstration on the capital available to it in 2018 without a non-dilutive bridge. It was not sufficient in any sense, and it was not the source of the technology. The fellowship bought two years of survival for a good thesis, which is exactly what the valley-of-death framing claims it does, and considerably less than what the aggregate follow-on figures imply when a reader attributes 1.89 billion dollars of outcome to a two-year residency.

The equity question, answered

A program named the Lab-Embedded Venture Capital Access Program, published by a venture capital firm, must state whether the sponsoring fund may invest in the companies it selects, mentors, and grades. Earlier editions of this paper listed funding sources and omitted the question, which reads as evasion whether or not it was. This edition answers it.

The available options are known. Some programs establish an investment fund and take small equity stakes in participants, or rights to invest later, in order to recycle returns into program operations. The counterweight is that a policy-oriented program should avoid specific fund strategies, and early-stage programs frequently decline equity in order to avoid conflicts and remain founder-friendly.

Our position. The sponsoring fund should not hold equity or investment rights in a venture during residency, and no person who participates in cohort selection should participate in an investment decision about a participant. Investment in graduates after the residency ends is legitimate, subject to four conditions:

1. **No rights at admission.** Admission confers no equity, no option, no right of first refusal, and no pro-rata right. A program that acquires investment rights as a condition of entry has converted a selection decision into an investment decision.
2. **A firewall with named members.** The selection committee and the investment committee share no members, and the firewall is published rather than asserted.

3. **Disclosure before application.** Every applicant is told, before applying, which funds are affiliated with the program and what they may do after graduation.
4. **A public register.** Investments made by affiliated funds into alumni are published, with dates, so that an outside observer can check the pattern rather than trust the policy.

The reasoning is not primarily ethical. The program's product is a credible signal, and the signal's value to every downstream investor depends on the program having no position in the asset when it issues the signal. A fund that has already bought cannot certify. If admission carries investment rights, every subsequent investor must discount the program's judgment by an unknown amount, which destroys more value than the recycled returns create. The recycling argument is real, and it should still be rejected here, because the amount recovered is small relative to what a compromised signal costs the whole network.

Stout Street Capital states its own interest plainly. The firm invests in early-stage deep technology and would be a plausible investor in graduates of a program of this kind. That is why the constraints above are written as constraints on the sponsor rather than as best practices for others.

A federated national commercialization network

The largest strategic payoff of LEVCAP is not any single program. It is the network the programs can form.

Regional nodes. Scaling begins with the identification of promising regions, where an ideal location combines strong research institutions, available infrastructure, a talent base, and committed local stakeholders. The model is sector-agnostic, but each node can lean into local strengths: a region with biotech companies and a medical research university will attract health-tech ventures, while a region with an aerospace lab and manufacturers will attract aerospace and advanced-materials ventures. Each node mirrors the core program elements, tailored to local context, and a capable local program director matters more than any other single hire.

Consistency across nodes. A national playbook keeps quality uniform through standard approaches to intellectual property agreements, selection processes, and outcome tracking, so that a startup in Texas and a startup in Massachusetts receive comparable support. NSF I-Corps proved the approach by establishing regional university nodes delivering one uniform curriculum nationwide [12]. LEVCAP nodes can share training modules, templates, and mentors the same way. Periodic peer evaluation among nodes protects the network's reputation, and it needs teeth: an underperforming node should receive additional support first and be restructured in the worst case, with the metrics, the reviewing body, and the treatment of fellows in residence during a restructuring all specified before the first node opens rather than after the first node fails.

Federation mechanics. Federation means each node operates independently day to day and contributes to a larger whole.

- **National cohort events.** Joint showcases bring all regional cohorts together at least once per cycle, so investors see a national class in one place and founders from different regions meet and partner.
- **Resource sharing.** No startup is limited to its local node's equipment. A venture in one region can access a unique instrument at another node's lab through an arranged visit or sample transfer, which makes every node a portal into the combined capability of all participating labs.

- **Multi-node funding.** National funds or syndicates commit to top graduates across all nodes, and regional investors co-invest across geographies, so that an investor in one technology area sees every relevant venture in the country rather than only the local ones.
- **Specialization with cross-pollination.** Over time nodes develop centers of excellence, and a startup with a need outside its node's specialty spends time at the node that has it.

