

From a Militarized to a Decarbonized Economy: A Case for Conversion

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Summary

Over five years following the end of the Cold War, the United States military budget declined by a third. Within the military budget, the procurement budget funding private military contractors decreased by two-thirds. As part of their strategy to turn these cuts around, military contractors began spreading their subcontracting chains more widely across the American landscape, thus building an enduring mechanism of political protection by connecting jobs in more congressional districts to military spending increases. During the period 2015-2020, the author visited a range of the communities tied to the military economy by bases, nuclear weapons labs, and military production sites. She interviewed relevant actors including economic development officials, business and labor leaders, local politicians, production workers, scholars and community members, while contextualizing their views with research on how these communities came to be part of the U.S. military economy and how these parts fit into the whole. While military contractors stake much of their claim to fatter contracts on their ability to create jobs and build community prosperity, this author's research, summarized briefly in what follows, presents evidence that weakens the case for military spending as the vehicle of choice for job creation and overall community prosperity.

The current paper makes a case for conversion, focusing largely on a case study showing that it is possible to convert military technology to civilian purposes, and outlining the keys to its success. The paper pays particular attention to the potential to redirect military economies toward the urgent cause of avoiding climate catastrophe.

But the paper finds that such conversion cases will remain infrequent and peripheral unless two conditions are met: First, U.S. policymakers must redirect substantial portions of the federal budget from the military to climate change mitigation; second, they must

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underwrite this fiscal shift with an industrial policy that turns from prioritizing production for the military toward producing the energy and transportation infrastructure necessary to decarbonize the economy. This paper examines the case of California during the post-Cold War period as the best U.S. model to date for such a policy transition.

Background: The Origins of a Militarized U.S. Economy

To mobilize for World War II, the United States government rapidly converted the country's industrial base to make weapons of war. After the war, government contracts incentivized significant chunks of that base to produce Cold War weaponry rather than returning to civilian production. Thus, for the first time in U.S. history, the country's war mobilization turned into an entrenched war economy, one that endures today. Now headed well above \$800 billion in the coming year, the U.S. military budget underwriting that economy is already larger than the military budgets of the next nine countries combined.²

In cutting the U.S. military budget by a third, and the procurement budget by two-thirds, the end of the Cold War created our militarized economy's biggest crisis.³ During the late 1990s, however, these cuts were reversed, as defense hawks both within and outside of government argued that the U.S. required multiple layers of military dominance to prevent the emergence of any new contender for the role of sole global superpower.

While promoting this line of argument, the major military contractors also devised their own strategies to send post-Cold War military budgets climbing to Cold War levels and beyond. In addition to growing their teams of lobbyists and their campaign contributions, military contractors began embedding their subcontracting and supply chains even more widely and deeply across the American landscape. The world's largest military contractor, Lockheed Martin, provides the most extreme and notorious example of this practice, advertising that its largest military project, the F-35 fighter jet, is built in 45 states.⁴

Jobs and Military Spending

Though this strategy is not a recipe for industrial efficiency, it does buy political protection, tying votes for higher military budgets to job creation in nearly every congressional district. Contractors and their allied politicians now promote weapons systems to the American public as much for their job creation potential as for their value to

² Peter G. Peterson Foundation. (2022, May 11). *U.S. Defense Spending Compared to Other Countries*. https://www.pgpf.org/chart-archive/0053_defense-comparison.

³ Bischak, G. (1997, July). *U.S. Conversion after the Cold War, 1990-1997: Lessons for forging a new conversion policy*. Bonn International Center for Conversion. <https://www.bicc.de/publications/publicationpage/publication/us-conversion-after-the-cold-war-1990-1997-lessons-for-forging-a-new-conversion-policy-113/>.

⁴ Lockheed Martin. (2022). *F-35 Global Partnership*. <https://www.lockheedmartin.com/en-us/products/f-35/f-35-global-partnership.html>.

national security. The reach of those jobs is often exaggerated: Wyoming's F-35 jobs base amounts to one location supporting about 10 jobs.⁵ Yet Congress' annual routine of devoting half of its allotted budget to military force does undeniably sustain a lot of jobs.

The question is whether privileging military spending among U.S. budget priorities is the *best* job creation strategy.

We can fully assess this policy's economic impact only if we consider alternative possible allocations. Economic modeling provides insight here. Studies over successive years continue to find that more jobs are created by federal spending on education, health care, mass transit and even tax cuts than equivalent spending on military procurement.⁶

Many economists, moreover, distinguish spending that contributes to the overall productivity of the economy—including contributions to improving infrastructure and the health and education of the workforce—from spending that doesn't.⁷ They suggest that while the U.S. spends money on the military to serve national security goals, this spending is otherwise less valuable than these other possible allocations to the functioning of the U.S. economy.

