A REPORTER ALOFT

ARE FLYING CARS FINALLY HERE?

They have long been a symbol of a future that never came. Now a variety of companies are building them—or something close.

By Gideon Lewis-Kraus

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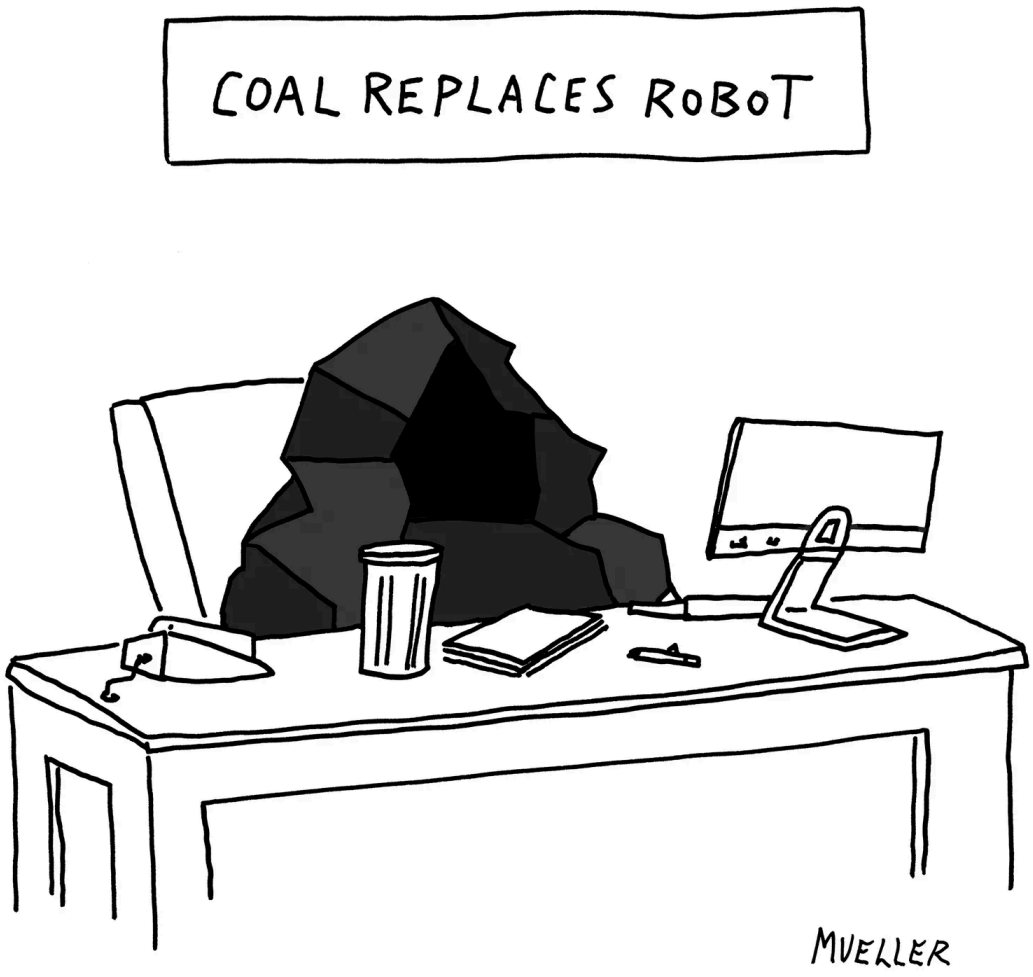
By 2030, customers could have access to self-driving, electric air taxis that travel between neighborhood "vertiports." One company promises a seven-minute trip from Manhattan to the airport for the price of a rideshare. Photographs by Balazs Gardi for The New Yorker

A little more than a decade ago, Founders Fund, a venture-capital firm run by the entrepreneur, investor, and political gadfly Peter Thiel, issued a proclamation called "What Happened to the Future?" As an investment thesis, it was underwhelming—it advanced biotechnology, energy, and the Internet as smart bets—but it was received as something of a spiritual treatise. Thiel was best known for his early investment in Facebook, but he believed that the nation had become sluggish. We might have been attempting to terraform nearby planets or surmount death. Instead, we made apps. His statement belonged to the genre of the writer F. T. Marinetti's Futurist Manifesto of 1909, which proposed that Italy's moribund museum culture be razed in favor of a machine cult of speed and steel: "We are going to be present at the birth of the centaur and we shall soon see the first angels fly! We must break down the gates of life to test the bolts and the padlocks! Let us go! Here is the very first sunrise on earth!" Thiel, no poet, was punchier: "We wanted flying cars, instead we got 140 characters."

"Where's my flying car?" quickly caught on as a meme in Silicon Valley and beyond. For Thiel, one culprit was obvious: regulators. In a contentious debate, he told Eric Schmidt, then the executive chairman of Google, that Schmidt was doing "a fantastic job as Google's minister of propaganda," but that the company had capitulated to an ethos of caution. "We've basically outlawed everything having to do with the world of stuff, and the only thing you're allowed to do is in the world of bits," he said. The economist Tyler Cowen offered a more neutral assessment in his book "The Great Stagnation," writing that perhaps "the low-

hanging fruit has been mostly plucked." The complaint found surprising allies. The late anthropologist David Graeber, who at the time had no clue who Thiel was, wrote, "A secret question hovers over us, a sense of disappointment, a broken promise we were given as children about what our adult world was supposed to be like." The question? "Where, in short, are the flying cars? Where are the force fields, tractor beams, teleportation pods, antigravity sleds, tricorders, immortality drugs, colonies on Mars?" Graeber blamed bureaucratic risk aversion and corporations concerned only with short-term capitalist incentives. By 2020, when the investor Marc Andreessen grumbled, in one of his routine tirades, that we still didn't have flying cars, it felt almost dutiful.



