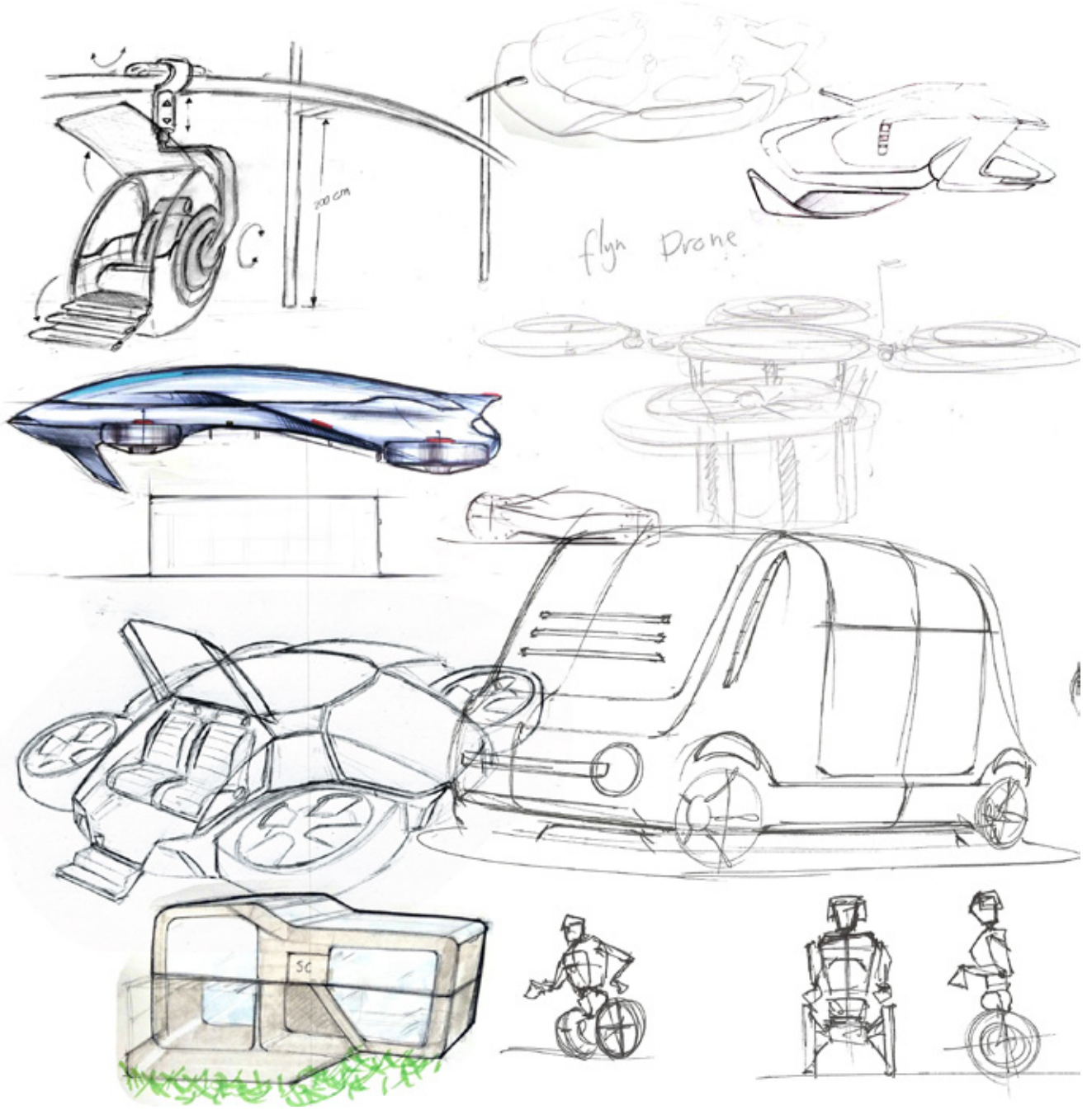
THE FUTURE OF AVIATION

BY CHARLES BOMBARDIER

ICAO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START-UPS & COMPANIES

Aerion, Aerofex, AeroMobil, Airbus, Aircraft Olympos, Arca, Aston Martin, ASX, Aurora, Bartini, Bell, Boom Supersonic, Cartivator, Delorean Aerospace, DJI, Ehang, ElectricVisionary Aircrafts, Faradair, Flyt, Goodyear, Google, Hirobo, Hoversurf, Hybrid AirVehicles, Hybrid-Airplane Technology, Imaginactive, ItalDesign, Jetman, JetpackAviation, Karem Aircraft, Kitty Hawk, Lazareth, Lift Aircraft, Lilium, Malloy, OmniHoverboard, Opener, Pal-V, Parsifal, Spike Aerospace, Starling, Terrafugia, Thales Alenia, Transcend Air, Uber Elevate, Urban Aeronautics, Volocopter, XTI Aircraft, Zapata, Zunum Aero

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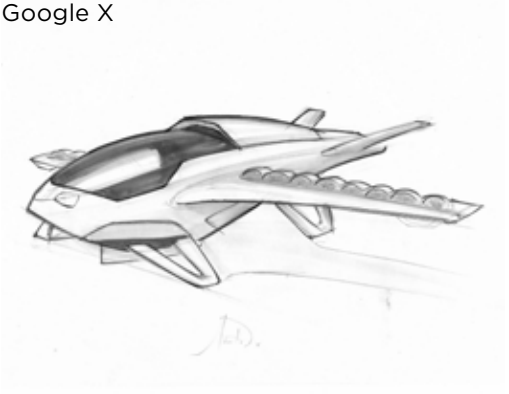
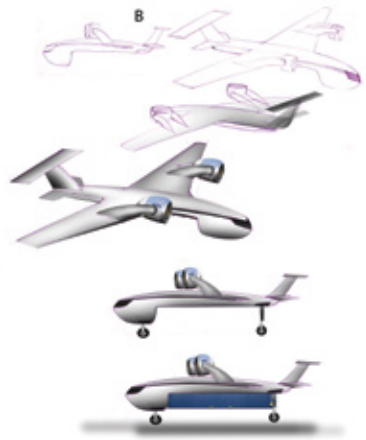
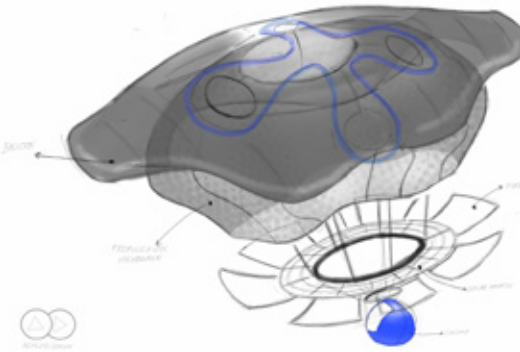


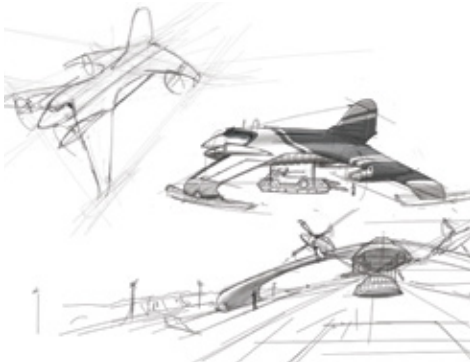
PROTOTYPES



PROJECTS

CONCEPTS





FOREWORD BY THE AUTHOR

CHARLES BOMBARDIER, ing. C.Dir. M.Sc.A.
FOUNDER, IMAGINACTIVE

Designers, engineers, entrepreneurs, scientists and other innovators are constantly creating new concepts and prototypes that will shape the world of tomorrow. As ICAO celebrates its 75th anniversary, I am honoured to present this 3rd annual book about the future of aviation. The first part of the book highlights 30 products and prototypes that are being built and tested today.