Questioning the Prosperity Gospel of Military Spending

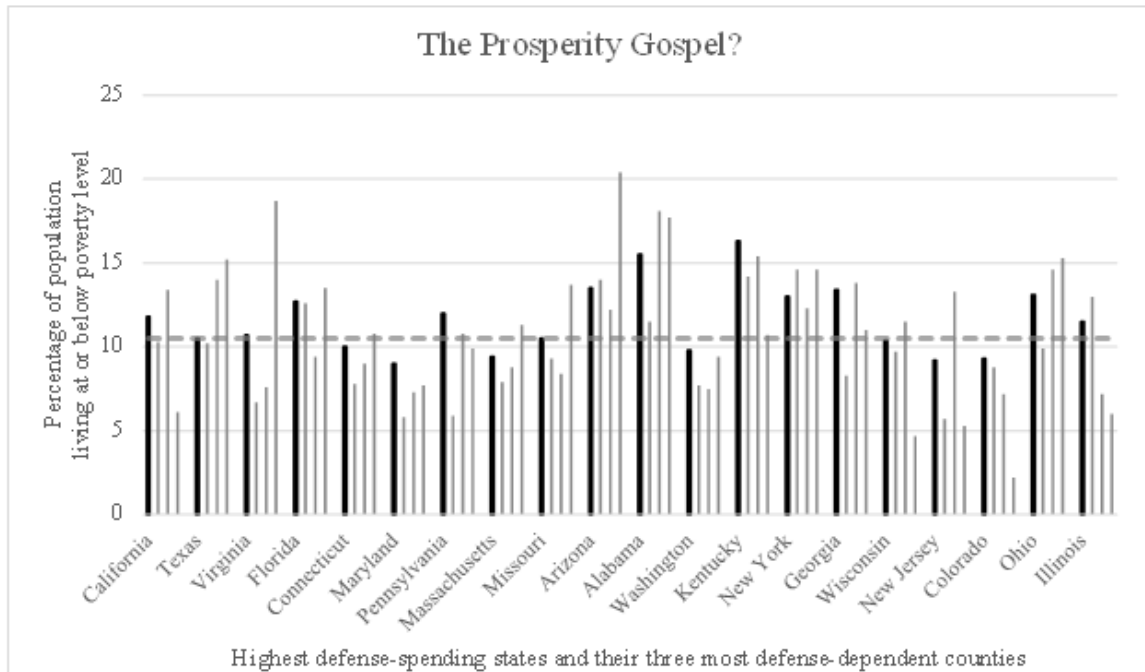
More research is needed to fully assess the overall impact of military spending on our economy. But a preliminary comparison of local defense dependency and poverty rates weakens the case that military spending delivers reliable community prosperity. Using data from the Defense Department and the U.S. Census, the author identified the three most defense-dependent counties in each of the twenty most defense-dependent states, and compared their poverty rates to the national average.⁸ In nearly half the cases, the poverty rates in these military contracting strongholds exceeded the national average:

⁵ Lockheed Martin. *F-35 Lightning II: Powering Job Creation for America and Its Allies*. <https://www.f35.com/about/economic-impact>.

⁶ Costs of War, Watson Institute, Brown University. *Employment Impact*. <https://watson.brown.edu/costsofwar/costs/economic/economy/employment>

⁷ Economic Policy Institute. (2009, October 15). *Krugman at EPI*. https://www.epi.org/publication/defending_the_deficit/.

⁸ U.S. Census Bureau QuickFacts. (2019, July 1). www.census.gov/quickfacts.; Office of Economic Adjustment. (2020). *Defense Spending State by State, Fiscal Year 2020*. U.S. Department of Defense. https://oldcc.gov/sites/default/files/defense-spending-rpts/OLDCC_DSBS_FY2020_FINAL_WEB.pdf.



- Dark vertical lines are poverty rates of the 20 most defense-dependent states
- Lighter vertical lines are the poverty rates of the three most defense-dependent counties within each state
- Hashed horizontal line is the national poverty rate

In a new book the author explores several of these strongholds, examining the role their military economies play in the overall enterprise of U.S. weapons production and in their local communities.⁹ Reasons to doubt the linkage of military spending with broad community prosperity emerged repeatedly in what she found. For example, *Forbes* magazine annually lists the highest per capita income counties in America. The list routinely places Los Alamos County, with its leading role in nuclear weapons research and development, at or near the top.¹⁰ Yet the adjacent county of Rio Arriba, at the bottom of the mesa where Los Alamos sits, remains at or near the bottom of the national income scale.¹¹ That is, the extraordinary prosperity of Los Alamos has not created much of any prosperity for its surroundings. Take the only site in the country where three of the Big Five military contractors—Lockheed Martin, Boeing and Northrop Grumman—co-exist. It is an airbase over the San Bernadino mountains north of Los Angeles. The former economic development director of the surrounding community of Palmdale wryly referred to his city’s reputation as a “basket case” of economic hardship.¹² Though the military economy

⁹ Pemberton, M. (2022, July 18). *Six Stops on the National Security Tour: Rethinking Warfare Economies*. London: Routledge.

¹⁰ DePietro, A. (2021, December 21). *Richest Counties in the U.S.* *Forbes*. <https://www.forbes.com/sites/andrewdepietro/2021/12/21/richest-counties-in-the-us/?sh=13ebfd8c2ecd>.

¹¹ Toscano, P. (2012, March 29.) *America’s Biggest Wealth Gaps*. CNBC. <https://www.cnbc.com/2012/03/29/Americas-Biggest-Wealth-Gaps.html?page=6>

¹² Personal interview, Mark Oyler and Curtis Cannon, June 18, 2019.

has brought prosperity to a few, this prosperity is not necessarily shared broadly.

The Conversion of Swords into Plowshares is Possible

What the military itself calls the “growing and urgent threat” of climate change to national security is producing both increasingly dire forecasts from climate scientists and increasingly severe current effects. Because for many decades the U.S. has concentrated the lion’s share of its federal R&D investment on weapons production, much of its industrial capacity has followed suit.¹³ Is it possible to reuse some of that capacity to help prevent irreversible climate change? Below is one case showing that it is.

Two conditions are required to propel the conversion of military resources to civilian use on a national scale: There must be substantial cuts to the military budget, and these must be accompanied by an industrial policy redirecting portions of the military economy toward other national priorities.

