



A FANTASTIC FLYING CAR THAT'S NO FANTASY

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The Lilium Jet is the most notable of the aeronautic innovators rattling the aerospace giants with a new array of flying objects that promise to transform the way we travel.

Who wouldn't want a flying car?

From New York's collapsing railroad system to the coagulated freeways of Los Angeles, a giant collective scream arises from commuters demanding relief. So just imagine the delight of being able to summon your Uber ride and flying high above the mess to your destination at 150 mph. That's the future according to Uber, arriving by 2025.

But let's not get carried away—literally. After all, the notion of a flying car has been around for at least 50 years and we have yet to see one that works. Most often they have looked like the worst of both worlds: a car too clunky to maneuver and an airplane that looked half-baked.

There is a reason for that. Neither technology—of the car or of the airplane—was itself changing. Working within the limitations of conventional technology, designers encountered a set of immutable physical laws. Cars were firmly terrestrial, and airplanes were firmly of the sky.

That is no longer true. Automotive and aerospace technologies are undergoing radical changes—and many of those changes are common to both. One thing more than any other is driving the change: electrical power.

Image result for Lilium Jet

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In the aerospace industry, this is the most transformative innovation since the jet engine. Electrical power really alters the game for all flying objects. Only now are we beginning to see how sexy some of those flying objects will be—and how disruptive they will be to all pre-conceived notions of infrastructure and transportation. The social, political, and industrial consequences are equally breathtaking.

A whole lot of startups are involved and shaking things up. Take a look, for example, at an amazingly cool and nimble machine that looks like something that James Bond's gadget master, Q, would have conjured up in a secret cave.

Here is the Lilium Jet making its first flight recently at an airfield near Munich, Germany.

The Lilium Jet belongs in a category of aircraft called VTOL—vertical take-off and landing. In fact, it marks the birth of an entirely new category of small vehicles able to levitate us free of the earth with a quiet swish of electrical power.

In place of a single engine, the Lilium machine has 36 tiny electrical motors driving propellers. These engines rotate on an axis: They face downward to power the vehicle vertically for takeoff, then pivot to horizontal for forward flight. On the first flight the two seats were empty—the vehicle was flown by remote control like a drone. Unmanned tests will be followed by piloted ones as the concept is proved.

Make no mistake. This was a very consequential event, and achieved within only two years of the company's founding. Most amazingly, Lilium has proved that VTOL flight is no longer uniquely the province of billion dollar military airplane programs like the V-22 Osprey and F-35. This is something you could keep in a garage. Moreover, unlike those military beasts, electrical power has no emissions and is very quiet.

Lilium is claiming that the final five-seat air taxi version of its design will be able to make the trip

from Manhattan to JFK Airport in five minutes, initially at a cost per passenger of \$36 but eventually falling to a good deal less than that.

Some of the Lilium team were in Dallas in April for what was rather grandiosely called the Uber Elevate Summit to outline the future of eVTOL (Uber adds the “e”). In this revolution, Uber is taking a role like that of the major American airlines when the prospect of jet travel first appeared in the '50s. Then the airline chiefs basically said to the airplane manufacturers, “You build it and we will fly it.” Boeing was the first to meet that challenge and as a result eventually came out on top.

Lilium isn't yet part of the consortium of interests that Uber has put together to develop its idea of air taxis, but it might well be the first to deliver. Uber is asking for a vehicle that can carry four passengers for distances of up to 50 miles at a speed of around 150 mph and can be priced like a premium limo service. That seems well within Lilium's demonstrated capabilities. Its five-seat version will have a range of 190 miles and a speed of 186 mph.

But let's try to stay sober. There have been visionary projects like this before that never happened. Only a decade ago we were promised fleets of ultra-light jet taxis that could be hailed like regular taxis for flights between airports nationwide. The price target was never met; conventional jet engine technology and airplane design couldn't cut it.

This time everything is different. Unlike the gas turbine jet engine, electrical power can be scaled down to the smallest vehicles and scaled up to much larger ones and remain efficient over the entire range.

There is an equally revolutionary step in the way these vehicles are built. Much of their structure is composed of lightweight composites, not metal. And complex parts that were once expensive to manufacture can now be made far more efficiently using 3-D printers (even Rolls Royce now uses 3-D printers for critical jet engine parts).

Finally, these flying objects are controlled best not by people but by digital systems that will ultimately include artificial intelligence. The autonomous car is the forerunner of the autonomous flying car.

Image not found or type unknown

In short, almost anything carrying people can be made to fly—and can fly itself.

Of course, there is always an if. In this case, a very big if: If anything can fly, then the near sky—the lower altitudes where these taxis will operate—will suddenly become a very busy space. This will create a whole new medium for movement, but it will also require a new world of regulations and policing to make it safe.