The second portion features over 40 aircraft concepts that are meant to stir up debate on how we—the public and our governments—want to direct the future of aviation. Do we want personal aircraft flying above our cities? How will drones deliver packages to our homes? Are we ready to support the development of hypersonic commercial jets and single-stage-to-orbit spacecraft?

Hopefully this book will help regulators, elected officials, delegations, industry leaders and the public to examine these subjects and engage in a meaningful discussion about them. Ultimately, the answers to these questions help us save time and resources in the product development cycle. We hope you will be as excited as we are by the future of aviation, and we encourage you to share your thoughts with us!

Charles Bombardier

FOREWORD
BY STEPHEN P.CREAMER

DIRECTOR, AIR NAVIGATION BUREAU
ICAO

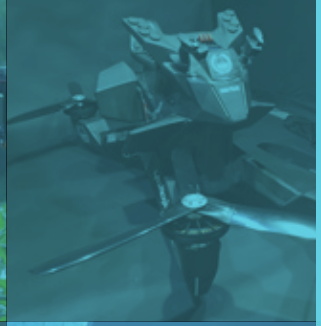
Aviation has always been a driver for innovation. For hundreds, perhaps thousands of years before that December day on Kitty Hawk in 1903, humans were driven by the dream of flying. That urge fueled the creativity of thinkers across the globe and throughout time to try, and try again. While almost all early attempts ended in failure, the inventions that it took for each try often left behind an improvement that the rest of society could enjoy and use to improve the quality of life. These included: lighter materials, stronger structures, more efficient machines, and a much better understanding of science in general. In fact, every time you see a skyscraper, use a computer, drive a car or enjoy a cruise you are experiencing something that was made possible, in some critical way, by the knowledge gained by failing to fly.

While it has been more than a 100 years since the first powered flight, that impetus for innovation – the dream of flight – has not disappeared. Once we acquired an understanding of the basic physics of flight we learned to fly across the oceans, then around the world, then faster than the speed of sound, then to space, to the moon and beyond. Each achievement encountered failure before we successfully harnessed the complexity and risk inherent to each new milestone. Today we build on the work of those who went before, and innovators are constantly creating new ideas and concepts that will serve or motivate the generations to come.

This book represents a few of those new dreams. We hope that it will be a source of inspiration for innovators and also encouragement as they fail in their future attempts, to tell them not to give up; and, to reassure them that even their failures will represent progress, and be of social and economic benefit to the people of the world. Today that desire for progress is still with us.

WING	Wing Aviation
H-AERO ONE	Hybrid-Airplane Technologies
AGRAS MJ1	DJI
BLACKFLY	Opener
HOVERBIKE	Hoversurf
VOLOCOPTER 2X	Volocopter
CORA	Kitty Hawk
TRANSITION	Terrafugia
AEROMOBIL 4.0	AeroMobil
PAL-V LIBERTY	Pal-V
LILIUM JET	Lillium
EHANG 216	Ehang
LOON	Alphabet
MAKANI	Google X





PRODUCTION





« Some of the following aircraft are already in production and being used commercially. Others are in the late stages of product development. They are sorted in order of payload. Please note that all specifications are estimated, please visit each company's website for official numbers.»





WING by **Wing Aviation**

Capacity: **UNMANNED** | Payload: **1.5 KG** | Altitude: **400 feet** | Speed: **113 KM/H** |

Range: **20 KM** | Wingspan: **1 METER** | Total motors: **14**

Wing has developed new method of transporting goods that's faster and more environmentally friendly than what's possible today with delivery on the ground. Wing is delivering a range of food, pharmacy items, and other goods to the yards of households across three continents.

The aircraft is designed with both fixed wings and hover propellers to seamlessly transition between an airplane and a helicopter –– keeping the package steady and level so it can deliver things like coffee without a spill. The 1 m wingspan allows the aircraft to fly further, faster, and more efficiently. Wing's flight operations software was built to provide UTM services and allows Wing, as well as recreational drone operators and aviation service providers, to manage complex flight paths and monitor the aircraft in real time.

Website: https://wing.com **Location:** Mountain View, California, USA

H-AERO ONE by Hybrid-Airplane Technologies

Capacity: **UNMANNED** | Payload: **2.8 KG** | Altitude: **13 000 feet** | Speed: **15 KM/H** |

Autonomy: **5 h** | Width: **3 METERS** | Price: **$28,000**

The h-aero one is a small European hybrid electric unmanned aerial vehicle which can source its energy completely from renewable sources via solar cells. The aerial vehicle combines static and dynamic lift, mirror or symmetric rotation flight modes and flies like a balloon, airplane and helicopter.

It was developed for professional and commercial use. It can be equipped with several different cameras (night vision, infrared and thermal imaging cameras). The simultaneous acquisition and evaluation of chemical components in the air (e.g. the measurement of particulate matter) is also possible. Additionally, equipped with radio communications systems, mobile hotspots (e.g. for disaster management) can be set up. The entire system can be customized on customers request.

Website: https://h-aero.com/en/one-2 **Location:** Baden-Baden, Black Forest, Germany

AGRAS MG-1 by DJI

Capacity: **UNMANNED** | Payload: **10 KG** | Altitude: **10 feet** | Speed: **79 KM/H** | Autonomy: **10-24 min.**

Area coverage: **10,000 M²** | Price: **$18,000**

The DJI AGRAS MG-1 is an octocopter designed for precision variable rate application of liquid pesticides, fertilizers, and herbicides, bringing new levels of efficiency and manageability to agriculture. The advanced flight controller integrated with the aircraft instantly and precisely responds to pilot inputs. Therefore, it is possible to choose between three flight modes: Smart mode, Manual Plus mode and Manual mode, according to terrain and the specific requirements of each mission.

Additionally, the MG-1 automatically records its current coordinates and remembers its past coordinates as it makes its way across the field. In case an operation is interrupted, for example due to depleted battery or spraying liquid, users can quickly land and resume flight from the last recorded point after changing the battery or refilling its tank.