The post-Cold War period partially supplied those conditions, and so provides the closest thing we have to a test case. In addition to the substantial Pentagon budget cuts, the federal government allocated funding to facilitate a transition to new lines of work for the companies, workers and communities affected by them. In his election victory speech, President-elect Bill Clinton declared the election, “a clarion call for our country to face the challenges of the end of the cold war and ...[t]o face problems too long ignored—from AIDS to the environment to the conversion of our economy from a defense to a domestic economic giant.”¹⁴ His administration’s conversion program included money for defense worker retraining programs, transition planning assistance for defense-dependent communities, and increased federal investment in civilian high technology, such as an effort to revive U.S. commercial shipbuilding.¹⁵

At the time, even the most defense-dependent big prime contractors were convinced, at least publicly, that they needed to venture into civilian manufacturing. In 1993, at the height of the post-Cold War downturn, Lockheed Martin, the entrenched world leader in military contracting (now 96% defense dependent) publicly predicted that “the growth in

¹³ American Association for the Advancement of Science. *Historical Trends in Federal R&D*. <https://www.aaas.org/programs/r-d-budget-and-policy/historical-trends-federal-rd>.

¹⁴ The New York Times. (1992, November 4). *The 1992 Elections: Celebration; Excerpts from the Victory Speech by President-Elect Clinton*. <https://www.nytimes.com/1992/11/04/us/1992-elections-celebration-excerpts-victory-speech-president-elect-clinton.html>.

¹⁵ Bischak, G. (1997, July). *U.S. Conversion after the Cold War, 1990-1997: Lessons for forging a new conversion policy*. Bonn International Center for Conversion. p. 7-9. <https://www.bicc.de/publications/publicationpage/publication/us-conversion-after-the-cold-war-1990-1997-lessons-for-forging-a-new-conversion-policy-113/>.

Lockheed's forecast will come from our nondefense sector," and that in five years just 55% of its revenue would come from DoD.¹⁶

Lockheed encouraged its engineering teams to brainstorm about what they might be able to do in the civilian realm. One team was working on fighter jets at a manufacturing facility in Binghamton, New York. The engineering team leader at the time, Bob Devine, explains that standard new product development practice involves positioning your existing product lines on a grid and looking for the "one box move."

You try to find these market adjacencies [between the military and civilian markets] which are also business adjacencies ... A one-box move might be new technology into the same market. Or new market, same technology. But trying to jump to commercial in a new market with new technology or a different approach to the business altogether is kind of a move on both those axes ... So it's a stretch for the business to be able to adapt.¹⁷

They chose to focus on technology adjacencies. As Devine put it, the team did not try to switch gears from fighter jets to toasters. They focused on a move to a product that shared the characteristics of high maneuverability, complex engineering and heavy-duty manufacturing with what they were building for the military. They had been working on replacing the mechanical hydraulic flight controls on the F-15 fighter jet with lighter and more reliable electronic versions. At the same time, they were building an electronic fuel injection control system for a new freight locomotive.

And we said, this is really interesting—if you have a set of batteries you have a hybrid. And you'll be able to capture regeneration—taking the heat energy that would normally be lost in braking and putting that back in the batteries. And thus was born the idea of a hybrid. Locomotives had been doing that for years, but we applied it to rubber tire vehicles—buses and trucks.

Toyota was figuring out regenerative braking for its Priuses around the same time, but, he claims, his shop at Lockheed got there first. They like to bring this up with Toyota from time to time, Devine said with a chuckle.

The engineers at the site could bring a variety of specialized skills to the task, as well as the "systems integration" experience from building complex weapons systems. They took the light, compact, highly reliable power controls from the jets and applied them to the diesel-

¹⁶ Defense News. *Top 100 for 2022*. <https://people.defensenews.com/top-100>; Apodaca, P. (1993, June 29). *Lockheed Looks Beyond Defense: Conglomerate: The company is calling its current strategy to diversify a big part of its future*. Los Angeles Times. <https://www.latimes.com/archives/la-xpm-1993-06-29-fi-8299-story.html>.

¹⁷ This case is detailed in Pemberton, M. (2022, July 18). *Six Stops on the National Security Tour: Rethinking Warfare Economies*. London. Routledge. Phone interviews with Devine were conducted on October 22 and November 11 of 2020, and April 29 and August 18 of 2021.

electric power train of the locomotives, creating a hybrid drive train system for what they called a “HybriDrive” transit bus.

As cities around the world looked for mass transit solutions that cut fuel consumption and carbon emissions, as well as maintenance costs and noise, HybriDrive buses began appearing on streets from New York City to London to Tokyo to Toronto. In February of 2022, Houston and Philadelphia were added to the list.¹⁸

In 1999, just months after announcing a delivery of 125 buses to New York City, Lockheed announced it would be selling the facility, including its HybriDrive line, to BAE Systems, another major military prime contractor. Its CEO explained the decision this way: “This proposed transaction is consistent with Lockheed Martin’s strategic initiative to focus on business and technical competencies that will strengthen our position ... in core aerospace and defense markets.”¹⁹ Since by then—just seven years after it began efforts to convert away from defense—the “crisis” of post-Cold War military budget cuts seemed to be well over, diversifying beyond their “core competencies” seemed, to Lockheed, no longer necessary.

Under BAE the bus-building project continued mostly as before, with the same players, and its production ramped up to meet the demand of proliferating markets domestically and overseas. By 2013, the team calculated that their buses had travelled more than 600 million miles and saved more than 520,000 tons of CO2 emissions.²⁰

Traversing the military-to-civilian divide

Beyond looking for technological adjacencies, the key to Lockheed Martin’s success was recognizing the differences between the two spheres of production, so they could change what they needed to change to adapt to the demands of civilian manufacturing.

The first change involved abandoning the military contracting practice of concurrency, that is, going into mass production before testing determines that any bugs are worked out. Concurrency suits the contractors because it tends to lock in multi-year contracts, and because they then get extra money to fix the bugs. The current hallmark case, displaying the costs of the practice for taxpayers and the benefits for contractors, is Lockheed’s F-35 fighter jet, the most expensive weapon system ever built. Since 2001, when Lockheed won the contract as lead manufacturer, the program’s total costs have more than doubled.²¹ As

¹⁸ BAE Systems, gettozero.com.