Cartoon by P. S. Mueller

Open cartoon gallery

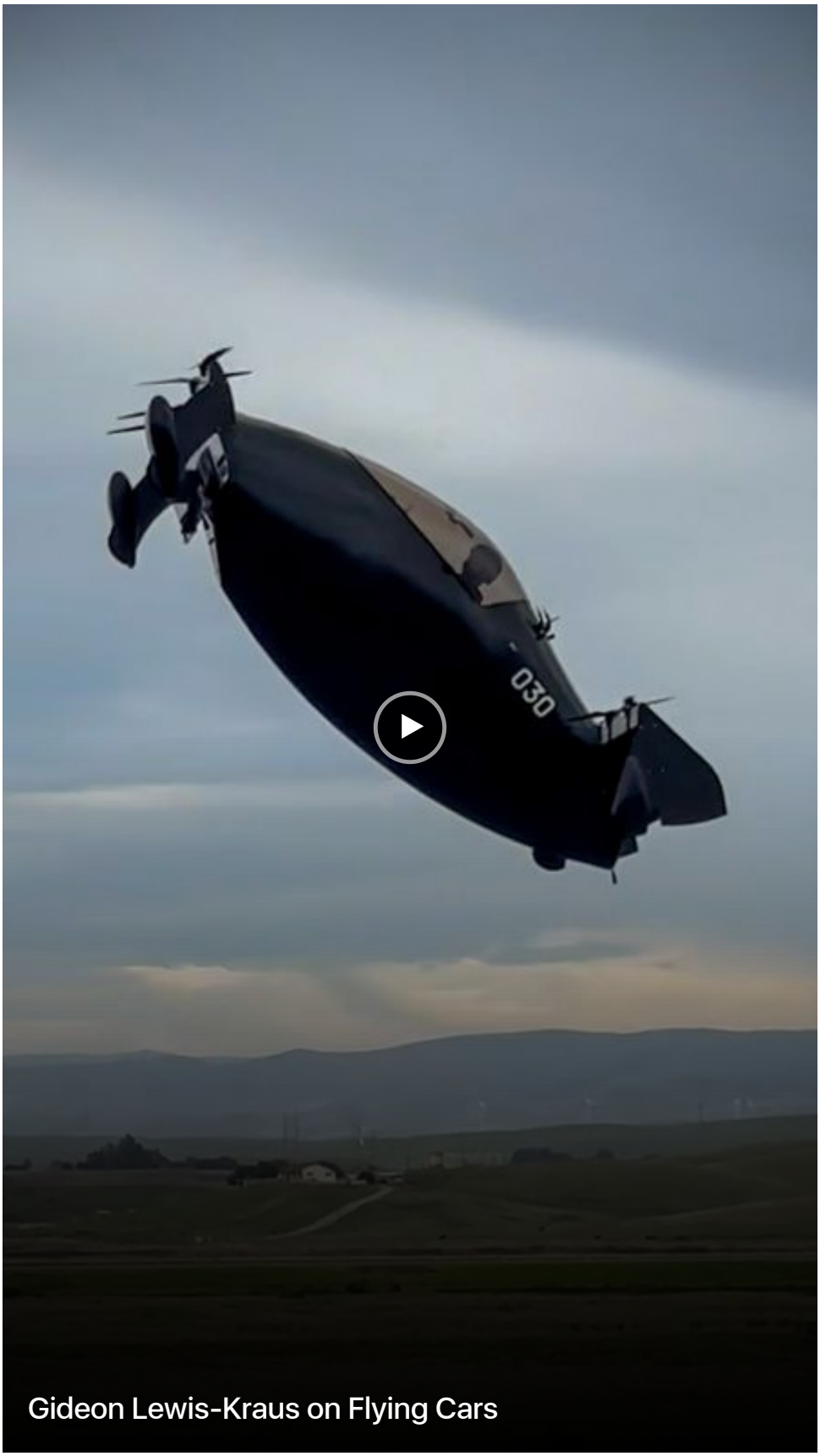
While one segment of Silicon Valley lamented the perpetual absence of flying cars, another, it turns out, was quietly building them—or, at least, something flying-car adjacent. Just three months after the Founders Fund manifesto appeared, a Canadian inventor named Marcus Leng invited his neighbors and a couple of friends to his rural property, north of Lake Ontario. Leng was in his early fifties, with a bowl cut of coarse graying hair. He instructed his guests to park their (conventional) cars in a row and cower behind them. He strapped on a helmet and boarded a device that he'd built in his basement. It had a narrow single-seat chassis and two fixed wings, one in front and one in back, each with four small propellers. It was at once sleek and ungainly, as if a baby orca had been hitched to two snowplows. Observers described it, for lack of a better comparison, as looking like a U.F.O. Leng called it the BlackFly.

Leng, who had been flying since he was a teen-ager, had long dreamed of the "perfect aircraft"—something "that didn't require a pilot's license, and could take off or land anywhere." He'd paid close attention to past designs but suspected that their propulsion systems were too heavy, too complex, and too unresponsive. In the previous few years, however, he'd noticed that full-sized remote-control airplanes had all of a sudden become very good: they had enough power to hover and could be controlled with precision. It was nevertheless an entirely different thing to put a person inside one. He told me recently, "The original had no redundancy built into it at all, and any single point failure would result in a total failure. It was fundamentally unsafe." At his demo, the BlackFly's propellers came online with a whine, then a purr, and it lifted into a hover about a metre off the ground. He pitched forward, in the direction of his guests. He'd thought that he would pivot into a skidding stop, in the manner of a skier. As he initiated a banking turn,

though, the edge of one wing caught on the lawn. "I thought, This is not going to end well," he said. But the craft held steady, dug a curving divot through thirty feet of grass, and came to rest. The trip lasted about twenty seconds. It was, as far as anyone knew, the first manned flight in an "electric vertical takeoff and landing vehicle," or eVTOL (pronounced "ee-*vee*-tall").

Today, there are more than four hundred startups in what is called the "advanced air mobility" industry. The term covers everything from actual flying-car-ish contraptions to more traditional-looking airplanes, but it generally refers to eVTOLs. For the most part, these crafts bear a greater resemblance to helicopter-plane hybrids than to automobiles, and they can't be driven on the road; they might better be described as electric aerial vehicles with the ability to hover and the no-fuss point-to-point flexibility of a car. Some are single-seat playthings: Jetson One, a Swedish company, has developed a craft that looks like a little aerodynamic cage and handles like Luke Skywalker's X-wing. Others fly themselves: EHang, a Chinese company, has been testing an autonomous passenger drone with a quadcopter design. (Its Chinese name translates to Ghost Intelligent Aerial Robot.) The first widespread use will be for air taxis—initially with pilots, then without—that will move passengers between neighborhood "vertiports." Matthew Clarke, a postdoctoral fellow in aeronautical engineering at M.I.T., said, "In a best-case scenario, we're seeing certification in two years and flying two or three years after that." The 2028 Summer Olympics, in Los Angeles, may feature the ferrying of athletes through the air from the village to their stadiums. Regular civilians, or at least the courageous among them, could have access to such services by the end of the decade. One company promises a seven-minute trip from Manhattan to an airport, with an aspiration to land inside security; seat prices would eventually be competitive with rideshares. Proponents imagine a system of cheap, sustainable aerial transit—ribbons of humming vehicles interlaced overhead.