Website: https://www.dji.com/ca/mg-1 **Location:** Nanshan District, Shenzhen, China

BLACKFLY V3 by Opener

Capacity: **1 person** | Payload: **113 KG** | Speed: **130 KM/H** | Range: **64 KM**

Propulsion: **8 motors** | Battery: **12 KWH** | Price: **$70,000**

The BlackFly V3 is a single-seat personal aerial vehicle (PAV) designed and built for a new world of three-dimensional transportation. It is simple to master and requires no formal licensing (in USA) or special skills to operate safely.

BlackFly primarily is designed to operate from small grassy areas. However, Opener's long-term vision is to integrate this highly-efficient vehicle into a rural/urban commuting network. These networks would be powered by renewable energy sources requiring only a fraction of the transportation energy used currently.

Website: https://www.opener.aero **Location:** Las Cruces, NM, USA

HOVERBIKE S3 by Hoversurf

Capacity: **1 person** | Payload: **115 KG** | Altitude: **10 feet** | Speed: **96 KM/H** |

Autonomy: **10 to 25** | Propulsion: **4 MOTORS** | Battery: **12,3 kWh** | Price: **$150,000**

The Hoverbike is an all-3 electric, four-rotor flying vehicle, utilizing various types of carbon fiber technology. Its entire frame is constructed from a single element, reducing its weight compared to Hoversurf's previous aluminum model.

The dimensions of the Hoverbike allow it to be rolled in a standard doorway and take off from a common parking space. Additionally, the Hoverbike has auto-take-off, auto-landing, altitude hold, and can be flown manually or with radio control.

Website: https://www.hoversurf.com **Location:** California, USA

VOLOCOPTER 2X by Volocopter

Capacity: **2 people** | Payload: **160 KG** | Altitude: **6 500 feet** | Speed: **100 KM/H**

Autonomy: **27 min** | Range: **27 KM** | Propulsion: **18 motors** | Battery: **9 Lithium-ion** |

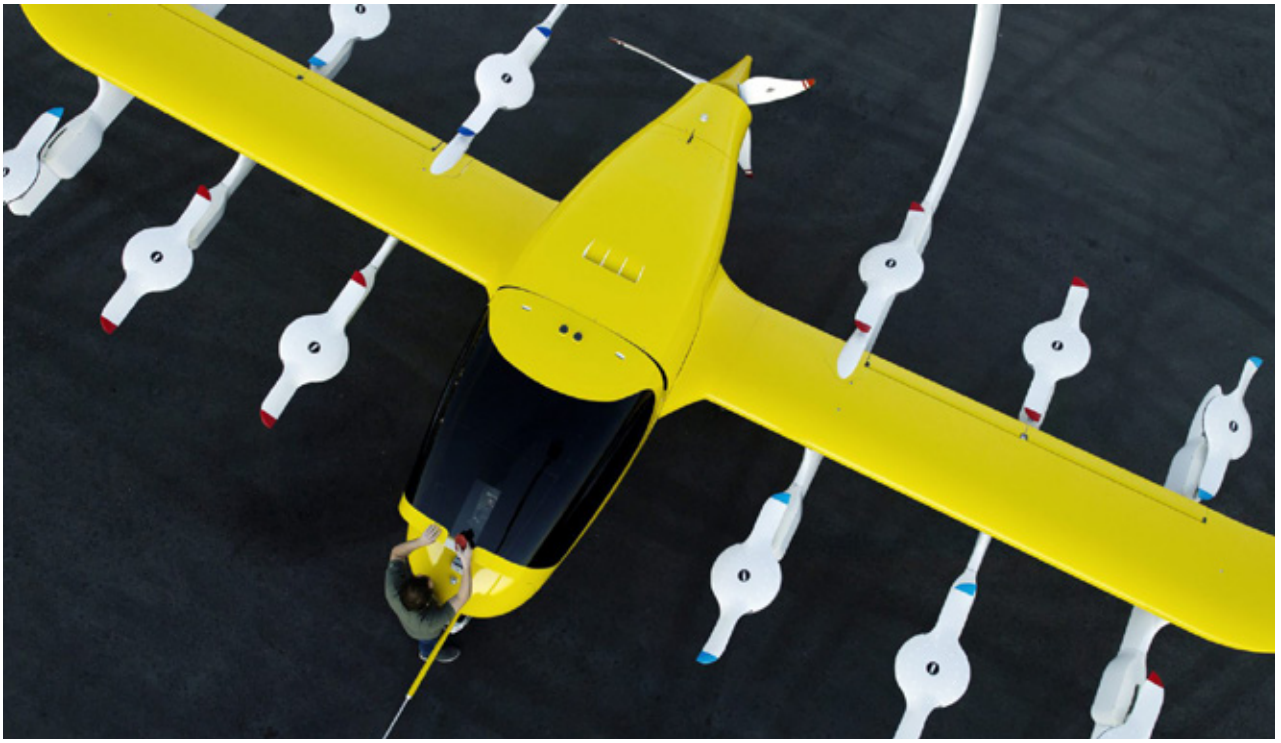
Price: **$330,000**

Volocopter is building a fully-electric VTOL to make humanity's dream of flying come true. The Volocopter 2X is a two-seat, optionally-piloted, multirotor electric helicopter which was introduced at the AERO Friedrichshafen air show in 2017. One of its goals is to help modern cities to resolve their increasing mobility issues.

The Volocopter 2X is powered by 18 quiet rotors, and the pilot can operate it with a single joystick. This aircraft could turn the vision of "flight for all" into reality. It does not have any combustion engine, it is quieter than traditional helicopters, and it has no complex mechanics. Just step on board, fly off and arrive in comfort.

Website: https://www.volocopter.com **Location:** Bruchsal, Germany

CORA by Kitty Hawk



Capacity: **2** | Payload: **181 KG** | Altitude: **3000 feet** | Speed: **180 KM/H** |

Autonomy: **19 min** | Range: **100 KM** | Propulsion: **13 motors** | Wingspan: **36 feet**

Cora is an air taxi that combines electric power, self-piloting software and vertical take-off to pioneer an entirely new way to fly. It all began as a dream: a personal flying vehicle that could take the everyday trips that define our lives and bring them to the sky. Cora is not just about flying. It is about the time you could save soaring over traffic. The people you could visit. The moments that move you.

The vehicle was designed with the planet in mind from day one. It is part of the electric revolution that is leading us to a sustainable future. And with the power to rise above the road, Cora will help ease the pressure that traffic places on all our lives.

Website: https://cora.aero **Location:** Mountain View, California, USA

TRANSITION by Terrafugia

Capacity: **2** | Payload: **227 KG** | Altitude: **9000 feet** | Speed: **160 KM/H** |

Autonomy: **120 min** | Range: **664 KM** | Wingspan: **27 feet** | Price: **$400,000**

The Transition brings the dream of the flying car to life. It seats two and converts from drive mode to flight mode in under a minute with just the push of a button. Eliminating the hassle of hangar storage, ground transportation, and aviation fuel, the Transition fuels up with automotive gas and can be stored in your home garage.