¹⁹ CNN Money. (2000, April 27). *BAE buys Lockheed unit*. <https://money.cnn.com/2000/04/27/europe/bae/>.

²⁰ Cohne, S. (2013, April 24). *HybriDrive Series-E Propulsion Selected to Power More Than 400 Hybrid Buses for Quebec*. Mass Transit. <https://www.masstransitmag.com/home/press-release/10927943/bae-systems-hybriddrive-solutions-hybriddrive-seriese-propulsion-selected-to-power-more-than-400-hybrid-buses-for-quebec>.

²¹ Grazier, D. (2020, October 21). *Selective Arithmetic to Hide the F-35’s True Costs*. POGO. <https://www.pogo.org/analysis/2020/10/selective-arithmetic-to-hide-the-f-35s-true-costs>.

of April 2022 nearly 800 had been built. A few months later a Government Accountability Office (GAO) assessment found that the planes had (coincidentally) more than 800 unresolved hardware and software defects.²² While the planes are being sold and deployed, U.S. taxpayers will still be paying the contractors to try to make them work.

Prior to the post-Cold War period, most efforts to adapt military technology to civilian use took place during the post-Vietnam War military downturn. A couple of highly-publicized failures cemented the narrative that attempting this was a mistake. One of them involved Long Island-based contractor Grumman, which began putting buses on New York City streets, soon after which the buses began breaking down. “There was something about it in the paper every day,” Devine says, and New York’s Metropolitan Transit Authority sued the company.²³

Devine’s HybriDrive team avoided the pitfalls of concurrency by doing as much testing off-road as they could, and then starting off by putting only ten buses onto the streets. When bugs appeared, it wasn’t a public relations disaster. And instead of charging the government to fix them, as they would for their military work, they absorbed the cost. Contracts with New York City for hundreds of buses followed.

From “high performance” to cost consciousness

The U.S. Cold War military was built around the idea that the demands of national security required that manufacturing standards for “high performance” had to take precedence over cost controls. Adapting to the demands of civilian engineering required a “culture shift” for military-trained engineers and managers. The HybriDrive team hired people out of the automotive industry to teach them about cost-consciousness, and managing commercial supply chains.

They scrutinized what needed to change in the production line—particularly to automate production for high volumes—and what didn’t. While circuit board requirements needed to change, for example, Devine said, “[T]he little machine that puts the parts on the board and solders them down? That can be exactly the same.”

In some respects the manufacturing process became easier. They were able to liberate themselves from the world of MILSPECS (extremely precise military specifications) and from much of the extra paperwork required by the FAR (Federal Acquisition Regulations.) They could do business with a broader set of suppliers than those that are military-approved. Setting up a separate cost accounting structure within the company that

²² Capaccio, A. (2021, July 13). *Lockheed F-35’s Tally of Flaws Tops 800 as ‘New Issues’ Surface*. Bloomberg. <https://www.bloomberg.com/news/articles/2021-07-13/lockheed-f-35-s-tally-of-flaws-tops-800-as-new-issues-surface>.

²³ Daley, S. (1984, February 8). *All Grumman Buses to be Put Off Streets in City Permanently*. The New York Times. <https://www.nytimes.com/1984/02/08/nyregion/all-grumman-buses-to-be-put-off-streets-in-city-permanently.html>.

prioritized cost savings was a big and necessary challenge. A separate IT system was also necessary to work more freely with international customers and partners.

While they wondered from time to time whether the project would do better spun off as a separate enterprise, they found advantages to being part of a larger company. Their successive managements gave them some time to turn a profit, a luxury that as a startup they might not have been able to afford. And they found value in being able to borrow certain personnel from other projects at the facility and return them when no longer needed.

New finance mechanisms

While both Lockheed and BAE provided modest internal funding for the project, mostly the project managers had to find external sources to replace the funding streams coming from the Defense Department. DoD covers most of its contractors' expenses on research and development, giving military contracting a built-in advantage over civilian manufacturing. And though R&D for complex military projects can take far longer than most civilian production, it is far less risky: To overcome the resistance of many American corporations to revamping their operations for World War II military production, the War Department (the precursor to DoD) structured its contracts as "cost-plus", that is, with a commitment to cover the contractor's costs plus a negotiated profit on top. While some new contracting arrangements have been introduced over the years, eighty years later the practice remains an entrenched privilege of military contracting. A 2020 study for the Costs of War project found that 30% of Pentagon contracts are still "cost-plus," amounting to \$1.2 trillion between 2008 and 2019. This is a far higher percentage than applies to contracting for any other federal agency. And the study found that only a bare majority of military contracts—55%—are competitively bid.²⁴

Beyond their focus on technological adjacencies, the HybriDrive team applied the "one-box move" strategy to identifying their market. Production for mass transit meant staying in the realm of government contracting, whose rules and practices they understood better than those of the commercial marketplace. They secured grants from sources including the Federal Transit Administration and the New York state Energy Research and Development Authority (NYSERDA), the public benefit corporation set up to increase the state's energy efficiency and decrease its reliance on fossil fuels.

But unlike the relatively steady and predictable funding stream from the Pentagon, the sources for mass transit were trickles that had to be collected from all over. And their flow kept drying up. As Devine put it,

²⁴ Peltier, H. (2021, June 30). *The Growth of the Camo Economy and the Commercialization of the 9/11 Wars*. Costs of War, Watson Institute, Brown University. <https://watson.brown.edu/costsofwar/files/cow/imce/papers/2020/Peltier%202020%20-%20Growth%20of%20Camo%20Economy%20-%20June%2030%202020%20-%20FINAL.pdf>.

They say, 'We're going to put \$10 million this year into this technology and we're going to go for three bidders,' and everyone goes yeah yeah yeah and produces it, but you end up with a business that's not sustainable because ... the program by definition has a start and end date that helps fund, test out and prove the technology ... and then the subsidy goes away.