Federal coordination. A modest central backbone multiplies the network's value. Agencies such as NSF, DOE, or Commerce can convene the nodes, fund independent program evaluation, organize cross-node events, and maintain unified outcome data on a single deduplicated basis, which the current programs conspicuously do not. Federal seed funding can catalyze new nodes that state and regional entities then match, following the pattern of manufacturing innovation institutes and I-Corps [12].

Adaptation to regional needs. Each node adapts within the common framework. A biotech-heavy node adds regulatory support for FDA pathways, and a node in a region with little venture capital emphasizes non-dilutive grants while local angel capacity grows. Mature nodes send experienced mentors to help new nodes climb the curve.

What the network would cost and produce

A strategy document that proposes a national network and never quantifies it cannot be acted on. The figures below are proposed design parameters rather than observed costs, and they are stated so that a reader can dispute them. Neither DOE nor Activate publishes per-node budgets, so these parameters cannot be validated against the reference programs, and that disclosure gap is itself worth naming: a decade-old federal program whose per-node operating cost is not public cannot be benchmarked by the states being asked to match its funding.

Node unit economics, proposed. A node admits 10 fellows per year on a two-year residency, which matches Cyclotron Road's 2026 intake of 11 and holds 20 fellows in residence at steady state. Per fellow-year, a stipend with benefits and travel is on the order of 150,000 dollars and a research allocation is on the order of 200,000 dollars, giving 350,000 dollars per fellow-year and 7.0 million dollars across 20 fellows. Program staff, comprising a director, two program managers, and an operations lead, add roughly 800,000 dollars fully loaded. Steady-state cash cost per node is therefore about 7.8 million dollars per year, with laboratory facility access contributed in kind and counted but not paid in cash. Standing up a node takes 18 to 24 months to first cohort, and the first year runs at roughly half of steady state.

Network scale. Twenty nodes at steady state cost about 156 million dollars per year. For calibration, I-Corps has cost roughly 300 million dollars federal across more than a decade, and ARPA-E has provided more than 3.4 billion dollars since 2009 [11][13]. A twenty-node network sits between them, which makes the ask legible rather than novel.

Output targets. An earlier version of this argument proposed that a national network launch 500 companies in five years, which raise 10 billion dollars and create 50,000 jobs across 20 states. The company count is defensible and the rest is not. Cyclotron Road produced 100 companies across twelve cohorts at one node, and its 2026 cohort produced 9 companies from 11 fellows, so a mature node yields roughly 5 to 9 companies per year and 20 nodes over five years at 5 per node-year gives exactly 500. The job figure fails its own arithmetic: 50,000 jobs across 500 companies implies 100 jobs per company, whereas LEEP reports nearly 4,000 jobs across more than 200 startups, about 20 per company, and Activate reports about 11 per company [3][5]. The defensible job target is therefore roughly 10,000, not 50,000. On follow-on funding, the deduplicated record implies about 17.6 million dollars per company, falling to about 12.6 million once Fervo is removed, so 500 companies should be expected to raise 6 to 9 billion dollars rather than 10 billion, and one or two companies will supply a quarter of whatever the total proves to be.

The resulting leverage claim. Twenty nodes for five years costs about 780 million dollars of public and matched money and should produce 500 companies raising 6 to 9 billion dollars, a ratio between 7.7 and 11.5 to one. That is the number this paper will defend. It is a quarter of the 44 to 1 figure the literature repeats, it is computed on a denominator that includes the program's overhead and its failures, and it is close to what I-Corps has already demonstrated.

Stating a lower number is not a retreat. A decision-maker asked to approve 156 million dollars a year can act on 7.7 to 11.5 to one. Nobody can act on a ratio whose denominator is undefined.

Stakeholder roles and benefits

LEVCAP aligns the self-interest of every participant with the shared goal of commercialization. No stakeholder participates out of charity.

Research institutions and laboratories

Role. Labs host the program, providing space, equipment, core facilities, and the scientists who mentor embedded ventures.