That regime is already being planned by NASA, the FAA, and the Air Traffic Controllers' Association in the form of a system called Unmanned Traffic Management (UTM). Initially this new bureaucracy is meant to regulate commercial drones, like Amazon's planned delivery service.

The system's ability to handle eVTOL flights for Uber will be tested in Dallas and Dubai in 2020. (That's ironic because the wealth of both cities is built on oil and electric power promises to be the nemesis of oil.) Uber claims that riding in an eVTOL vehicle will prove to be twice as safe as driving in a car.

Beyond the needs of Uber, vehicles like the Lilium Jet seem set to displace helicopters in many roles. Their speed and quietness make them ideal for use as air ambulances as well as by the police or even counter-terrorism units.

Given all the hype attached to our levitated future, it's essential to make clear that one formidable barrier to success has yet to be broken: producing batteries powerful enough to meet the demands of electric jets and able to run for long periods between charges. Lithium-ion batteries like those developed for Tesla cars fall short of the energy needed. The critical measurement is called energy density. Several companies are promising new battery technology with far higher energy density to break this barrier for good by 2020.

Personal confession: I am as susceptible as anyone to the lure of man-toys and this is probably the sexiest parade of such toys I have ever seen, all of them promoted with sizzling Hollywood-quality graphics. Could this, after all, be another utopian tech fantasy bubble?

Not if you look at the response of the two aerospace gorillas, Airbus and Boeing. Both are aware of the message implicit in Lilium's achievement: the price of entry into the aerospace industry has fallen so fast that gifted innovators can outsmart mega corporations.

But these giants have different approaches. Boeing buys into startups through a small investment arm called Boeing HorizonX. Airbus has its own Silicon Valley lab called A3 that develops prototypes and is free to play with any new technology.

Having seen early results from California, Airbus chief Tom Enders plucked Paul Eremenko from A3 and made him Chief Technology Officer for the whole Airbus group. Now 37, Eremenko first cut his teeth at the Pentagon's innovation lab, DARPA, and then moved to Google boss Larry Page's personal "skunk works," Advanced Technology and Projects. At Airbus, he pits Silicon Valley free thinking against a formidable and entrenched multi-national bureaucracy.

Eremenko faces a culture geared to the decade-long development cycle and huge investments of conventional commercial jets. That's not readily changed. Much of the development time involves meeting rigorous safety regulations and carrying out test flying for which there can be no short cuts.

Two of Eremenko's brainchilds are Pop-uP, a small bus designed as a module that can operate either by road or by air, and CityAirbus, an electric-powered hybrid of VTOL and helicopter with four seats and far more modest aims than the Lilium Jet: CityAirbus trips would be limited to 15 minutes at 95 mph.

But beyond this there is a much bigger game requiring much deeper resources and a lot more money. Boeing and Airbus are planning to bring electrical power to a new place in the sky between air taxis and conventional passenger jets. Both companies foresee a network of regional inter-city routes flown by 50-seater airplanes that would be up to 80 percent cheaper to operate.

To this end, Boeing has invested in Zunum, a 2013 startup based in Washington state. After a low-profile launch, Zunum went public this year with a fully-realized concept for a 50-seat jet using a combination of electrical and turbojet power: Shorter flights would be all-electric, and the turbojet would cut in to support longer flights.

The striking thing about all these next generation flying vehicles is that they do not require billions of dollars in new infrastructure. The air taxis can operate from parking lots or the rooftops of office towers. The inter-city flights can use the many small city airfields that have been deserted by the big airlines as they created their hubs. On the new jets, passengers will carry their bags on and off as they would on a train or a bus.

Indeed, billion-dollar—and decidedly earthbound—infrastructure projects like high-speed rail, long touted as the solution for congestion in the U.S. northeast corridor or California, would be made redundant. Once you lift off in a whisper-clean new jet, you don't need roads or hundreds of miles of track, and the sky is a zero-cost pathway.

That said, air taxis and regional air networks won't replace mass transit, which stubbornly remains the only way to move millions of people in and out of major cities every day. The future of flying may be changing, but not in a way that will ever make it a low-cost universal public amenity.

Nonetheless, there is a Kitty Hawk quality to that first flight by the Lilium Jet. After all, the Wright brothers were a startup. They ran a bicycle repair business. They needed little capital. (Ilium has just raised 10 million euros from a venture capital company headed by a founder of Skype.) Their essential breakthrough was to figure out how to control a flying machine—and how to adapt the internal combustion engine to power it. At first, very little notice was paid to them, well after their first flight.

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