The Transition is the only aircraft that incorporates the required safety features for both autos and aircrafts. Setting a new standard for safety, the vehicle includes an airframe parachute, crumple zones, advanced avionics, rear-view cameras and more.

Website: https://terrafugia.com/transition **Location:** Woburn, MA, USA

AEROMOBIL 4.0 by AeroMobil

Capacity: **2** | Payload: **240 KG** | Speed: **360 KM/H** | Range: **750 KM** | Transition: **3 min.** |

Wingspan: **29 feet** | Price: **$1.6 MILLION**

The AeroMobil 4.0 is an exceptional STOL vehicle. A real flying car, with all that a car and an airplane have to offer. It cuts travel times compared to traditional airline alternatives, while its powerful engine provides greater range and a more efficient use of energy than most civil helicopters and personal drones. Also, the vehicle incorporates the very latest in vehicle recovery ballistic parachutes, designed to bring an airborne vehicle back to ground safely should the pilot choose to deploy it.

Really exciting news is that AeroMobil is already working in the upcoming version of the vehicle, the AeroMobil 5.0 VTOL, which will be launched in 2025.

Website: https://www.aeromobil.com **Location:** Pr ípojná, Bratislava, Slovakia

PAL-V LIBERTY by PAL V

Capacity: **2** | Payload: **246 KG** | Altitude: **11 500 feet** | Speed: **160 KM/H**

Autonomy: **4.3 h** | Range: **500 KM** | Landing roll: **100 feet** | Price: **$399,000**

Inspired by nature, engineered by men and evolved over time, the **PAL-V Liberty** is a ground-breaking product that inaugurates the age of the flying car. It is a marriage between safety and fun, designed to satisfy the most demanding customers.

The PAL-V Liberty in flight is an autogyro or gyrocopter, with a foldable pusher propeller providing forward thrust and a free-spinning rotor providing lift. The company also offers a pioneer edition for those that wish to be part of a unique group. In fact, only ninety flying cars of the Pioneer Edition will be made which distinguishes itself from the normal Liberty by the full carbon package.

Website: https://www.pal-v.com **Location:** Raamsdonksveer, The Netherlands

LILIUM JET by Lilium

Capacity: **5** | Payload: **246 KG** | Altitude: **: 3,000 m** | Speed: **300 KM/H** |

Autonomy: **1 h** | Range: **300 KM** | Propellers: **36 electric motors** | Cost: **Air fare**

Lilium is a Munich-based start-up developing a revolutionary on-demand air mobility service. To give wings to its vision of a world where anyone can fly anywhere, anytime, it has designed and prototyped a brand new form of aircraft that will enable it to deliver journeys that are four times faster than a taxi, yet competitive in price.

Manufacturing and operating the Lilium Jet, a five-seater, fully-electric aircraft that can take-off and land vertically (VTOL), will enable it to address a trillion-dollar market opportunity that will not only change the way people choose to live and travel but will also connect communities at a fraction of the cost of conventional high-speed infrastructure such as road and rail.

Website: https://lilium.com **Location:** Wessling, Germany

EHANG 216 by EHang

Capacity: **2** | Payload: **260 KG** | Altitude: **3200 feet** | Speed: **130 KM/H** | Autonomy: **30 min**

Range: **35 KM** | Cost: **$330,000**

EHang is a dominant player in the quadcopter drone market. The company hopes to extend its unmanned electric VTOL technology to manned applications. The EHang 216 is based on the EHang 184, yet it has eight arms instead of four. This allows for the vehicle to be seat two passengers instead of just one.

The EHang 216 Autonomous Aerial Vehicle (AAV) was first announced in February 2018. Manned and unmanned flight testing was conducted in China in 2017, and a manned flight test took place at the Amsterdam Arena in April 2018.

Website: http://www.ehang.com **Location:** Guangzhou, Guangdong, China

LOON by Alphabet

Capacity: **UNMANNED** | Altitude: **75 000 feet** | Speed: **WIND SPEED** |

Coverage: **80 KM** | Energy: **SOLAR**

Billions of people around the world are still without internet access. Loon is a network of balloons traveling on the edge of space, delivering connectivity to people in unserved and underserved communities around the world. The company partners with mobile network operators globally to expand the reach of their LTE service.

Together, they help expand coverage to places that lack it, supplement existing networks, and provide expedient coverage after natural disasters. Loon is a sister company of Google.

Website: https://loon.co **Location:** Mountain View, California, United States

MAKANI by Google X

Capacity: **UNMANNED** | Rotors: **8** | Altitude: **Tethered** | Power: **600 KW** | Energy: **WIND**

Wingspan: **85 feet**

The Makani energy kite is an aerodynamic wing tethered to a ground station. As the kite flies in loops, rotors on the wing spin as the wind moves through them, generating power that is sent down a tether to the grid. The newest kite is capable of generating up to 600 kilowatts of electricity, which is 30 times more energy than the previous prototype and enough to power about 300 homes.

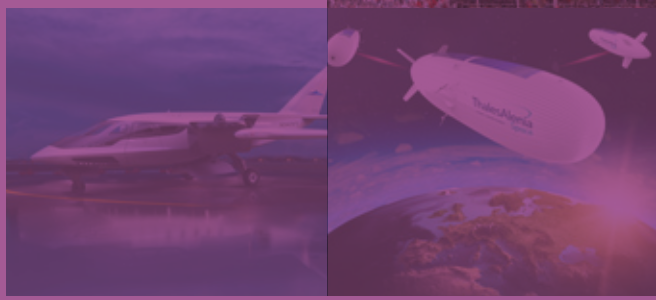
Over the last ten years, Makani has been prototyping and testing energy kites that can generate electricity by efficiently harnessing energy from wind resources that are not accessible or cost-effective today.

Website: https://makanipower.com **Location:** Mountain View, California, United States

OPENSKY M-02	Aircraft Olympos
MARK 1	Omni Hoverboard
BIT	Hirobo
LMV 496	Lazareth
FLYBOARD AIR EX	Zapata
JB-11	Jetpack Aviation
JETWING	Jetman
MALLOY HOVERBIKE	Malloy
HEXA	Lift Aircraft
FLYER	Kitty Hawk
PAV	Aurora
VAHANA	Airbus
ODYSSEUS	Aurora
STRATOBUS	Thales Alenia
TRIFAN 600	XTI Aicraft
AIRLANDER 10	Hybrid Air Vehicles

PROTOTYPES

« This section contains a series of aircraft prototypes that have been designed, engineered and built recently. Most of them have flown and are part of a funded development program. They are sorted in order of payload. »



Please note that all specifications are estimated, please visit each company's website for official numbers.