During most of this century, the Federal Transit Administration's Transit Formula Grants that are supposed to fund mass transit systems across the country have amounted to only about \$10 billion a year.²⁵ Contrast that to the military's supply of more than \$800 billion.

BAE's military identity also hampered their access to the available federal money for mass transit. The company's legislative affairs (lobbying) people had well-honed relationships with staff on the key committees governing military spending. "We'd say, 'Hey, we'd really like you guys to get into the Department of Transportation for me.' And they'd say 'Whaa?' They don't even know what street it's on. They would do it for us, but it's not really their day job."

Post-Cold War California: Modeling a new industrial policy

The HybriDrive engineers showed that adapting a sword to run a plowshare can be, not a pipedream but, with enough attention to their differences, achievable. But such cases remain few, scattered, and marginal. The conditions required to replicate them—substantial military budget cuts and a strong impetus to develop a new industrial policy—were most present in California during the post-Cold War period. We will look at that case now, as a model for the present.

Cobbling together their motley collection of funding sources, the HybriDrive team tapped into a California invention called CALSTART, launched in June 1992. Decades before HybriDrive was conceived, California had begun responding to its choking smog problem by developing what remains today the nation's strongest green industrial policy. By the early sixties it had established the first tailpipe emissions standards in the nation. The 1963 Clean Air Act gave California permission to set stricter standards than the nation as a whole. In the eighties, Gov. Ronald Reagan signed the law creating the California Air Resources Board and giving it the power to enforce those standards. The Board conceived of its role not just as a regulator but as a convener of the business sector, local governments and the public to solve the state's air quality problems.²⁶

Then in 1990, the California legislature added the component of industrial development to the state's air quality portfolio. It required the state's manufacturers to produce an

²⁵ Budgetary Resources: Federal Transit Administration. *FY 2022 Budget Highlights*, U.S. Department of Transportation. https://www.transportation.gov/sites/dot.gov/files/2021-05/Budget-Highlights2022_052721_FINAL.PDF.

²⁶ California Air Resources Board. *History*. <https://ww2.arb.ca.gov/about/history> ; LA County Economic Adjustment Strategy.

increasing number of zero-emission vehicles. At the same time, the post-Cold War Pentagon budget cuts were hitting California's aerospace industry harder than almost anywhere else in the country. For a while, the two challenges lined up to propel an industrial transition.

The Los Angeles County Board of Supervisors commissioned an economic research group called the Los Angeles Economic Roundtable to come up with a strategy to deal with the city's aerospace industry collapse. In March of 1992, with funding from the federal Economic Development Agency, the plan arrived. It proposed basing the strategy on "an integrated statement of public goals for mass transportation, environmental quality, alternative energy vehicles, and job creation for high technology workers." It prescribed connecting the challenge of defense diversification to the work of a Center for Clean Energy and Power Sources, a joint effort of Cal Tech, USC and UCLA. These universities had set up five collaborative teams working on developing the technologies of hybrid vehicles, fuel cells, alternative fuels, solar power systems and advanced batteries, and transferring them for use by commercial manufacturers.²⁷

Major industrial transitions are hard. Most start-ups fail, and most manufacturers would rather keep doing what they're doing than venture into the unknown. The strategy outlined key forms of assistance to get over these humps. They included seed funding targeting products and processes already proven but needing more R&D to get to market; such technical assistance as incubators, prototype testing, securing federal and state R&D awards, management restructuring, and exporting; and revamping the state job training system to better serve laid-off defense workers and retrain them for the new work.

The plan also discussed ways of "recycling" the abandoned defense plants littering the landscape, proposing that one be used as the center for development and manufacture of a new advanced surface transportation industry in Los Angeles County. And it examined the coordination among public and private actors that would turn piecemeal efforts into a true regional industrial policy.

One of these coordinating efforts was called Project California. This brainchild of the California Council on Science and Technology was funded by contributions from several public authorities, utilities and corporations. The group identified Los Angeles' competitive advantages growing out of the aerospace industry's know-how in systems integration, remote imaging and sensing, satellite communications and composite materials, and connected them to the most promising emerging markets, including mass transit command and control systems, advanced telecommunications, electric vehicles, alternative fuel vehicles such as fuel cells, and High Speed Rail. Like the collaborators on the Economic Roundtable strategy report, they emphasized the public benefits—in reduced pollution, more efficient transportation and cleaner energy—of this industrial transition, as well as

²⁷ Flaming, B, et al. (2016, August 18). *Los Angeles County Economic Adjustment Strategy for Defense Reductions*. SSRN.

the need for intensive regional coordination among business, labor and government to make it happen.

For each of these targeted industries they developed a concrete action plan, involving a combination of standard setting and regulation to propel new market demand, public procurement to underwrite these emerging markets, and public R&D funds to enable new and existing companies to enter them.²⁸

The initiative that checked the most of these boxes was CALSTART. Its mission connected three big dots: the state's ground-breaking emissions standards, an aerospace industry in desperate need of different lines of work, and Californians' famous love affair with their cars. Building an electric car industry would satisfy all three.

Then-Congressman Howard Berman's district included Burbank, where in 1990, without warning, Lockheed had shut down its entire local operation, wiping out approximately 4,000 jobs. The congressman put one staffer to work full-time figuring out how to use the "peace dividend" that is, the money saved from post-Cold War military budget cuts, to propel green technology development in southern California.

The result was CALSTART, which pulled in the cast of characters that the Project California and Economic Roundtable blueprints had said would be needed: the major aerospace contractors and commercial manufacturers, engineering and environmental research firms, public utilities, the Air Resources Board, labor leaders and state and local officials. Starting off with 40 institutional members, CALSTART quickly doubled that number.

