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What Is a Flying Car?
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Inside Silicon Valley's 10-year quest to make soaring above a crowded city street as easy as calling an Uber.

It was sleek, cone-shaped, a little confusing — like something Hollywood would give a sci-fi villain for a quick getaway.

It wasn't a helicopter. And it wasn't an airplane. It was a cross between the two, with a curved hull, two small wings, and eight spinning rotors lined up across its nose and tail.

At the touch of a button on a computer screen under a nearby tent, it stirred to life, rising up from a grassy slope on a ranch in central California and speeding toward some cattle grazing under a tree — who did not react in the slightest.

"It may look like a strange beast, but it will change the way transportation happens," said Marcus Leng, the Canadian inventor who designed this aircraft, which he named BlackFly.

BlackFly is what is often called a flying car. Engineers and entrepreneurs like Mr. Leng have spent more than a decade nurturing this new breed of aircraft, electric vehicles that can take off and land without a runway.

They believe these vehicles will be cheaper and safer than helicopters, providing practically anyone with the means of speeding above crowded streets.

"Our dream is to free the world from traffic," said Sebastian Thrun, another engineer at the heart of this movement.

That dream, most experts agree, is a long way from reality. But the idea is gathering steam. Dozens of companies are now building these aircraft, and three recently agreed to go public in deals that value them as high as \$6 billion. For years, people like Mr. Leng and Mr. Thrun have kept their prototypes hidden from the rest of the world — few people have seen them, much less flown in them — but they are now beginning to lift the curtain.

Mr. Leng's company, Opener, is building a single-person aircraft for use in rural areas — essentially a private flying car for the rich — that could start selling this year. Others are building larger vehicles they hope to deploy as city air taxis as soon as 2024 — an Uber for the skies. Some are designing vehicles that can fly without a pilot.

One of the air taxi companies, Kitty Hawk, is run by Mr. Thrun, the Stanford University computer science professor who founded Google's self-driving car project. He now says that autonomy will be far more powerful in the air than on the ground, and that it will enter our daily lives much sooner. "You can fly in a straight line and you don't have the massive weight or the stop-and-go of a car" on the ground, he said.

The rise of the flying car mirrors that of self-driving vehicles in ways both good and bad, from the enormous ambition to the multi-billion-dollar investments to the cutthroat corporate competition, including a high-profile lawsuit alleging intellectual property theft. It also recreates the enormous hype.

It is a risky comparison. Google and other self-driving companies did not deliver on the grand promise that robo-taxis would be zipping around our cities by now, dramatically reshaping the economy.

But that has not stopped investors and transportation companies from dumping billions more into flying cars. It has not stopped cities from striking deals they believe will create vast networks of air taxis. And it has not stopped technologists from forging full steam ahead with their plans to turn sci-fi into reality.

'The Wild West of aviation'

The spreadsheet was filled with numbers detailing the rapid progress of electric motors and rechargeable batteries, and Larry Page, the Google co-founder, brought it to dinner.

It was 2009. Many start-ups and weekend hobbyists were building small flying drones with those motors and batteries, but as he sat down for a meal with Sebastian Thrun, Mr. Page believed they could go much further.

Mr. Thrun had only just launched Google's self-driving car project that year, but his boss had an even wilder idea: cars that could fly.

"When you squinted your eyes and looked at those numbers, you could see it," Mr. Thrun remembered.

The pair started meeting regularly with aerospace engineers inside an office building just down the road from Google headquarters in Mountain View, Calif. Mr. Page's personal chef made meals for his guests, including a NASA engineer named Mark Moore and several aircraft designers from Stanford.

Those meetings were a free flow of ideas that eventually led to a sprawling, multi-billion-dollar effort to reinvent daily transportation with flying cars. Over the past decade, the same small group of engineers and entrepreneurs fed a growing list of projects. Mr. Moore helped launch an effort at Uber, before starting his own company. Mr. Page funneled money into multiple start-ups, including Mr. Leng's company, Opener, and Mr. Thrun's, Kitty Hawk. New companies poached countless designers from Mr. Page's many start-ups.

"It is the Wild West of aviation," Mr. Moore said. "It is a time of rapid change, big moves and big money."