OPENSKY M-02 by Aircraft Olympos

Capacity: **1** | Payload: **50 KG** | Speed: **90 KM/H** | Autonomy: **15 min**

The OpenSky is a Japanese primary glider/jet-powered motor glider inspired by the Möwe aircraft and flown by the protagonist in the Hayao Miyazaki Japanese anime Nausicaä of the Valley of the Wind. It is a tailless design intended to be powered on take-off and climb for a duration of 10 minutes, then flown unpowered as a glider.

When the movie was first released in 1984, a vehicle like that seemed like it could only exist in science fiction. Nevertheless, Kazuhiko Hachiya has spent the past decade designing and testing his own single-person glider in order to unveil a full-sized model with a working jet engine.

Website: https://www.ac-olympos.com **Location:** Tokyo, Japan

MARK-1 by Omni Hoverboards

Capacity: **1** | Payload: **80 KG** | Altitude: **15 feet** | Speed: **11 KM/H** | Autonomy: **1,5 min** |
Range: **0,3 KM** | Energy source: **12 lithium polymer batteries** | Price: **$10,000 TO $20,000**

The Mark-1 is an octocopter with motors oriented down, getting a clear and sure top platform in which, the pilot can be. Additionally, the control of the power makes it through a remote control connected directly to the hoverboard. Horizontal stabilization is achieved with a flight controller similar to other multirotor and changes of direction are made by the inclination of the body.

In 2015, Catalin Alexandru Duru broke the world record for the longest hoverboard flight. Duru flew up to five metres above a lake for a distance of 0.2759 km aboard his homemade hoverboard in a trip that lasted more than 1.5 minutes. Thereafter, Duru created Omni Hoverboards and he is currently working on a next-generation version of his invention.

Website: http://omnihoverboards.com **Location:** Montreal, Québec, Canada

BIT by Hirobo



Capacity: **1** | Payload: **900 KG** | Speed: **97 KM/H** | Autonomy: **30 min** | Range: **0,8 KM** |

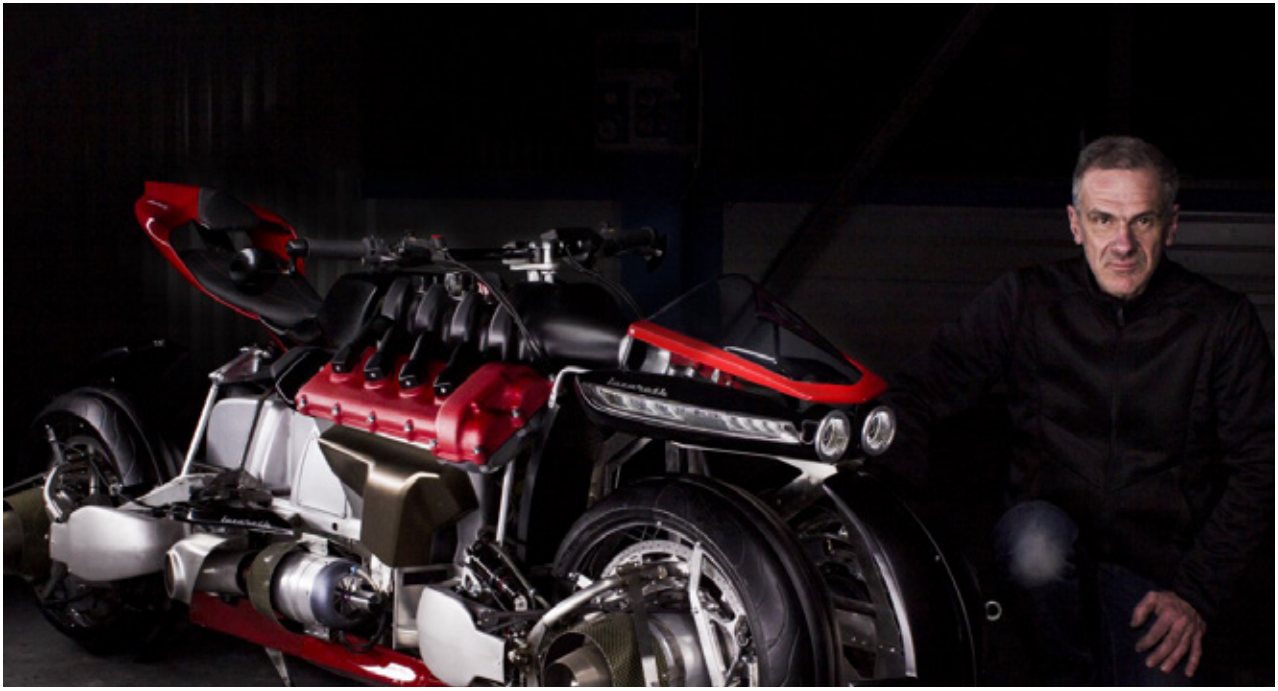
Energy source: **Electric** | Price: **$320,000**

The company **Hirobo** is specialized in electric unmanned helicopters, therefore they decided to use their expertise to present, the first all-composite, all-electric, single-person micro helicopter, the Hirobo BIT.

The Hirobo BIT has two counter-rotating rotors and simplified controls with a joystick, so it can be used as a recreational vehicle. This totally out of the ordinary vehicle will be ready for market in 2020.

Location: Sakuragaoka, Japan **Website:** https://www.hirobo.co.jp

LMV 496 by Lazareth



Capacity: **1** | Payload: **100 KG** | Speed: **280 KM/H** | Altitude: **500 feet** | Autonomy: **10 min**

Range: **40 KM** | Price: **$1 MILLION**

The Flying Motorbike, made of Kevlar carbon composite and inspired by the first model of LM847, takes the visual signature of the latter. The driving position and the light steering of the LMV496 offer immediate grip, while braking and undercarriage technology is directly inspired by Lazareth vehicles.

On the road, the LMV496 is an electric motorcycle with a hundred kilometers of autonomy. The power required for takeoff is provided by Turbines. The total power delivered is around 1300 horses for 2800N of thrust. In addition, the transition from the road mode to the flight mode is done by operating a simple switch on the dashboard and it can be done in 60 seconds.

Website: https://www.lazareth.fr/project/lmv496 **Location:** Annecy-le-Vieux, France

FLYBOARD AIR EX by ZAPATA

Capacity: **1** | Payload: **102 KG** | Speed: **145 KM/H** | Autonomy: **10 min**

Zapata's **Flyboard Air EX** is the next generation of advanced individual mobility. An embedded stability program uses vectored thrust from six small turbine engines to create an intuitive, responsive, and imminently stable flying platform. Engineered for safety, the Flyboard Air EXP incorporates multiple redundancies to provide graceful degradation and safe landing in the event of control channel interruption or multiple engine-loss.

With Zapata's proprietary balance methodology, fail-safes, and patented designs, the Flyboard Air is superbly safe and stable in the air and can reach speeds of over 90 mph, allowing the user to fly with exceptional confidence.