Benefits. Labs gain a direct pathway to translational impact, so that discoveries progress to products and companies instead of stopping at publication. The concrete demonstration is specific rather than general: one multi-lab initiative spun out six startups in under two years using lab-derived intellectual property, a marked increase over the historical rate for comparable institutions [4]. Hosted startups raise utilization of expensive facilities and push equipment in new directions. External funding flows in through startup grants, sponsored research, and eventual licensing royalties. Entrepreneurial fellows invigorate research culture and build a workforce skilled in both research and innovation, and the lab becomes a visible node in its regional innovation network, which strengthens its position in funding competitions.

Startups and entrepreneurial teams

Role. Startups develop the technology into a viable product and business with the program's resources.

Benefits. Startups gain access to research infrastructure that no garage can match, and one founder framed the value as a question: "How can you make an explosion on your own?" [4]. Technical mentors shorten development cycles and prevent costly mistakes, business training turns technical founders into capable chief executives, and stipends let founders work on the venture full time [7]. Facilitated introductions to investors, built over the whole residency, make fundraising faster and better-termed. Corporate partners supply pilot opportunities, early customers, and supply-chain contacts. Selection into a rigorous program, and data generated at a respected lab, confer credibility with investors, customers, and regulators alike, which is the same mechanism that made a geothermal claim legible in the case traced above.

Venture investors

Role. Venture funds, angels, and other financial partners advise during the program and invest in its graduates, subject to the constraints set out in the equity section.

Benefits. Investors receive screened deal flow, because a graduate has achieved milestones, resolved key uncertainties, and been stress-tested by experts before any term sheet is written. The follow-on record of these cohorts is strong and should be read with its concentration in view: at most 6.6 billion dollars across at most 375 companies on a deduplicated basis, with roughly 29 percent of that total attributable to one company [3][5][8]. Survival should be read with equal care. The 2024 analysis reporting that about 96 percent of companies remained active after roughly a decade [2] is a striking figure, and "active" is a weak predicate: a company with a website, a small team, and no revenue satisfies it. That number is evidence that lab-embedded companies rarely shut down abruptly, which is genuinely different from the venture norm, and it is not evidence that they reach scale at unusual rates. Earlier editions of this paper claimed survival rates "conventional startup pipelines do not approach" without supplying a baseline for conventional pipelines, and no such baseline is offered here because none was located on a comparable definition.

Engagement with the program also gives investors early insight into emerging technology areas at low cost, and it lowers the barrier for generalist investors to enter deep tech. The capital efficiency is direct: prior non-dilutive support has already paid for much of the early research, so the invested dollar goes toward scaling. Standardized agreements developed by programs reduce legal friction [4].

Corporate partners

Role. Corporations serve as mentors, strategic partners, pilot customers, and co-investors.

Benefits. Corporates gain early access to technologies that could disrupt or advance their industries, with the option to shape development toward their needs. The lab setting de-risks collaboration with early-stage companies, because vetting has occurred and pilots can run on lab infrastructure with expert oversight. Employee mentors return with entrepreneurial energy, and corporate venture arms find strategic investments aligned with their roadmaps. Participation also demonstrates innovation leadership, which carries weight in regulated industries.

Government and public-sector partners

Role. Agencies fund stipends and operations, align policy, and integrate the program with public innovation initiatives such as SBIR and technology transfer programs.

Benefits. LEVCAP converts public research spending into companies, jobs, and tax base, at a leverage ratio this paper puts between 7.7 and 11.5 to one on a fully loaded denominator. The model advances national priorities in critical technologies by keeping talent and intellectual property domestic, and it gives funding agencies reportable outcomes that justify research budgets. Its regional structure spreads opportunity beyond established hubs [2]. Direct involvement also gives agencies ground-truth feedback on regulatory barriers.

Incubators and entrepreneur support organizations

Role. Existing incubators and accelerators co-operate programs, provide business mentorship, and receive graduates into next-stage programs.

Benefits. Incubators gain deep tech deal flow they could not source alone, and they share resources with the lab instead of duplicating infrastructure. Association with a successful program raises their profile and funding prospects, and the network connects them to labs, investors, and corporates nationwide.