They decided to focus first on three related challenges: establishing the infrastructure for electric vehicles; building a prototype electric vehicle to showcase; and electric buses. Congressman Berman, a former labor lawyer, reached out to Don Nakamoto, the union representative for the laid-off Lockheed workers, but also to Lockheed, until recently his district's largest employer. Its sudden move to close the Burbank plant without mentioning it to the union had generated the kind of publicity Lockheed didn't want. So, Berman negotiated a deal: For \$1 a year, CALSTART would move its advanced transportation R&D and manufacturing operations into Lockheed's shuttered Burbank facilities. It became an incubator connecting the technologies of approximately twenty companies into an electric car prototype.

A small cadre of Nakamoto's laid-off machinists began assembling one there. Nakamoto says it was "light years ahead of what was out there."²⁹ It made its debut at the Los Angeles Auto Show and was the pace car in the 1992 Monaco Grand Prix.

At the same time, CALSTART also paid attention to the infrastructure that would be needed to make cool electric cars into viable transportation. Its vice president, Bill Van Amburg,

²⁸ *Project California: A Blueprint for Energizing California's Economic Recovery*, discussed in Oden, M.; Markusen, A.; Flaming, D.; Drayse, M. (1996). *Post Cold War Frontiers: Defense Downsizing and Conversion in Los Angeles*. Project on Regional and Industrial Economics. Rutgers University.

²⁹ Personal interview, June 20, 2019.

reports that they installed between 300 and 500 charging stations around the city. “Some technologies were directly transferred from defense, such as an inductive paddle Hughes developed for safe underwater power transfer.” And “we showed that there’s an opportunity for public-private partnership with the state’s environmental and social goals matching the commercial industry’s capabilities.”³⁰

California’s plans to build a new industrial base focused on electric cars had the potential to replace all the lost aerospace jobs, create millions more, and drastically reduce greenhouse gas emissions across the globe. But it needed financing to move from prototype to full production. The comprehensive financing routinely provided for military contracting was nowhere to be found. CALSTART stitched together piecemeal start-up funds from the Federal Transit Administration, the California Energy Commission and its Department of Transportation, plus private dollars from its member companies, and a modest amount of money that Congressman Berman was able to insert into federal appropriations bills.

Also missing, crucially, was the guaranteed market the Pentagon provides to its contractors. “So many market forces were working against us,” Nakamoto says. And “light years ahead” may have been “too far ahead.” Among the obstacles: California residents then uninterested in getting into electric cars, and major automakers uninterested in, indeed vehemently opposed to, building them.³¹

California’s Aerospace-to-Green Policy Stalls

As for the big defense contractors, they were mostly indifferent and dismissive. Though they put representatives on the CALSTART board, Nakamoto says they were mostly communications people rather than people with decision-making power. “I don’t think they sincerely wanted to be involved; they just put their name in there to avoid public criticism. In my meetings with them behind closed doors they said it was ridiculous for them to get involved in any of this stuff.”

Some participants viewed the project not as a plentiful source of manufacturing jobs, but as a “quasi-government non-commercial enterprise to synthesize and do early planning before it’s commercially attractive.” But Nakamoto’s workers needed jobs, and for a long time, there weren’t many.

California did install some other pieces of its industrial policy frameworks during this period. The California Manufacturing Technology Center, for example, is part of a federally-funded network trying to provide the manufacturing equivalent of the Department of Agriculture’s extension centers. During this time, it concentrated on beefing up its technical assistance in fields relevant to the challenges of aerospace contractors trying to move into

³⁰ Phone interview, June 24, 2019.

³¹ The documentary “*Who Killed the Electric Car?*” (2006) examines this history.

commercial manufacturing, such as process/product development, technology transfer, systems integration, strategic planning and marketing.³²

And some individual companies were making the move from military contracting to civilian manufacturing. Most were small and medium-sized enterprises. Aura Systems, for example, converted its operations working on missile defense toward producing fuel-efficient generators and hi-tech sound systems. A business survey by the Los Angeles County Economic Development Corporation found 60% of the defense suppliers and 29% of the subcontractors reported pursuing commercial work; only 10% of the prime contractors said the same. Among the primes, Hughes Aircraft, having been acquired by GM, demonstrated the most enthusiasm for the challenge. Their designers turned from building power systems for fighter-jet radar to figuring out how those charging stations for electric cars could resupply the cars' batteries in 20 minutes. Their most famous conversion success was DirecTV.³³

Post-Cold War military budget cuts propelled California to pursue the nation's most creative and concerted effort to redirect its aerospace economy toward the national need for clean energy and transport technology. Among the opposing forces were the major car manufacturers, most of the big prime military contractors, and the political players contending that California's way out of its post-Cold War trough was to become more "business-friendly" by lowering its taxes and lifting its regulations.

Policies at the Federal Level Insufficient

California, and the nation, also needed a national industrial policy to turn the promise of the end of the Cold War toward other national challenges. President Clinton's initiatives to convert the economy "from a defense to a domestic economic giant" were insufficient to the task. Between 1993 and 1997 federal funding for the conversion of the military economy amounted to about \$16.5 billion—a tiny fraction of the defense dollars cut during the post-Cold War period. They included retraining funds for displaced defense workers and community adjustment planning, plus a couple of tiny demonstration projects actually funding efforts by defense companies to move into civilian production.³⁴

Clinton's conversion initiatives allocated a total of \$1.4 billion to a Technology Reinvestment Project funding consortia involving defense and commercial companies,

³² Oden, M.; Markusen, A.; Flaming, D.; Drayse, M. (1996). *Post Cold War Frontiers: Defense Downsizing and Conversion in Los Angeles*. Project on Regional and Industrial Economics. Rutgers University. P. 105-107.