Website:https://zapata.com **Location:** Le Rove, France

JB-11 by Jetpack Aviation

Capacity: **1** | Payload: **104 KG** | Altitude: **15 000 feet** | Speed: **193 KM/H** | Autonomy: **10 min**

Range: **0.64 KM** | Energy source: **Kerosene/Diesel** | Cost: **$340,000**

The JB-11 is powered by six turbo jet engines specially modified for vertical flight. A sophisticated engine computer balances thrust between engines and in the unlikely case of an engine failure it will enable the pilot to maintain control and land. Additionally, all computer hardware and code are designed and written respectively in-house.

The JB 11 can carry a heavier fuel load and hence has longer Autonomy than the JB 10, the past version. Moreover, it can be operated either in the Ultralight or Experimental category.

Website: https://jetpackaviation.com **Location:** Los Angeles, California, USA.

JET-WING by Jetman

Capacity: **1 person** | Payload: **105 KG** | Altitude: **6500 feet** | Speed: **257 KM/H** |

Autonomy: **10 min** | Range: **40 KM** | Energy source: **Jet fuel** | Cost: **$150,000**

The Jetwing is the culmination of 25 years of innovation and is set on the path to achieving what has long been thought of as impossible. Driven by his desire to "fly like a bird," Swiss military-trained pilot and aviation enthusiast, Yves Rossy, designed and built what is today known as the Jetwing.

When Rossy flies, he goes up 1,981 meters in a helicopter and for 10 minutes, he knows what it is to fly. The only instruments Rossy uses are an altimeter and a timer mounted on his chest. Other than that, he simply uses his skin and ears as airspeed indicators without making use of any other mechanism.

Website: http://www.jetman.com/loft **Location:** Dubai, United Arab Emirates

MALLOY HOVERBIKE by Malloy

Capacity: **1** | Payload: **130 KG** | Altitude: **10 feet** | Speed: **97 KM/H** |

Autonomy: **6 minutes** | Range: **148 KM** | Price: **$40,000**

The Hoverbike by Malloy is a large quadcopter, the size of a small car, with an electronic flight controller brain and a simple all electric drive system. It can autonomously deliver aid, people, and equipment over buildings, rivers and mountains at the push of a button.

It is cheap, safe and reliably. Moreover, this air vehicle can fly to the same speed and height as a typical light helicopter. However, unlike a helicopter it can operate safely close to the ground and around people, and can do so, with little or no training.

Website: https://www.hover-bike.com **Location:** White Waltham, England

HEXA by Lift Aircraft

Capacity: **1** | Payload: **196** | Altitude: **1 200 feet** | Speed: **100 KM/H** |

Autonomy: **15 min** | Range: **0,5 KM** | Cost: **$250 / per flight**

Meet **Hexa**, an entirely new type of aircraft that anyone can fly since all that is needed is an autopilot computer with a single, 3-axis joystick. The flying vehicle has eighteen independent electric motors and propellers which are the only moving parts needed for perfectly stable, controlled flight. In addition, four perimeter floats provide stability while a large central float provides buoyancy for safe water landings.

Moreover, with an airframe built entirely of carbon fiber, Hexa is compliant with the Federal Aviation Administration (FAA)'s Powered Ultralight classification; therefore, no pilot's license is required to fly. It also possesses an autonomous ballistic parachute and a whole aircraft airbag system.

Website: https://www.liftaircraft.com/aircraft **Location:** Austin, Texas

FLYER by Kitty Hawk

Capacity: **1** | Payload: **200 KG** | Altitude: **20 feet** | Speed: **48 KM/H** |

Autonomy: **12 to 20 min** | Range: **10 KM** | Propellers: **10**

The Flyer is Kitty Hawk's first personal flying vehicle and the first step to make flying part of everyday life. It is a prototype personal aircraft, kept aloft by eight battery-powered propellers. The vehicle is designed to be easy to fly for recreational purposes over water and uncongested areas.

The flyer is not currently available for purchase since Kitty Hawk is currently focused on making personal flight accessible and affordable for everyone in the future.

Website: https://flyer.aero **Location:** Mountain View, California, USA

PAV by Aurora

Capacity: **2** | Payload: **225 KG** | Speed: **180 KM/H** | Range: **: 80,47 KM**

Aurora's Passenger air vehicle will provide on-demand transportation to minimize long commutes due to heavy traffic and urbanization in populated areas. While initially operated with a safety pilot, the VTOL aircraft is designed for fully autonomous operations, and the flight capability will be three times as efficient as a multi-copter aircraft.

The PAV's infrastructure plan includes urban vertiports for passenger boarding, vehicle servicing and a hub-to-hub service between designated vertiports. The first test flights are scheduled to begin in 2020 in Dallas and Dubai.

Website: https://www.aurora.aero **Location:** Manassas, Virginia, USA

VAHANA by Airbus

Capacity: **1** | Payload: **340 KG** | Altitude: **200 feet** | Speed: **92 KM/H**