Leng's company, now called Pivotal, occupies a few nondescript buildings on the marshy end of Palo Alto, wedged in behind Google and a NASA research center. The company recently began selling the BlackFly to hardy individuals. It has the footprint of a monster truck, but it weighs less than three hundred and fifty pounds. This past January, Kristina Menton, Pivotal's C.O.O., welcomed me to the company's training center, a miniature flight school for prospective customers. There was a foyer with a sweeping C.G.I. panorama of the aircraft in flight over a rocky Pacific coastline, a cavernous showroom with a single demonstration vehicle, a classroom, and the all-important simulator chamber. Menton, who served as a test pilot in the early days, told me, "Back then, it was terrifying. You did months of training for thirty seconds of flight, with fifteen people there to support you. Now we just want to get more people in the air." She added, "Everybody comes down from their first flight and has the same exact face, just the pure joy of flight." Pivotal's aircraft is permitted under the Federal Aviation Administration's special carve-out for "ultralights," a concession to the reality that the government cannot plausibly prevent you from fastening a lawnmower engine to a kite and barnstorming over your back yard. Ultralight pilots are not subject to any training requirements. The Pivotal team is aware, however, that just one crash might render the company's trajectory unrecoverable, and potential customers are expected to complete a two-week program at its training center. Meals are catered.



Watch the writer fly an eVTOL himself and discuss the future of air taxis and personal aerial vehicles.

Before I arrived, the company's P.R. person called to ask if I exceeded the pilot's weight limit of two hundred pounds. The team had recently developed an abbreviated curriculum that took less than a week, and they invited me to try my luck. If at the end they deemed me sufficiently unlikely to die, and take the company with me, they would green-light me to fly. My odds of success, she noted, were likely to correlate with my aptitude for video games. My small children were resolutely enthusiastic about the endeavor, my wife somewhat less so.

The training setup looked like a dentist's chair, with two joysticks and a virtual-reality headset. A software engineer at the company reminded me that this equipment could afford to be a little janky: "A sim can't fall out of the sky." The actual BlackFly has the glide ratio of a dishwasher; a catastrophic failure would entail a direct plunge to the ground. As I hesitated at the entrance to the training room, Menton tried to reassure me. "The simulator is good," she said. "The simulator *has* to be good. Because even your first flight is a solo."

A few years ago, the technologist J. Storrs Hall published a manifesto called "Where Is My Flying Car?," one of the few recent cultural artifacts that takes the question seriously rather than symbolically. Storrs Hall's story begins not with the fanciful flying cars of the future but with those of historical record. In the nineteen-twenties, a Spanish aeronautical genius named Juan de la Cierva invented something called an autogyro, a kind of low-rent helicopter precursor. The vehicles fell to earth a lot, but their passengers frequently survived. Unfortunately, the engineer himself died as a passenger in an unrelated plane crash. In the thirties, Waldo Waterman sold a handful of Aerobiles, cars with removable wings and a road-ready fuselage. Machines like these might have been unwieldy, but the concept seemed within reach, especially once so many veterans returned from the war with pilot training. The aviation company Cessna ran magazine advertisements for the Family Car of the Air, a sensible little plane that you could park in your garage, with copy like "Remember, Mrs. America likes to

go places and see things. And when she finds out that she can cover 600 miles in a morning, to shop or visit in any one of a dozen cities, she's *going to fly*."

By the mid-fifties, it was almost a given that some future sedans would come with wings. If we were going to live in mile-high space needles, how else would we move about? The title sequence of "The Jetsons," which premièred in 1962, doesn't show the ground once; George takes his wife and children to their respective floating platforms in his domed airship, and then heads to his office at Spacely Space Sprockets, Inc. (Storrs Hall estimates that George has a 1,341-horsepower vehicle, which draws on the equivalent of a thousand pounds of jet fuel.) Some of this imagery was the standard-issue utopianism of the bright-eyed mid-century, but it really wasn't *that* far-fetched. After all, many of the era's predictions came to pass: portable radios, televisions with screens "the size of a pocket handkerchief," air-conditioning, plastics. "The Jetsons" more or less foretold the invention of the Roomba. And flying cars were already being built. The Aerocar had wings and a tail that could be stored in a trailer. The ConvAirCar had an airplane attachment that could be rented at an airport. But the flying car was always something of an engineering chimera. Ideally, cars grip the road's surface rather than depart from it—a spoiler is the opposite of a wing. Most pure flying-car designs have been jury-rigged compromises between a lousy automobile and a stupid airplane. The ConvAirCar's test pilot ran out of gas in the air—he'd been looking at the automobile's fuel gauge rather than the airplane's—and crashed; he survived, but the project did not. The military continued to experiment with things like the AirGeep, a small craft that didn't require a runway. But, for the most part, the dream of a flying car was dead by the late seventies.

For Storrs Hall, this was not inevitable. He lays out several interlocking reasons for our supposed technological stagnation, but the gist is that, as a society, we've lost our taste for Promethean ambition—flying cars fell victim to "the wave of hostility and suspicion of technology" that swept America. In 1973, the F.A.A.

banned the Concorde from flying over the United States, citing noise concerns. Storrs Hall argues that it was the ban itself that prevented the development of quieter supersonic flight. He sees a similar mentality at work in the retreat from nuclear power, which seemed, well into the nineteen-seventies, like the obvious successor to fossil fuels. But after the core meltdown at Three Mile Island, in 1979, despite the fact that there were no documented fatalities, it became almost impossible to build new nuclear plants in the United States. This now looks like a mistake.

For theorists of stagnation, flying cars were another victim of our unwillingness to bear the costs of progress. It's often remarked upon, in boosterish circles, that American society allows about forty thousand road fatalities a year but refuses to tolerate even one aviation death. Storrs Hall told me, of the F.A.A., "Why can't they say, 'If you want to develop a flying machine, go out in the desert and do whatever you want'? I remember when Amazon was trying to test drone delivery they had to do experiments in Canada." In the sixties, a heliport was built atop New York City's Pan Am Building. After a period of inactivity, it was put back into use in 1977, with as many as sixty-four scheduled departures each day to local airports. That May, there was a landing-gear failure. Four people were killed by spinning rotor blades; a fifth was killed by a blade that careened to the street below. The heliport was permanently closed.

A BlackFly is assembled at Pivotal’s manufacturing center.