³³ Johnson, R. (1993, August 5). *Aerospace Swords Into Plowshares: Defense Contractors Convert to Consumer Goods and Brush Up on their Rusty Marketing Skills*. Los Angeles Times. <https://www.latimes.com/archives/la-xpm-1993-08-05-me-20751-story.html>.

³⁴ Bischak, G. (1997, July). *U.S. Conversion after the Cold War, 1990-1997: Lessons for forging a new conversion policy*. Bonn International Center for Conversion. P. 7-9. <https://www.bicc.de/publications/publicationpage/publication/us-conversion-after-the-cold-war-1990-1997-lessons-for-forging-a-new-conversion-policy-113/>.

various federal research laboratories and other entities to collaborate on commercializing defense technology. The Technology Reinvestment Project identified five key priorities, one of which was: “Redirecting the fruits of our forty-year investment in military supremacy to the challenge of climate change.”³⁵ But about 80% of the grants were directed toward so-called dual-use technology that had to serve military as well as civilian purposes.³⁶ About \$220 million went into building up the commercial shipbuilding industry. Eighty-five percent of the cumulative defense savings during the post-Cold War period, amounting to about \$116 billion, went into deficit reduction.³⁷

This result diluted the investment value of the Peace Dividend. More targeted investment, such as California was attempting, could have laid the foundation for the kinds of civilian industries that might provide what economists call “demand-pull,” picking up the slack in the economy created by defense cuts, and attracting military contractors to major new markets. It was insufficient to overcome the inclinations of most of the prime contractors to hunker down in the remaining realm of military contracts and wait for the military budget slide to turn around.

The contractors also redefined the idea of conversion to include arms exports: They began “converting” by offloading what they couldn’t sell to the U.S. government to governments overseas. Lockheed Martin underwrote a major conference promoting NATO expansion into Eastern Europe, that is, into a potentially huge new export market for Lockheed’s military hardware.³⁸

The prospects for civilian reinvestment took another hit after control of Congress shifted to Republican hands in 1994. The trajectory of military spending began to climb.

For forty-plus years the U.S. had concentrated its talent and treasure around the mission of winning the Cold War. Privileging military production was the de facto industrial policy. The term “industrial policy” itself was mostly taboo, equated with un-American Soviet-style five-year plans, and with impeding the free market by giving government the license to “pick winners and losers.” Only the Pentagon was allowed to do that.

The abrupt end of the Cold War in 1991 had opened the door to a new national mission. To compete with the pull by contractors and defense hawks back to the industrial policy of

³⁵ Potomac Institute for Policy Studies. (1999, January 30). *A Review of the Technology Reinvestment Project*. https://potomac institute.org/images/studies/TRPFinalReport_Publish.pdf

³⁶ Oden, M.; Bischak, G.; Evans-Klock, C. (1995). *The Technology Reinvestment Project: The limits of dual-use technology policy* (Briefing Paper No. 16). Washington DC: National Commission for Economic Conversion and Disarmament.

³⁷ Bischak, G. (1997, July). *U.S. Conversion after the Cold War, 1990-1997: Lessons for forging a new conversion policy*. Bonn International Center for Conversion. P. 7-9. <https://www.bicc.de/publications/publicationpage/publication/us-conversion-after-the-cold-war-1990-1997-lessons-for-forging-a-new-conversion-policy-113/>.

³⁸ Gerth, J.; Weiner, T. (1997, June 29). *Arms Makers See Bonanza in Selling NATO expansion*. The New York Times. <https://www.nytimes.com/1997/06/29/world/arms-makers-see-bonanza-in-selling-nato-expansion.html>.

militarism, the suitable replacement needed to be large, complex, and critical to the country's security and welfare. The accumulating evidence pointed in one direction: revamping the energy and transportation infrastructure of the nation, its building materials and its agricultural systems to prevent catastrophic climate change.

Though the Clinton administration took some modest steps in this direction, this level of investment, as we know now, was insufficient to the magnitude of the problem. No military forces on earth can stop climate change, which the military calls an urgent and growing threat to national security. However, to mitigate the worst effects of climate collapse, the country's manufacturing capacity, too much of it devoted to supplying those military forces, can be redeployed to produce the technologies that will get us to carbon neutrality.

HybriDrive in 2022

In a small way, this redeployment is happening in Binghamton. BAE's HybriDrive operation is building on its foundation of hybrid-electric buses to move into the necessary future of all-electric vehicles. Devine was put in charge of the "Advanced Applications" team assigned to figure out how BAE buses could "Get to Zero." The current manager of the operation, Steve Trichka, is on the board of CALSTART, helping steer its initiative to propel development of zero-emission heavy trucks.³⁹ BAE is collaborating with partners to install its electric drive technology in battery electric buses and streetcars, and in boats. Another collaboration is installing BAE electric drive systems into engines powered by hydrogen fuel cells.⁴⁰

For all the stress headaches, Devine says, "It was very exciting to do something that was definitely out of the mold. Putting together systems we'd never put together before. Fast moving, dynamic, challenging."

BAE's leadership has really stood by the business. They've had a lot of drive to see it happen ... I think it's a point of pride for Steve [Trichka] and the business that they've built it to a point where 350 people have steady employment ... which is damn good. Being able to turn around and say, Hey, there's a business that got created, out of nowhere, employing all those people.

But: The Hybridrive operation makes up a tiny fraction of the Binghamton facility's work product. While the exact proportion is proprietary, Trichka and Devine estimate it at about five percent. And BAE as a whole sells 95% of what it makes in the military market, a proportion that is second only to the world's most defense-dependent company, Lockheed Martin.⁴¹

³⁹ California Air Resources Board. *Advanced Clean Trucks*. <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks>.

⁴⁰ BAE Systems. Gettozero.com.