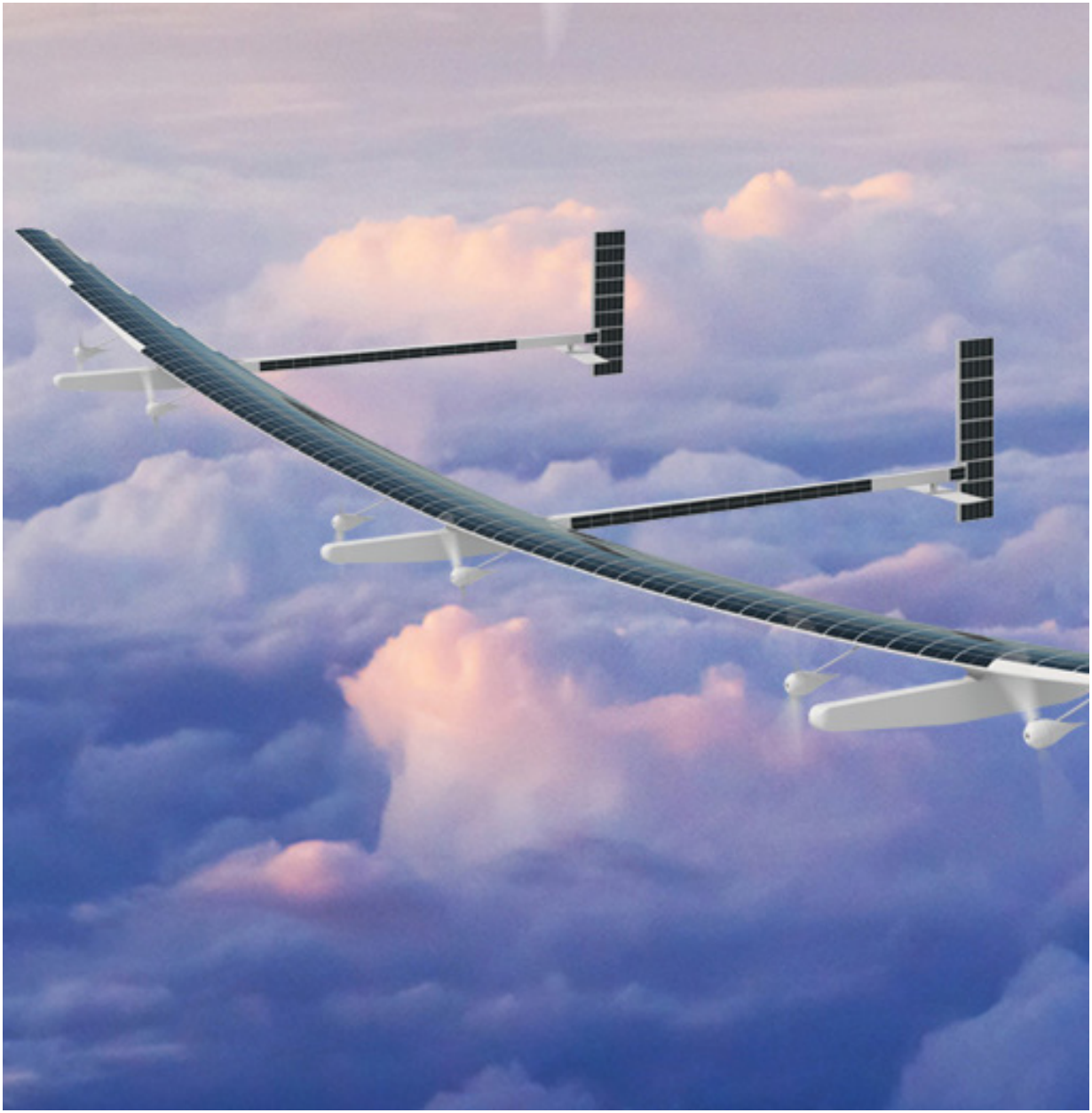
Autonomy: **7 min** | Range: **1 KM** | Cost: **$2.4 TO $4.00 / KM**

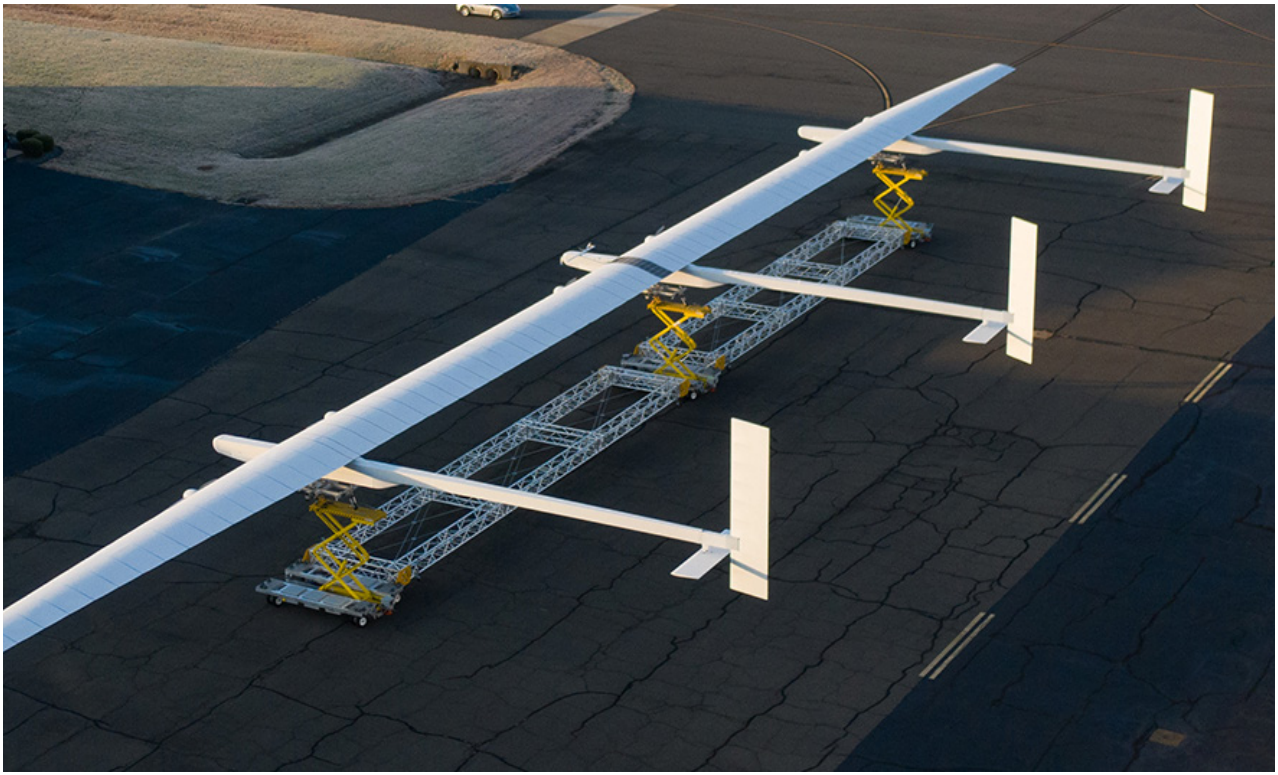
Project **Vahana** intends to open up urban airways by developing the first certified electric, self-piloted vertical take-off and landing (VTOL) passenger aircraft. The project is envisioned as being a cost-comparable replacement for short-range urban transportation like cars or trains.

Likewise, as a platform, Vahana can be as diverse as its wheeled grounded counterpart when being used for cargo delivery, emergency services, search and rescue, or even as a tool to deploy modular infrastructure in disaster sites.

Website: : https://vahana.aero **Location:** Santa Clara, California, USA.