This story, as an explanation for why we don't fly out of our driveways, is both true and incomplete. It's also the case that the contours of aviation had begun to change. By the eighties, flying your own little plane had grown so expensive that the activity shifted from being useful to being a hobby. At the same time, commercial aviation became not only vastly cheaper but also less and less likely to kill you. Fifty years ago, planes went down all the time. The most recent fatal crash of a domestic commercial jetliner was in 2009. For aviators, this is nothing short of a miracle. We didn't panic and retreat from technology; we panicked and improved it. But, for decades, we didn't have the advances required to make a personal flying machine that would be stable, easy to use, and cost-efficient. And the safety concerns are strongly felt. "There's this different limbic-system response" to flight, Cyrus Sigari, a pilot and a prominent investor in advanced-air-mobility companies, said. "Everything in our bodies tells us that it's not normal, so the strong reaction we have to plane crashes, as a society, is 'Hey, I told you we're not supposed to be in the air, and you went in the air and crashed.' "

Then, about fifteen years ago, a lot of people simultaneously noticed that several relevant technologies had caught up with us. In 2010, Larry Page, a co-founder of Google, had Sebastian Thrun, a German engineer, over for dinner. Thrun ran Google X, the company's Skunk Works, and he was one of the world's foremost developers of autonomous vehicles. Page produced a spreadsheet of calculations, which Thrun described as "similar to what Elon used to argue the correctness of Tesla." Batteries had become better and lighter, and electric propulsion systems dramatically more powerful. New sensors had improved autonomous capabilities. Page's calculations showed that there were newly viable methods to get into the air and stay there. "We thought it might even invalidate self-driving cars, because, all things being equal, you'd rather fly than drive," Thrun said. They decided that this was too experimental a project for Google—self-driving cars were one thing, but flying ones? "Larry said, 'O.K., I'll do it myself.' "

In the next few years, Page secretly funded multiple companies—including one called Zee.Aero and another, run by Thrun, called Kittyhawk—that functioned as

a kind of distributed research-and-development shop. His initial idea was to build a self-driving flying machine that could take off from and land in a parking space. He had an array of corporate jets, but presumably the trip to the airport was still annoying. In the first five years, he put more than a hundred million dollars of his own money into one company alone. Page, who initially kept an apartment above one of the design hangars, was never referred to by name; he was called Gus, for "the guy upstairs." One team had trouble sourcing batteries, so Page bought ten motorcycles off a lot and stripped them for fuel cells. Some engineers couldn't secure access to a wind tunnel, so they put their prototype on an exposed train car to Southern California. It was a bit of a madcap scene. At one point, a team of engineers devoted themselves to their entry in Red Bull Flugtag, a contest in which participants take a running leap off a pier and glide as far as they can. (The team set a record, which still stands, using the wing design from its vehicle.) By 2014, the team's proof-of-concept craft had completed more than two hundred successful test flights. Word began to get out, and planespotters skulked around outside the hangars, trying to get a glimpse of Page's unearthly machines.

Soon enough, these successes ushered in an entire industry. Airbus spent four years developing an eVTOL prototype. A German company raised an enormous amount of money for a craft that was later rumored not to work. Storrs Hall attributed the sudden flourishing of flying machines to the prevalence of drone technology in everyday life, and to a greater mood of optimism about technology: "The whole Zeitgeist has changed a bit, and people are beginning to say, 'Why aren't we landing on the moon anymore?' " Page spread his bets around. Three years after Leng's maiden voyage, Pivotal got funding from Page and moved to Silicon Valley. In 2022, a former drone executive named Ken Karklin came aboard as C.E.O. He told me that, when he took the job, he got a call from Chris Anderson, a former editor of *Wired* and later the C.T.O. of Kittyhawk, to say, "Welcome to Larry Page's air force."

Pivotal's simulator room is a carpeted space with an azure accent wall, a couch for resting, and a snack table. The simulator chair rotates only on one axis—nose up or nose down—to capture the vehicle's jarring ascent. Some eVTOLs use two sets of propellers, one for lift and one for thrust. Others use a tilting mechanism—imagine if a helicopter rotor rotated forward to become a propeller. The BlackFly is unusual: the entire vehicle rears back nearly ninety degrees and launches like a rocket ship. At about forty feet above the ground, you bring the machine back to level, and the wings generate lift. It's only then that the craft starts to look as though it wants to be in the air.

My first flight instructor was Charlie Bushby, a soft-spoken, bespectacled British pilot with a genteel accent and a collection of refined loafers. He had actually never flown a BlackFly—he slightly exceeded its size limitations. But, he told me, "over the fortnight you're with the customer, you take them on a very unique journey. It's a dream they've always had—to experience flight." The curriculum typically began with the very basics—the use of checklists and the like—but the training was supposed to be a "bespoke, white-glove customer experience," and Bushby wanted to get me into the simulated air as quickly as possible.

I assumed the pilot's chair, put on a virtual-reality headset, and gripped the joystick with carnival-booth force. (Bushby noted that aircraft generally respond better to gentle movements than to twitches of terror.) He set the simulator to begin in Central Park and led me through the ignition sequence. The chair pitched back abruptly as I lifted into a hover, then evened out. Bushby added in a nice tailwind and topped off my battery as I flew south through midtown, past the abandoned heliport of the old Pan Am Building, and then over the East River in the direction of my apartment, in Brooklyn. It was hard not to feel a sense of wonder, peering down over recognizable streets and buildings I'd never seen so closely from above.

Nobody is going to be flying himself home from Manhattan anytime soon. For one thing, we don't yet have the ground infrastructure; Thrun thinks that landing on rooftops, for example, would be a pain. "You would need the right roof and the right fencing, so kids don't fall off," he said. "To me, it sounds very expensive." Regulators would also laugh you out of the room. Operating a standard, nonexperimental aircraft in an urban environment already involves multiple layers of bureaucracy: from the F.A.A., which oversees airspace, and from municipalities, which oversee the ground. The municipal rules can be strict. Until recently, San Francisco prohibited nearly all helicopters from landing within the city limits. Uri Tzarnotzky, the lead designer at Wisk, one of the companies traceable to Page, told me, "The reality is that people really don't want everybody to have one of these. If you look at the comments section of the YouTube videos, there's a mix of NIMBYism and 'Have you seen how people drive?' "

The BlackFly cannot be flown in controlled airspace—near an airport or above a certain altitude—or over congested areas, and it can't be employed in commercial activities. It can't even be flown in a strong wind or a light drizzle. Its batteries currently allow for a maximum flight time of about twenty-five minutes, but battery life is not something you want to mess with; power is required for a controlled descent. The company's newest model costs about two hundred thousand dollars. Karklin, Pivotal's C.E.O., said, of his customers, "If I'm going to generalize, they're white, over fifty, and male." Bushby projected that Pivotal's customer base would represent "places with some money and a lot of uncontrolled airspace." Miami was no good, but maybe Louisville.