The next few years will be crucial to the industry as it transitions from what Silicon Valley is known for — building cutting edge technology — to something much harder: the messy details of actually getting it into the world.

BlackFly is classified by the government as an experimental “ultralight” vehicle, so it does not need regulatory approval before being sold. But an ultralight also cannot be flown over cities or other bustling areas.

As it works to ensure the vehicle is safe, Opener does most of its testing without anyone riding in the aircraft. But the idea is that a person will sit in the cockpit and pilot the aircraft solo over rural areas. Buyers can learn to fly via virtual reality simulations, and the aircraft will include autopilot services like a “return to home” button that lands the plane on command.

It has enough room for a six foot, six-inch person, and it can fly for about 25 miles without recharging. The few Opener employees who have flown it describe an exhilarating rush, like driving a Tesla through the sky — an analogy that will not be lost on the company’s target customer.

Mr. Leng sees all this as a step toward the starry future envisioned by “The Jetsons,” the classic cartoon in which flying cars are commonplace. “I have always had a dream that we could have unfettered three-dimensional freedom like a bird does — that we can take off and just fly around,” he said.

BlackFly will initially be far more expensive than your average car (perhaps costing \$150,000 or more). And its combination of battery life and mileage is not yet as powerful as most anyone’s daily commute requires.

But Mr. Leng believes this technology will improve, prices will drop to “the cost of an S.U.V.” and the world will ultimately embrace the idea of electric urban flight. By putting his vehicle into the hands of a relative few people, he argues, he can open the eyes of many more.

He compares BlackFly to one of his other inventions: a new kind of foam padding that molded itself to your body when you sat on it. He did not initially know what it would be good for, but this “memory foam” wound up in office chairs, car seats and mattresses. In much the same way, he is unsure how BlackFly will work its way into everyday life, but he is confident of the possibilities.

Others in the field are skeptical. They estimate it will be years — or even decades — before regulators will allow just anyone to fly such a vehicle over cities. And they say the technology is too important and transformative to remain a plaything for millionaires. So they are betting on something very different.

‘It is going to take longer than people think’

When Sebastian Thrun watches his flying vehicle — Heaviside — rise up from its own grassy landing pad, he sees more than just the trees, hills and crags of the California test site. He envisions an American suburbia where his aircraft ferries people to their front doors sometime in the future.

Yes, there are regulatory hurdles and other practical matters. These planes will need landing pads, and they could have trouble navigating dense urban areas, thanks to power lines and other low-flying aircraft.

There is also the noise factor, a crucial selling point over loud combustion engine helicopters. Sitting a few hundred feet from the vehicle, Mr. Thrun boasted about how quiet the aircraft was, but when it took off, he had no choice but to stop talking. He could not be heard over the whir of the rotors.

Even so, Mr. Thrun says Kitty Hawk will build an Uber-like ride-hailing service, in part, because of simple economics. Heaviside is even more expensive than BlackFly; Mr. Thrun said it costs around \$300,000 to manufacture. But with a ride-hailing service, companies can spread the cost across many riders.

Like BlackFly, Heaviside offers only one seat — and that seat is a tight fit, even for the average-sized person. But a future version will offer a second seat and fly on its own, allowing it to carry two passengers. By mass-producing a two-seat aircraft and sharing the vehicle among many riders, Mr. Thrun said, the company can eventually get the cost per mile down to a level that is on par with today's automobiles.

Wisk Aero, a company that spun out of Kitty Hawk in 2019 with backing from Mr. Page and Boeing, sees the future in much the same way. It is already testing a two-seat vehicle, and it is building a larger autonomous air taxi that may have more seats.

Many believe this is how flying cars will ultimately operate: as a taxi, without a pilot. In the long run, they argue, finding and paying pilots would be far too expensive.

This arrangement is technically possible today. Kitty Hawk and Wisk are already testing autonomous flight. But once again, convincing regulators to sign off on this idea is far from simple. The Federal Aviation Administration has never approved electric aircraft, much less taxis that fly themselves. Companies say they are discussing new methods of certification with regulators, but it is unclear how quickly this will progress.

"It is going to take longer than people think," said Ilan Kroo, a Stanford professor who has also worked closely with Mr. Page and previously served as chief executive of Kitty Hawk. "There is a lot to be done before regulators accept these vehicles as safe — and before people accept them as safe."