⁴¹ Defense News. *Top 100 for 2022*. <https://people.defensenews.com/top-100>

The HybriDrive line is a conversion success story. A piece of the U.S.' extraordinary postwar investment in military technology has been made useful to the civilian sector, and directed to climate change, our most urgent and far-reaching national security challenge. But within the scope of our industrial base, it is a barely noticeable piece.

And such successes are rare. They will remain rare, and a marginal feature of our economy, unless the two conditions already cited are met: Military spending must be cut significantly, on the order of the cuts made in response to the end of the Cold War. And a demilitarized industrial policy must redirect those savings toward new industrial activity. For reasons outlined above, the policy moves to demilitarize our industrial policy were insufficient to overcome the military-industrial complex' capacity to make sure they didn't succeed.

Opportunity Costs: The U.S.'s Missed Chance to Invest in Climate Innovation

The U.S. postwar strategy of military dominance has skewed U.S. budget priorities and industrial development toward military production. In her research on defense-dependent communities across the country, the author kept encountering examples of what economists call the opportunity costs of this strategy, that is, the loss of what an alternative strategy could have delivered. For example, a congressman representing the former steel town of Johnstown, Pennsylvania used his power over military appropriations to lure a wave of military contractors to town. When the congressman died, so did much of its military contracting, leaving Johnstown an officially-designated Distressed Community.⁴² In 2005, a Spanish wind turbine blade manufacturing company called Gamesa began employing hundreds of workers near Johnstown. Local economic development officials blamed the lack of certainty around federal windpower production tax credits for the company's 2014 decision to begin moving out of town.⁴³ The U.S.' militarized industrial policy steered Johnstown toward the military economy and failed to support its toehold in the growing market for green technology.

Another example: As mentioned, an airbase north of Los Angeles houses three of the Big Five U.S. military prime contractors. Also sharing the space, in an abandoned Boeing facility, a Japanese company called Kinkisharyo is supplying Los Angeles with its streetcars.⁴⁴ Whereas U.S. companies could be the ones supplying this green energy technology, the U.S. prioritization of militarized industry over green technologies has led to foreign competitors filling the gap.

⁴² Economic Innovation Group. *Distressed Communities – Interactive Map*. <https://eig.org/distressed-communities/2022-dci-interactive-map/?path=zip/15901>.

⁴³ Mellot, K. (2014, January 28). *Gamesa closing Cambria plant*. The Tribune-Democrat. https://www.tribdem.com/news/local_news/gamesa-closing-cambria-plant/article_9e2ca3fc-0880-5f20-af81-8194f45e7274.html.

⁴⁴ Antelope Valley Press. (2021, March 27). *Kinkisharyo lands deal for light rail vehicles*. <https://www.avpress.com/news/kinkisharyo-lands-deal-for-light-rail-vehicles/article>.

And finally, the U.S. is planning to install offshore wind power up and down the eastern seaboard. Across the river from Electric Boat, the U.S.' lead builder of nuclear submarines, Connecticut is building a new pier to become the main launching pad for these systems. While unionized U.S. workers will be installing and maintaining the towers, the company building the initial installation off the Rhode Island coast is Danish.⁴⁵ Had U.S. policies prioritized the development of these technologies, it could be a U.S. company profiting from this contract.

While these foreign-owned companies do employ American workers, they illustrate the price of the U.S.' historically militarized industrial policy. As Spain, Denmark, and Japan have been developing an industrial base for clean energy and transport, the U.S.' potential to contribute its own innovation to this arena has lagged behind, captive to its policymakers' decision to prioritize weapons production. The U.S. is playing catch-up in applying its own ingenuity to tackle the climate crisis.

Conclusion: Current Challenges for a Demilitarized, Decarbonizing Industrial Policy

This paper examines a case initiated during the period after the Cold War, when there was an opening to break the grip of military contractors over U.S. industrial policy, showing that it is possible for a major contractor to convert military technology to uses relevant to the climate crisis. The case also outlines the means by which a contractor can navigate key obstacles in the way. Such cases are not replicable on a national scale, however, without a substantial shift from a militarized industrial policy to one focused on decarbonization.

During the post-Cold War period, military contractors prevented such a shift in part by linking military spending to job creation in as many congressional districts as possible, creating a powerful cultural belief that military spending and jobs go hand-in-hand. Yet this author's research shows that concentrating military spending in a community is not a reliable path to that community's prosperity.

It is indisputable that had the U.S. seized that opportunity with a full-court-press embrace of a national green industrial policy, we would have a better chance of averting climate catastrophe, and living in a more secure world, today. Now, we can't fail.

The Biden administration has outlined a green industrial policy, combining the tools of regulation and investment to propel the transition to a decarbonized economy. While the sclerotic state of U.S. politics has put many obstacles in the way of achieving these goals, the passage of the Inflation Reduction Act (IRA) will contribute substantial investment. Yet funding for military production still dwarfs investment in clean energy and transport: At

⁴⁵ Smith, G. (2021, February 26). *New London secures host agreement with offshore wind partners*. The Day. <https://www.theday.com/article/20210226/NWS01/210229506>.

about \$30 billion a year, climate funding in the IRA will amount to less than 5% of Pentagon spending.

Meanwhile, the war in Ukraine has spurred an expansion of the entire U.S. military budget. At \$858 billion, the 2023 military budget is \$80 billion higher than the previous year, even though most of the money allocated for Ukraine is being added on top. Military spending hawks in Washington have been emboldened to argue that securing American really requires a military budget upwards of a trillion dollars.⁴⁶ Among their effects, these scenarios run the risk of steering more companies toward the expanding U.S. military industrial base, rather than toward their potential as contributors to the task of avoiding a future of catastrophic climate change.

⁴⁶ Schake, A. (2022, April 5). *America Must Spend More on Defense*. Foreign Affairs. <https://www.foreignaffairs.com/articles/united-states/2022-04-05/america-must-spend-more-defense>.