"As a business case, don't underestimate recreation," Karklin said. "Polaris is a multi-billion-dollar company, and they sell snowmobiles." Some customers have actual use cases in mind. They might, for example, survey their vineyards. A customer in central California wants to commute a dozen miles, from his ranch to his manufacturing plant, and Pivotal's team had drawn up a courtesy flight plan that wouldn't endanger his neighbors. Other customers were more ambitious: "We've got a father-daughter superfan team that wanted to cross the country twenty minutes at a time." (The company talked them out of it.) Pivotal's first customer, Tim Lum, lives in Washington's North Cascades. One of his buddies lived on the next ridge over, a forty-minute walk or a two-minute flight. He told me, "My first few flights, the townspeople or the ranchers would call the sheriff." One day, he approached a neighbor who he heard was planning to shoot down what the neighbor thought was a surveillance drone: "My neighbor said, 'It's you, isn't it?' I said, 'Of course it is.' "

Karklin readily conceded that the BlackFly was, for the moment, a pleasure craft for the wealthy. But nobody would have looked at the Wright brothers' plane at Kitty Hawk and predicted that we'd have a Boeing 707 sixty years later; these new crafts could be just the beginning of a similar sea change in aviation. "Every transportation revolution going back to probably the chariot—who are the early adopters? People with resources. Who bought the first cars? People called them 'toys for rich people.' " Karklin continued, "Right now, we're Michael Douglas in 'Wall Street,' on the beach with that giant brick of a cell phone." Leng, for his part, believes that regulatory anxieties will ease as people grow habituated to personal flight, just as they did to commercial. Imagine a parallel universe, Leng suggested, where small airplanes were the norm: "Now you say, O.K., I want to build a plane for five hundred people, it's going to weigh a million pounds, on takeoff it's going to be carrying four hundred thousand pounds of highly flammable fuel, and we're going to fly it over our biggest cities!"

For now, Pivotal maintains a degree of gentle paternalism. Karklin told me that the company had been approached by a YouTube influencer wearing a skintight

flight suit and had given her a "soft no," suggesting that perhaps a future model would better meet her needs. The company anonymously monitors all customer usage and is prepared to ground customers who damage the aircraft or get edgy with battery capacity.

My childlike delight persisted in the simulator until I encountered virtual-reality nausea, first gradual and then sudden. But there was no time to lie on the carpet. The BlackFly's flight controls are intuitive—like a relatively simple video game—but the stakes are high, and the cognitive load is considerable. Motor temperatures and battery levels must be monitored constantly, lest the vehicle experience what is politely referred to as "uncontrolled descent into terrain." As these thresholds near, the craft becomes agitated, with dinging alarms and colored alerts: yellow, or land soon; red, or land immediately; and purple, or pull the red knob to activate the whole-craft parachute. Nobody has ever pulled the red knob. The company's best guess is that it doesn't really help below about a hundred and sixty feet. My own flight was not supposed to exceed a hundred and ten. They nevertheless had to insure that I knew how to pull the red knob.

The BlackFly lands the same way it takes off, by tilting back nearly ninety degrees to induce drag, in the manner of a descending pigeon. This position makes it difficult for the pilot to see the ground below. In my attempt to set down gently in Prospect Park's Long Meadow, I smashed into a large tree. Bushby, apparently unperturbed, was optimistic: "Maybe one day you really could be flying this over New York." For the next three days, I arrived early to practice. I was drilled in how to recover from the loss of various instruments—G.P.S., altimeter—and what to do if a joystick failed. (The protocol for the loss of the right joystick is to trigger the left joystick; the protocol for the loss of both joysticks is to hope it never happens.) At the end of the final simulator day, I was tested by the chief flight instructor, an Army veteran named Rob Dreer, who flew drones in Afghanistan and Iraq. After three hours, Dreer cleared me for my first actual flight. He grew solemn, as if he were sending me into battle. He had seen photos of my children.

"The true milestone of being a real pilot is being up there by yourself," he said. "You'll experience that tomorrow—being a true aviator." Then he set the simulator location to Yosemite, where I let my anxiety drain off in slow, serene loops between Half Dome and El Capitan.

Although advanced air mobility in America is heavily concentrated in Silicon Valley, the tacit industry motto seems to be "Move slowly and break nothing." There are a variety of more or less measured approaches to the aerial transit of the future, and a company called Beta Technologies has decided to focus first on cargo logistics and military applications, sectors in which eVTOL operations can be refined without the need to build additional infrastructure or to convince passengers to come on board. On a cold, overcast day in January, I met Beta's C.E.O., Kyle Clark, at the company's research-and-development facility, in a renovated hangar in South Burlington, Vermont. Clark is tall, restless, and rangy —a "lanky-ass bastard," he called himself—with a tattooed band on his ring finger. The F.A.A. requires that planes accommodate all passenger sizes from the fifth percentile of women to the ninety-fifth percentile of men, but Beta had to extend the latter to the ninety-ninth percentile for Clark. "Right now, we operate in this two-dimensional world," Clark told me. "Even a commercial flight going three thousand miles at thirty-two thousand feet, that's horizontal, for all intents and purposes. And we're going to go ahead and *add* a whole other dimension to where you can be and go? The whole thing—how can it not be really intriguing?"

When Clark was a kid, all he wanted to do was fly. Every birthday and Christmas, he requested an airplane. His parents were unusually permissive, but, when an adolescent Clark started building an ultralight in his garage, his mother set the parts on fire. She drew the line at D.I.Y. aviation. As a junior at Harvard, in 2001, Clark left to play hockey for the Washington Capitals. He spent his signing bonus on flight training. When he returned to college, a few years later, he won the engineering department's prize for his thesis, a plan for an aircraft that a pilot

could guide with body pressure; ultimately, he envisioned a flying motorcycle that you could drive out of the airport. When he sold his first company, which made power electronics, he bought a Cessna and a partially assembled kit aircraft, which he completed himself.