'Like Uber meets Tesla in the air'

No one is flying in an electric taxi this year, or even next. But some cities are making early preparations. And one company has 2024 in its sights.

In another central California field not far from where Kitty Hawk and Opener are testing their prototypes, Joby Aviation recently tested its own. Called the Joby Aircraft, this polished, pointy prototype is much bigger than Heaviside, with more space in the cabin and larger rotors along the wings.

From several hundred yards away, with a traditional helicopter flying above, observers had trouble determining how loud it was during take off and landing. And it flew without passengers, remotely guided from a command center trailer stuffed with screens and engineers on the ground. But Joby says that by 2024, this vehicle will be a taxi flying over a city like Los Angeles or Miami. It too is planning an Uber for the skies, though its aircraft will have a licensed pilot.

Joby believes that regulators are unlikely to approve autonomous flight anytime soon. “Our approach is more like Tesla than Waymo,” said the executive chairman, Paul Sciarra, using this burgeoning industry’s favorite analogy. “We want to get something out there on the way to full autonomy.”

To aid in these plans, it has partnered with Toyota to manufacture aircraft and acquired Uber Elevate, the air taxi project Mr. Moore helped create inside the ride-hailing giant. In the coming months, Joby plans to merge with a special purpose acquisition company, or SPAC, that will take it public at a \$6.6 billion valuation. Two other companies, California-based Archer and Germany-based Lilium, have struck similar deals.

The SPAC deals allow the companies to advertise ambitious business projections, something the Securities and Exchange Commission otherwise prohibits in initial public offerings. In an investor presentation, Joby touted a trillion-dollar market opportunity.

After launching in one city, the company says, it will quickly expand to others, bringing in \$2 billion in revenue and more than \$1 billion in gross profit within two years, according to its investor presentation. Until then, it will lose more than \$150 million each year.

Reid Hoffman, the venture capitalist and LinkedIn co-founder, is an investor behind the SPAC that is merging with Joby. He admires the vehicle’s cool factor. “It’s like Uber meets Tesla in the air,” he said, taking v.c. speak to the skies. But he was most attracted to the company’s potential to redefine cities, commutes and gridlock for a broad group of people.

Of the three going public, Joby is the only one whose prototype is now flying. And both its rivals are facing questions over their technology. One has been sued by Wisk, accused of intellectual property theft after poaching several engineers, and the other recently abandoned a prototype because of a battery fire.

Some believe that even with pilots in the cockpit, these companies will be hard pressed to launch services by 2024. “There is a big gap between flying an aircraft and being ready for revenue,” said Dan Patt, who worked on similar technology at the Department of Defense.

Flying cars may reach the market over the next several years. But they will not look or operate like the flying cars in the Jetsons. More likely, they will operate like helicopters, with pilots flying people from landing pad to landing pad for a fee.

They will be greener than helicopters and require less maintenance. They will be quieter, at least a little. And they may eventually be cheaper. One day, they could even fly on their own.

“Can we do this tomorrow morning? Probably not,” Mr. Thrun said. But if you squint your eyes and look at one of these prototypes, he added, you can see it happen.