Operational considerations

Execution determines whether the model delivers. Nine operational areas matter most.

1. Governance. Use a consortium structure with a lead institution managing daily operations and a steering committee drawn from labs, funders, investors, and corporate sponsors selecting cohorts and monitoring progress. Define roles, responsibilities, and conflict-of-interest rules at the outset, giving effect to the firewall specified in the equity section. Appoint a program director with both technical and business experience.

2. Selection. Run a competitive national call even for a regional program, and evaluate technical merit and entrepreneurial potential together with interdisciplinary panels of scientists, industry experts, and investors. Use staged selection: review, interviews, then diligence. Encourage applications from underrepresented groups and diverse institutions. Sign clear agreements stating what the program provides and what it expects, including time commitment, relocation, and milestones [7].

3. Intellectual property. Clarify at the start how existing intellectual property is licensed and how new intellectual property will be owned, and streamline wherever possible through predefined license terms, template research agreements, and dedicated technology transfer officers. A multi-lab accelerator demonstrated that streamlined licensing and contracting materially speeds startups' access to lab technologies [4]. Balance publication norms with startup confidentiality through agreed delays. The hard case is not the routine one: a fellow whose invention builds on laboratory background intellectual property already committed under an agreement with a third party will face a dispute that no template resolves, and the program should identify such encumbrances during diligence rather than during graduation.

4. Funding and sustainability. Blend government grants for stipends and operations, corporate sponsorships, philanthropy, and in-kind lab contributions, and commit funding across multiple cohort cycles because deep tech ventures mature slowly. Keep overhead low, consider matching requirements, and track outcomes rigorously. Set an explicit ceiling on federal dependence, discussed below.

5. Curriculum and milestones. Structure the residency in phases: technical proof of concept with customer-discovery training early, prototype and pilot experiments in the middle, refinement and investor preparation at the end. Set venture-specific milestones and tie continued support to them, combining group workshops with one-on-one mentorship and cultivating the alumni network.

6. Location and logistics. Solve the mundane problems early: relocation and housing support, co-working space near the lab, generous facility access hours, and streamlined security training, IT access, and badging [7].

7. Risk management. Adopt a portfolio mindset, because some ventures will pivot and some will stop. Regular reviews catch technical dead ends early, advisors help teams pivot or exit gracefully, and lessons from failures are shared across the cohort. Extend the lab's full safety and compliance protocols to embedded startups without exception.

8. Ecosystem integration. Connect the program to the surrounding support chain: university entrepreneurship programs and I-Corps upstream, seed funds and follow-on accelerators downstream, and SBIR and STTR grants throughout, with handoffs planned in advance.

9. Measurement and iteration. Define success metrics from the start, including ventures created, follow-on funding, jobs, licenses, survival, and founder diversity, and publish them on a deduplicated basis with access dates. Collect feedback after each cohort and adjust.

How this fails

A model presented only through its benefits has not been examined. Six failure modes deserve naming, and the first four are internal.

Signal inflation. The program's central asset is the credibility of admission, and credibility is a function of scarcity. Four nodes admitting 29 fellows a year issue a strong signal. Twenty nodes admitting 200 a year issue a weaker one, and the network's value to investors falls as its coverage rises. This is a direct tension between the paper's scaling argument and its quality argument, and it does not resolve on its own. The mitigation is that admission standards are enforced nationally and published, so that scarcity is maintained by selectivity rather than by the accident of there being few nodes.

Node capture. A node in a region with one dominant corporate sponsor will drift toward selecting ventures aligned with that sponsor's roadmap, because the sponsor funds the node and its executives mentor the cohort. The drift is gradual and each individual decision is defensible. The mitigation is a cap on any single sponsor's share of a node's cash budget and a selection panel with a majority of members who are not sponsors.

Mission conflict with the host. A laboratory optimizes for scientific output and long-horizon programmatic work, while a startup optimizes for a financing milestone eighteen months out. The concrete failure is mundane and common: a fellow's critical experiment queued behind a programmatic user with priority allocation, costing a quarter that the venture's runway cannot absorb. Facility access agreements should therefore specify guaranteed instrument hours rather than eligibility to request them.