In 2017, Martine Rothblatt, the founder of a biotechnology company, told Clark that she needed an environmentally friendly, cost-efficient way to move organs between medical facilities. He rushed over to the Burlington airport and arranged to rent an office. Not long after, the airport leased him a derelict hangar where snow-removal equipment was being stored. His team, then made up of eight people, had to invent and manufacture its own parts. Such is the force of Clark's personality that he and his team finished an eVTOL prototype in ten months. In an initial funding round, the company raised three hundred and sixty-eight million dollars. "Every day, I say that there are two things that'll put us out of business—running out of money and killing people in our planes," Clark said. "And we're doing everything we can to insure that won't happen." Beta now has more than six hundred employees, most of whom seem to have wandered in from a dog park outside a microbrewery. One of the company's pilots, who flew me in the chase plane that accompanies their aircraft for observation, was previously a local pizza-delivery guy who moonlighted as a flight instructor. From the beginning, Clark wanted his engineers to know how to fly—"It's different to design landing gear when you're the one flying the plane"—so he hired a retired fighter pilot as an in-house teacher. The decision was canny, morale-wise. "When people get the bug and love flying, their passion drives them harder than any perks or bonuses," he said. One employee told me that, in his first interview, Clark taught him how to fly a helicopter.

The drive from South Burlington to Beta's facilities in Plattsburgh, New York, is about an hour and a half and includes a ferry ride. It's also a twelve-minute flight. It was what Clark unironically described as a "beautiful day" in January—freezing temperatures under a gunmetal sky. We climbed into the company's 1967 Cessna,

and, as we ascended, I withdrew my phone to record the patterns of fractured ice on Lake Champlain below. "See? If we were in a car, I bet you wouldn't be taking pictures," he said. The airstrip on the far shore stretched out before us, and Clark came in for a low, slow descent. As he touched down, he made sure that I registered his relaxed achievement: "That was a no-flap landing, by the way."

Clark's team was busying itself in a whitewashed Cold War-era hangar. Its eVTOL, called Alia, is vaguely based on the skeleton of an Arctic tern, with a fishbowl cockpit. To me, it looked immaculate, but Clark said, "Could've cleaned the fucking bugs off the windscreen." UPS had already ordered as many as a hundred and fifty of the vehicles, which it planned to use for its "middle mile" routes, between distribution centers and warehouses. Other potential customers showed an immediate interest in a conventional-takeoff version, which in any case was going to be easier to certify, so the team built a near-identical second model without lift propellers. Clark's pitch was not only about sustainability. Electric motors run at much lower temperatures and show less performance wear. Electric aircraft are orders of magnitude cheaper to fly, and they will improve over time as higher-capacity batteries are swapped in. Like helicopters, they can also land pretty much anywhere, but at a fraction of the cost and with less of a din. Certain drones are already being used to transport blood and medical supplies in parts of sub-Saharan Africa where there are few roads, but you can't put a doctor, or hundreds of pounds of medical equipment, in them.

Charlie Bushby, one of Pivotal's instructors, uses its flight simulator.

Clark told me that he also recently signed a contract with the U.S. Air Force, worth up to a hundred million dollars. Electric vehicles could make forward operations less reliant on fuel supply lines. The Pentagon recently spent more than ten billion dollars in a year on fuel alone. A study found that more than half of the American casualties in Iraq and Afghanistan were in fuel or water convoys, not actual battles. One National Guard officer sketched for me a vision of a decentralized Pacific theatre in which electric vehicles could "refuel" with solar panels on remote islands. Vertical takeoff and landing could be used for the transfer of supplies to far-flung places without airstrips. The military recently tested Beta's craft in a simulated casualty evacuation and found that sixteen hundred dollars of fuel could be replaced by five dollars of electricity.

Back in the Cessna, Clark turned to me and said, "You take the controls now." I put my feet on the pedals and practiced some rudder movements as we turned onto the runway, where he instructed me to throttle up a bit. As we reached takeoff speed, he coached me to lift the nose, and I could feel the wings bite into the air. He directed me into a banking right, but in my exhilaration I may have pushed our angle of attack into dangerous territory. "Um, maybe nose down a little before we stall there," he said. He asked if I wanted to fly the rest of the way back, and land, but I happily gave up the controls. He still thought we all deserved to experience personal flight, but he acknowledged the scale of the challenge. When he first raised money for the company, he told me, "there was all this social pressure to do the obvious thing—to hop over traffic—and we thought about doing that, but we're pragmatists about the way to get there." He added, "We do believe we'll get to urban air mobility." As we crossed back over the small bays where he used to play hockey, he peered down to examine them. "If it were late February, I'd offer to land on the ice." He smiled as he thought it over. "Well, it's *probably* safe if we needed to," he said. "But I guess we don't."

The world wasn't quite ready for Larry Page's original vision of a personal craft that could land in a parking space, but his efforts ultimately coalesced in the

form of a company called Wisk, now a subsidiary of Boeing. Wisk, along with its rivals Joby and Archer, settled on an air-taxi model. Wisk's design employs rotors that operate vertically for lift and then tilt horizontally for thrust. (This is the architecture used by the Bell Boeing V-22 Osprey, which was recently cleared to fly again after being grounded in the wake of several fatal crashes.) The company's current craft, called Cora, has an average speed of about a hundred and forty miles an hour and a range of about a hundred miles. The company's design shop is in the Bay Area, in a cul-de-sac behind Pivotal. When I visited, last year, Wisk employees showed me a prototype of their newest model, which seated four passengers. With a bulky fuselage painted a blinding shade of yellow, the vehicle looked like a miniature school bus. Tzarnotzky, the Wisk designer—a large, thoughtful man with the aspect of a plush bear—told me, "Our competitors have a dark, exclusive branding that's supposed to communicate a jet-set life style. People have criticized this for looking like a minivan with wings—but that's a good thing! You want Grandma in the minivan, not in the thrill ride."

The air-taxi idea goes like this: you book your trip through an app; you stroll a few blocks to the closest vertiport (an existing helipad for now, while municipalities or contractors construct new infrastructure); you stow your bag in the "frunk," climb in, and fasten your seat belt tight across your lap; the taxi ascends in a hover, transitions to forward flight, and joins a zippy procession of other craft along an established aerial corridor, probably one that follows a highway below. They will almost certainly be used first for transit to airports or for local tourism—to reach offshore islands, say. If this sounds like the democratization of the helicopter, it is. "There's a reason a lot of this is focussed on Los Angeles," David King, a professor at Arizona State University who studies transportation, told me. "The reason Kobe Bryant flew around in helicopters was because he was rich, but the other reason a fairly high share of rich people in L.A. are already getting around by helicopter is because up until a decade ago all skyscrapers there had to be flat on top, for helipads."

What differentiates Wisk from its competitors is the absence of a pilot. More than half of the company's team flies their own planes; on sunny Saturdays, they have a club that meets for what hobbyist pilots like to call a "hundred-dollar burger." But Wisk's business-model calculations suggested that pilots do not pencil out—they add weight, require training, and typically insist on a salary. Also, there aren't nearly enough of them, and a discount pilot is much worse than no pilot at all. Planes already do about ninety per cent of the flying themselves. Even if most commercial passengers are aware, on an intellectual level, that the skilled but underutilized pilots in the cockpit are mostly being paid to drink coffee, the idea of fully autonomous flight will require some acculturation. When I took a seat in a full-scale mockup of Wisk's prototype, a soothing video displayed my proposed flight path. A supervisor on the ground oversees the flight and can intervene if necessary. The display consoled me with the prospect of communicating with a "remote hospitality crew."