IMPORTANT LEGAL INFORMATION

Forward Looking Statements

This document contains certain forward-looking statements within the meaning of the federal securities laws with respect to the proposed transaction between Reinvent Technology Partners (“RTP”) and Joby Aero, Inc. (“Joby Aviation”). These forward-looking statements generally are identified by the words “believe,” “project,” “expect,” “anticipate,” “estimate,” “intend,” “strategy,” “future,” “opportunity,” “plan,” “may,” “should,” “will,” “would,” “will be,” “will continue,” “will likely result,” and similar expressions. Forward-looking statements are predictions, projections and other statements about future events that are based on current expectations and assumptions and, as a result, are subject to risks and uncertainties. Many factors could cause actual future events to differ materially from the forward-looking statements in this document, including but not limited to: (i) the risk that the transaction may not be completed in a timely manner or at all, which may adversely affect the price of RTP’s securities, (ii) the risk that the transaction may not be completed by RTP’s business combination deadline and the potential failure to obtain an extension of the business combination deadline if sought by RTP, (iii) the failure to satisfy the conditions to the consummation of the transaction, including the adoption of the Agreement and Plan of Merger, dated as of February 23, 2021 (the “Merger Agreement”), by and among RTP, Joby Aviation and RTP Merger Sub Inc., a Delaware corporation and a direct wholly owned subsidiary of RTP, by the shareholders of RTP, the satisfaction of the minimum trust account amount following redemptions by RTP’s public shareholders and the receipt of certain governmental and regulatory approvals, (iv) the lack of a third party valuation in determining whether or not to pursue the transaction, (v) the inability to complete the PIPE investment in connection with the transaction, (vi) the occurrence of any event, change or other circumstance that could give rise to the termination of the Merger Agreement, (vii) the effect of the announcement or pendency of the transaction on Joby Aviation’s business relationships, operating results and business generally, (viii) risks that the proposed transaction disrupts current plans and operations of Joby Aviation and potential difficulties in Joby Aviation employee retention as a result of the transaction, (ix) the outcome of any legal proceedings or other disputes that may be instituted against Joby Aviation or against RTP related to the Merger Agreement or the transaction, (x) the ability to maintain the listing of RTP’s securities on a national securities exchange, (xi) the price of RTP’s securities may be volatile due to a variety of factors, including changes in the competitive and highly regulated industries in which RTP plans to operate or Joby Aviation operates, variations in operating performance across competitors, changes in laws and regulations affecting RTP’s or Joby Aviation’s business and changes in the combined capital structure, (xii) the ability to implement business plans, forecasts, and other expectations after the completion of the transaction, and identify and realize additional opportunities, and (xiii) the risk of downturns and a changing regulatory landscape in the highly competitive aviation industry. The foregoing list of factors is not exhaustive. You should carefully consider the foregoing factors and the other risks and uncertainties described in the “Risk Factors” section of RTP’s Annual Report on Form 10-K for the year ended December 31, 2020, as amended, the registration statement on FormS-4 (File No. 333-254988) discussed below and other documents filed by RTP from time to time with the SEC. These filings identify and address other important risks and uncertainties that could cause actual events and results to differ materially from those contained in the forward-looking statements. Forward-looking statements speak only as of the date they are made. Readers are cautioned not to put undue reliance on forward-looking statements, and RTP and Joby Aviation assume no obligation and do not intend to update or revise these forward-looking statements, whether as a result of new information, future events, or otherwise. Neither RTP nor Joby Aviation gives any assurance that either RTP or Joby Aviation or the combined company will achieve its expectations.

Important Information for Investors and Stockholders

This document relates to a proposed transaction between RTP and Joby Aviation. This document does not constitute an offer to sell or exchange, or the solicitation of an offer to buy or exchange, any securities, nor shall there be any sale of securities in any jurisdiction in which such offer, sale or exchange would be unlawful prior to registration or qualification under the securities laws of any such jurisdiction. In connection with the proposed transaction, RTP has filed a registration statement on Form S-4 (File No. 333-254988), which includes a preliminary prospectus and proxy statement of RTP, referred to as a proxy statement/prospectus. A final proxy statement/prospectus will be sent to all RTP shareholders. RTP also will file other documents regarding the proposed transaction with the SEC. Before making any voting decision, investors and security holders of RTP are urged to read the registration statement, the proxy statement/prospectus and all other relevant documents filed or that will be filed with the SEC in connection with the proposed transaction as they become available because they will contain important information about the proposed transaction.

Investors and security holders will be able to obtain free copies of the registration statement, the proxy statement/prospectus and all other relevant documents filed or that will be filed with the SEC by RTP through the website maintained by the SEC at www.sec.gov.

The documents filed by RTP with the SEC also may be obtained free of charge at RTP's website at <https://www.reinventtechnologypartners.com> or upon written request to 215 Park Avenue, Floor 11 New York, NY.

Participants in the Solicitation

RTP and Joby Aviation and their respective directors and executive officers may be deemed to be participants in the solicitation of proxies from RTP's shareholders in connection with the proposed transaction. A list of the names of the directors and executive officers of RTP and information regarding their interests in the business combination will be contained in the proxy statement/prospectus when available. You may obtain free copies of these documents as described in the preceding paragraph.