Cohort attrition, honestly stated. Some fraction of every cohort will not produce a going concern, and the reference programs do not publish that fraction on a definition that distinguishes a company which stopped from one which merely persists. The 96 percent active figure discussed above is not the answer to this question. Until a program publishes outcomes on a scale that separates scaled, sustaining, stalled, and stopped, nobody operating this model can state its failure rate, including this paper.

Political and budgetary risk. The programs held up as proof are Department of Energy programs funded through annual appropriations. The first paper in this series argues that institutions resting on political foundations get unwound faster than their builders expect, and consistency requires applying that argument here rather than only where it is convenient. The May 2026 move of LEEP under the Office of Technology Commercialization is described by the Department as strengthening connections across commercialization programs [5], and it may be exactly that. An administrative consolidation is also the step that precedes a merged budget line, and a merged line is easier to trim than a named one. Independent commentary on lab-based accelerator programs has flagged their uncertain future alongside their growing spinout counts [4], and that hedge belongs in the record.

The non-federal foundation. The mitigation for the preceding risk is structural rather than rhetorical, and Fraunhofer supplies the template. Fraunhofer draws no more than about one-third of its contract research budget from federal and state base funding and raises at least two-thirds competitively [14]. A network designed on that ratio survives a hostile appropriations cycle; a network at full federal dependence does not. The design constraint follows: no node should draw more than half its cash budget from a single federal line by its third cohort, with the balance from state and regional matching, corporate sponsorship subject to the concentration cap above, philanthropy, and institutional contribution. A node that cannot reach that mix by its third cohort has not found local demand for what it does, which is information worth having early.

Conclusion

LEVCAP bridges the divide between laboratory research and market realization through strategic collaboration and capital-efficient financing rather than through any single mechanism. The model gives deep tech ventures the time, space, resources, and connections to cross the valley of death [1][2], and every stakeholder captures value, which is what makes it durable.

The evidence now spans a decade and it is smaller than the published totals suggest. Deduplicated, the American lab-embedded cohort comprises at most 375 companies, at most 6.6 billion dollars of follow-on funding, and at most 4,200 jobs, with roughly 29 percent of the funding attributable to one company [3][5][8]. Computed on a denominator that includes overhead and failures, the leverage is between 7.7 and 11.5 private dollars per public dollar rather than 44. The model remains proven on the claim that matters, which is that a two-year non-dilutive residency inside a laboratory converts unfinanceable theses into financeable companies at a rate that justifies its cost.

It is also underdeployed, concentrated in one sector and four federal laboratories while comparable research assets across the country sit unconnected to any commercialization engine. The federated network is therefore the strategic proposal: twenty nodes at roughly 7.8 million dollars each per year, 156 million dollars annually at steady state, producing on the order of 500 companies and 10,000 jobs over five years, governed by a published playbook, a firewall between selection and investment, a cap on federal dependence, and outcome reporting on a single deduplicated basis.

Deep tech commercialization also depends on trust infrastructure, because new technologies reach markets faster when buyers can verify claims through recognized independent institutions, which is the subject of the first paper in this series. The evaluation discipline that investors and programs need in order to select and guide these ventures is the subject of the third. Together the three describe one worldview: the deep tech era requires institutions built for it, and the blueprint for each is already visible.

The advances emerging from our laboratories should not languish. The playbook exists, the results are on the record at their true size, and the network is ready to be built.

About this series

Stout Street Capital publishes this paper as №02 of a three-part series on the institutions the deep tech era requires.

- **№01. The Assurance Gap.** The case for independent conformance assessment of deployed AI systems: published test methods, a defined certification unit, and a public registry, operating inside the existing accreditation architecture.
- **№02. LEVCAP** (this paper). A lab-embedded venture capital access program: the commercialization engine that moves deep technology from laboratory to market.
- **№03. A Holistic Evaluation Framework for Innovation and Technology Commercialization.** The evaluation instrument: a refined framework that joins technical readiness with commercial metrics to judge what is real.

Stout Street Capital invests in early-stage deep technology and would be a plausible investor in graduates of a program of the kind proposed here. The governance constraints in the equity section are written as binding on the sponsor for that reason.

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