In the long run, these companies imagine a world of aerial commuters. According to a Deloitte report, air-taxi services would be three to five times faster than existing ground transit. Over time, we might free up resources dedicated to decaying roads and bridges in favor of streams of evenly spaced aircraft proceeding overhead. Despite the metropolitan "Blade Runner" allure of this vision, Cyrus Sigari, the prominent investor, told me, "The suburban and rural use cases are way more relevant and easier to address" than flying taxis within cities. In theory, it would be possible to live in Scranton or Binghamton and make it to New York City in half an hour. David King, the Arizona State professor, noted, "Air-taxi routes could help rejuvenate some rural economies, if the cost was such that you could legitimately live ninety to a hundred miles away from your work." Matthew Clarke, the engineering postdoc, told me that, as someone from a minority background, he tends to be skeptical of shiny technocratic solutions, but he sees something real here. "I've talked to janitors from Stockton, people who spend a lot of money on gas every day to commute for hours, who could take a short flight

from Stockton Airport to Palo Alto Airport. Instead of waking up at 4 A.M., they could wake up at 7 A.M." (Alternatively, the Bay Area could build more housing.)

Wisk has a tentative agreement with the Council of Mayors of South East Queensland, Australia, which is hoping to offer Wisk services to tourists and locals in time for the Brisbane Olympics, in 2032. My visit to Wisk coincided with the arrival of a delegation of Australian officials, who had come to watch a test flight at a rural airport. Adrian Schrinner, the ruddy, thick-necked Lord Mayor of Brisbane, swept his hand over his brilliantined hair and told me that he'd volunteer to take the first passenger flight. (His P.R. person leaned over and said, in a stage whisper, "The Deputy Lord Mayor is quite O.K. with that!") We stood in a light rain at the end of the runway and watched Cora take off in a sibilant hover. At about a hundred feet, the aircraft shifted to horizontal flight. The moment of transition drew muted awe, but once in flight it just looked like a little airplane—although a passenger alone inside would presumably have felt otherwise. By the end of the demo, most of the mayors were glancing down at their phones, trying to figure out if the videos they took were impressive. Jim Tighe, Wisk's C.T.O., told me that he hopes to see this sort of behavior among customers in the air, too: "When people get out their phones and doomscroll during a flight, I think, I really nailed it!"

At Wisk's offices, Schrinner told me that air taxis could one day connect remote Indigenous communities to urban hospitals, or sightseers to the Bay Islands. "It's only eighty kilometres from Brisbane to the Gold Coast," he said. "It should only take an hour by car, but on a busy weekend it can take two." Out of curiosity, I asked how long public transit takes. He paused before admitting that he didn't know. But in a Wisk it might take as little as fifteen minutes. He picked up a toy model of Cora and said, "At back-yard barbecues, people tell me, 'This is far-fetched, we've heard about flying cars for decades.' But we saw it this morning, and it's not a pie in the sky. I tell them, 'It will happen.' "

People in the industry tend to think that flight is useful and awesome, and not necessarily in that order. One of the reasons that the idea of flying cars has endured is that it seems to promise two different kinds of freedom: on the one hand, to get from point A to point B without a lot of hassle; on the other hand, to know the euphoria of exploring the third dimension. Most people at these companies got into the business because they were personally enraptured by flight. They are nonetheless well aware that airplanes and automobiles have vastly different requirements, and that the vision of a car that both drives and flies never made a ton of sense. An inventor and professor named Paul Moller spent four decades working on his Skycar, believing for years that it was just within reach. In 2009, as the modern industry was starting, he went bankrupt. For a period, a company called ASKA had a mockup of a flying car in a window display in downtown Los Altos, California; members of its "Founders Club," who paid a five-thousand-dollar deposit to get on the preorder list for an eight-hundred-thousand-dollar vehicle, were entitled to customize their aircraft's design. Today, the storefront is vacant. (The company says it's looking for a bigger showroom.) Soberer parties now understand that you have to make trade-offs between the breathtaking and the handy. During one of my visits to Wisk, I was inadvertently shown a set of talking points that employees had been given. Their comments were to be restricted to observations "grounded in reality/today," and they were instructed to "avoid making bold claims that cannot be backed up with data/proof." Beta was even reluctant to be portrayed as building anything like a flying car.

One company already has a deal with United to start air-taxi services to Newark Airport next year, but such deals remain highly provisional: a German startup planned to fly passengers at this summer's Paris Olympics, until European regulators quashed the idea. Dubai seems poised to begin offering services; China's regulatory body just approved the mass production of an eVTOL for commercial use. But for such plans to become a widespread reality, let alone the future of transport, regulatory agencies will have to be coaxed into an overhaul of the way that airspace is structured and administered. We would need foolproof, digital detect-and-avoid systems to prevent collisions. eVTOLs might not be helicopter loud, but they are noisy. Engineers think that this issue can eventually be ameliorated, but, if it can't, no one will be happy with an insistent mosquito buzz in the background. And then there's the sheer number that would be needed. Before the pandemic, about four hundred thousand people a day crossed the Hudson River into Manhattan. Aerial commuting would require tens of thousands of drone taxis operating on regular, reliable schedules, with flawless safety records. David King told me, "So all of a sudden you're into the realm of, 'Why didn't we just build a train?' "

Most responsible urban planners believe that public transit is a political problem, not a technological one. The tools to improve urban mobility—trains, trams, bicycles, sidewalks—have been around for a long time. The issue isn't that we were promised flying cars and got a hundred and forty characters; it's our attachment to

a nostalgic kind of gizmo-first futurism, one that speaks to a profound failure of the national imagination. There's something a little dismal about the fact that the mid-century dream of the future might, if everything goes perfectly according to plan, come to fruition in the form of saving half an hour en route to J.F.K. Then again, that isn't too far from the initial vision. In an age of abundance, the promise of the future sold to affluent suburbanites was one of ever-greater consumer ease. George Jetson was not dizzyingly free; he had a flying car that folded up into a briefcase, and he used it *to get to work quickly*.

Almost everyone in the industry thinks that personal aerial vehicles will arrive eventually—maybe in twenty years, maybe in fifty. If they do, it will be through a series of gradual changes—the kind of thing that can look, to the untrained eye, like stagnation. Peter Thiel and J. Storrs Hall seem to find it almost personally insulting that jets look just like they did in the sixties. But Brian Yutko, a former Boeing executive who is now Wisk's C.E.O., told me, "That's so off base. Do the airplanes largely look the same if you're a four-year-old holding up two pictures? Yes, but they're actually pretty different. They got seventy per cent more fuel-efficient, they have a much longer range, and safety incidents have been driven as close to zero as possible." He continued, "That's technological progress that took human ingenuity for five or six decades. Other sectors should learn from that! It's not stagnation, it's 'How did you do that?' "

Last fall, I joined Wisk's team in New Zealand, where it was participating in an "airspace integration test"—a pioneering attempt to introduce unmanned flights into an area with commercial planes and other air traffic. New Zealand has a lot of empty sky, crashes pose a risk largely to sheep, and the country's regulatory agencies have been hospitable to experimentation. The tests took place about twenty miles south of Christchurch, on a thin, dusty isthmus called the Kaitorete Spit. The airfield there is a joint venture with local Maori councils, who named it Tāwhaki, for a god who gathered knowledge from the heavens and brought it back to earth.

One design for early automobiles, known as Horsey Horseless, featured an artificial horse head mounted on the front of the chassis, so that it would resemble something familiar to other horses on the road. Wisk took a similar approach in the test. It was using a Boeing drone that was not being flown autonomously but by pilots in regular communication with air-traffic control; the pilots simply happened to be on the ground rather than in the cockpit. This was quite a big step for commercial aviation, in which virtually all procedures are based around the presence of an onboard pilot, but the accomplishment was buried under a barrage of bureaucratic acronyms: they hoped to do B.V.L.O.S. for an R.P.A. under I.F.R. conditions in C.T.A. One employee, who had come to Wisk from a jet-pack startup, told me that "a scaled-up U.A.M. operation would saturate the existing system within minutes." U.A.M. means "urban air mobility," and what they were doing here, he continued, was laying the groundwork for a P.S.U.

"What's a P.S.U.?" I asked.

"A provider of services for U.A.M.," he said, laughing. "It's an acronym within an acronym."

The pilots, dressed in vintage patterned fleeces and heavy work boots, were camped in the rear of a ground-control trailer. They were confident that their vehicle's path would be even more precise and reliable than that of a standard craft. It was launched with the faint snow cover of the Southern Alps in the distance, and it climbed in a tight spiral to twenty-five hundred feet before the pilots requested clearance to enter controlled airspace. The reply came over the radio: "You are identified and cleared." To a civilian, it wasn't easy to tell what the fuss was all about. Aviators, however, knew better. Boeing's regional executive, who had come to make a bottle-breaking appearance, declared it an "enormous milestone for aviation."

Byron Airport is an uncontrolled airfield about forty miles east of the Bay Area. On the morning that I arrived, the winds were calm, at about three

knots from the east, with scattered cloud cover at thirteen thousand feet. Mt. Diablo was visible in the haze, and the windmilled hillsides, freshened by a week of rain, were a deep green. Wyatt Warner, Pivotal's chief test engineer, hauled a BlackFly on a trailer to a small landing pad, which made a sucking sound in the mud. We waited for a planeload of skydivers, who bloomed against the gray cloud cover, to finish their descent. Then Warner took off in the BlackFly for a nine-minute test flight. His flight was elegant, though the craft still looked as if it didn't want to be in the air—like a tractor having a nightmare. Allison King, a mechanical engineer who was monitoring flight data, told me that she'd come across Pivotal's Web site shortly after graduating from M.I.T. "I thought, Well, that's just C.G.I.," she said. "Then I looked at the disclaimer that said, 'This is not C.G.I.,' and I was, like, 'Wait, what?' "

When Warner returned, Charlie Bushby, my first flight instructor, said, "You know what that means?" They gave me a flight suit with a smart BlackFly patch. Warner, watching the jumpers, was reminded of an old joke: "The good thing about when your parachute doesn't open is that you have the rest of your life to solve the problem." Idle conversation turned to plane-crash survival: a Serbian flight attendant who fell from thirty-three thousand feet and lived; those who walked away from the 1999 crash in Sioux City. We spoke about a local test pilot who had worked for Beta and interviewed at Pivotal; he had died weeks before in a tragic kit-plane crash. Bushby said, "Perhaps let's not talk about this right now?"

The BlackFly was used in what may have been the first manned flight of an eVTOL.

With a clipboard checklist strapped to my thigh, I climbed up into the vehicle and slid the plexiglass canopy over my head. I turned the propellers on, tested the controls, and then initiated the takeoff sequence. My first flight was a simple hover—up and then down. The propellers began to spin with the sound of leaf blowers, the craft reared back, and I was wrenched upward, pinned to my seat, heart hammering. Warner had instructed me to breathe, but my body sent only lurching reminders that flight is wrong. I hung there just long enough to steal a hurried glance in each direction, then thumbed the toggle to descend. In what felt like both an instant and an eternity, I was back on the ground. We let the craft rest for ten minutes before my second test flight, which involved flying in a small box

pattern over the landing pad. The flight plan meant a long interval in pure hover, and while I was airborne my motor temperatures quickly hit a hundred and twenty degrees. The yellow warning lights flashed; although I wasn't perfectly centered over the pad, this seemed like a good time to land, which I did, with a little skid into the mud. I hopped out, and Warner and I dragged the BlackFly back to the proper takeoff spot.

I was now ready, they told me, to fly for real. As I took off into a hover, I twisted the stick to the right, turning away from everyone below, and lit out in the direction of the hills. Once I levelled off, the propellers quieted to a much softer hum, and all at once I had a feeling of lightness and agility in the air. Below me were muddy ponds, glistening patterns of water and grass, a cluster of black cows. I crested through a long, slow turn over the base of the foothills, and the machine felt alive to my touch. The company had disabled cruise mode, limiting me to an airspeed of about thirty miles an hour—something they said they'd done to prevent me from accidentally slipping into higher gear. But I knew now that, if cruise weren't disabled, I would have pushed the craft to whatever speed was available to me; I would have flown in the direction of the hills and the sky and never come back; I would be up there still. There was the sense that the vibrating craft was an extension of my limbs. It was no wonder that the disembodied march of software had left so many technologists longing for the experience of living inside the circuitry. Entirely forgotten was the banality of commuting to work. The delirium of flight was enough. I glanced at my viewscreen, began the slow, gradual descent I'd practiced on the simulators, and, with great reluctance, triggered the sequence to land. ♦

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