ODYSSEUS by Aurora





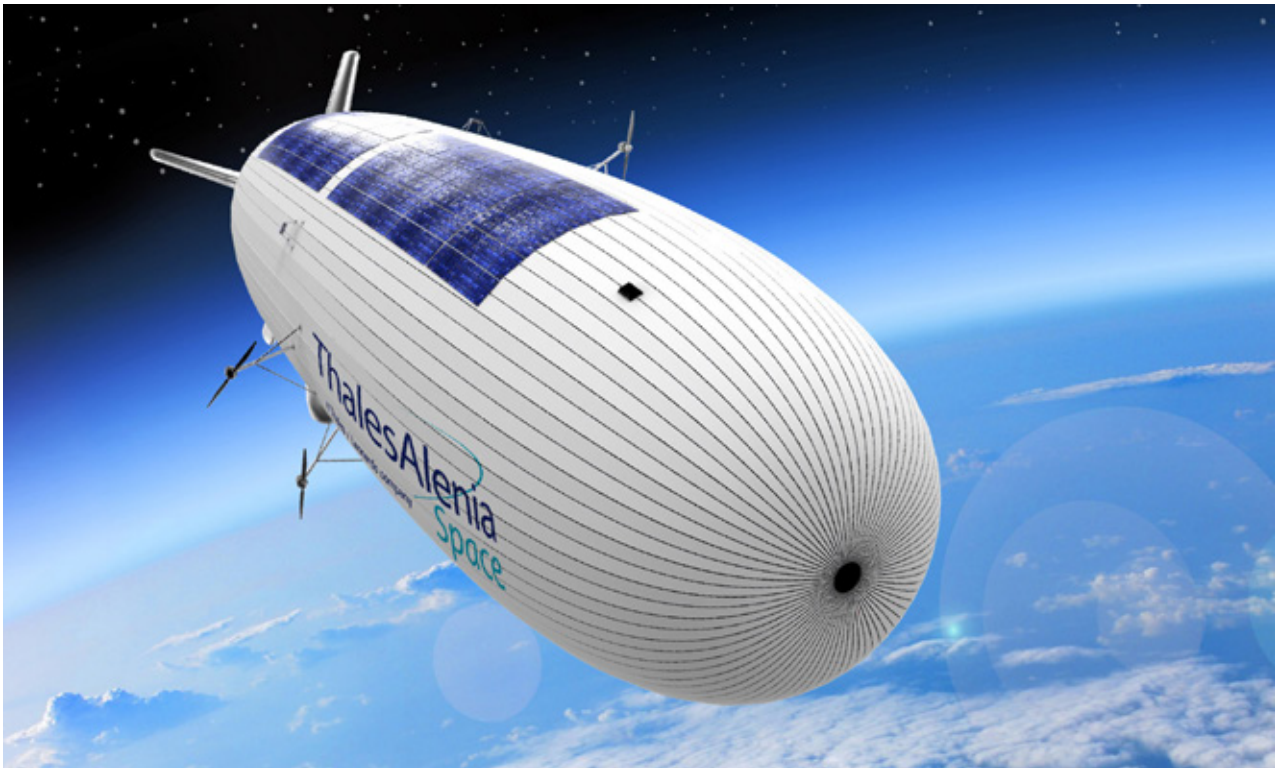
Capacity: **UNMANNED** | Payload: **450 KG** | Altitude: **65 000 feet** | Energy source: **Solar Energy**

Odysseus is the world's most capable, solar-powered, autonomous aircraft ready to deliver your mission from the stratosphere. This high-altitude pseudo-satellite (HAPS), Also known as a HALE UAV (High-Altitude, Long Autonomy) provides the biggest payload capacity available in solar aviation. This enables more missions and better resulting data quality from each mission at a fraction of the cost of a satellite.

Additionally, Odysseus operates far above the weather and other aircraft with the ability to cover a broad geographic area while keeping its station. Powered by advanced solar cells and built with light-weight materials, it has zero emissions and can be repositioned and reprogrammed as mission requirements and technology evolve.

Website: https://www.aurora.aero **Location:** Manassas, VA, USA

STRATOBUS by Thales Alenia Space



Capacity: **UNMANNED** | Payload: **450 KG** | Altitude: **65 000 feet** | Speed: **115 KM/H**

Autonomy: **Weeks** | Range: **WORLDWIDE COVERAGE** | Energy source: **BATTERIES / SOLAR**

Stratobus is an autonomous multi-mission stratospheric airship, in functional terms halfway between a drone and a satellite. Mainly designed for local or regional missions, Stratobus is the perfect complement to satellites. It's designed to fly at an altitude of 19 kilometers (above the jet stream and air traffic), and carry out various civil and/or military missions on a regional level, for telecommunications, navigation, observation, etc.

Stratobus offers real time, stationary satellite-like capabilities over wide areas of more than 1000,000km^2 for missions up to one year. Exclusively powered by solar energy, it flies autonomously, stroring during daytime the energy needed for the night. This airship will weigh nearly 8 metric tons and stretch 140 meters long, measuring 32 meters wide at its maximum diameter. In other words, for local missions extending to a horizon of 250 kilometers.

Website: www.thalesaleniaspace.com **Location:** Cannes, France

TRIFAN 600 by XTI Aircraft

Capacity: **6** | Payload: **816 KG** | Altitude: **29 000 Feet** | Speed: **480 KM/H**

Autonomy: **3.5 h** | Range: **1,240 KM** | Cost: **$ 6 TO 8 MILLION**

Using three ducted fans, the **TRIFAN 600** lifts off vertically and in seconds, the two wing fans rotate forward for a seamless transition to high-speed flight. Within just 90 seconds, the airplane reaches cruise speed – where the lift is provided by the wings just like every other fixed-wing airplane.

Thereafter, the fuselage-mounted fan, no longer needed, closes up. The airplane flies directly to its destination and reverses the process. Landing vertically right where it needs to be – wherever there is a clear helipad-sized paved surface.

Website: : http://www.xtiaircraft.com/trifan-600 **Location:** Englewood, Colorado

AIRLANDER 10 by Hybrid Air Vehicles

Capacity: **19 PEOPLE** | Payload: **10 000 KG** | Altitude: **19 500 Feet** | Speed: **150 KM/H**

Autonomy: **5 days** | Range: **7,408 KM**

The Airlander 10, the largest aircraft flying to day, is a hybrid airship designed and built by British manufacturer Hybrid Air Vehicles (HAV). Comprising a helium airship with auxiliary wing and tail surfaces, it flies using both aerostatic and aerodynamic lift and is powered by four diesel engine-driven ducted propellers.

The prototype was first named HAV 304 and was originally built for the United States Army's Long Autonomy Multi-Intelligence Vehicle (LEMV) programme. Thereafter, Hybrid Air Vehicles reacquired the airship and brought it back to England. It was reassembled and modified for civilian use, and in this form was predesignated as the Airlander 10.

Website: https://www.hybridairvehicles.com **Location:** Bedford, England

AERO	Goodyear
AERO-X	Aerofex
AS-2	Aerion
BARTINI FLYING CAR	Bartini
BEHA M1H	Faradair
BELL NEXUS	Bell
CITY HAWK	Urban Aeronautics
DRONE TAXI R-1	Hoversurf
DR-7	Delorean Aerospace
FLYTCYCLE	Flyt
MOBI-ONE	ASX
ONYX2	Aeronyx
POP-UP NEXT	Ital Design
PRANDTLPLANE	Parsifal
S-512	Spike Aerospace
SKYDRIVE	Cartivator
STARLING JET	Starling
TF-2	Terrafugia
UBER AIR AND SKYPORT	Uber Elevate
VY 400	Transcend Air
ZA10	Zunum Aero
OVERTURE	Boom Supersonic
X01	Electric Visionary Aircrafts



PROJECTS





« The following aircraft projects have been unveiled publicly and are in the early stages of product development. Some need fund-ing, while others are fully staffed with an R&D team. They are listed in alphabetical order. »

Please note that all specifications are estimated, please visit each company's website for official numbers.

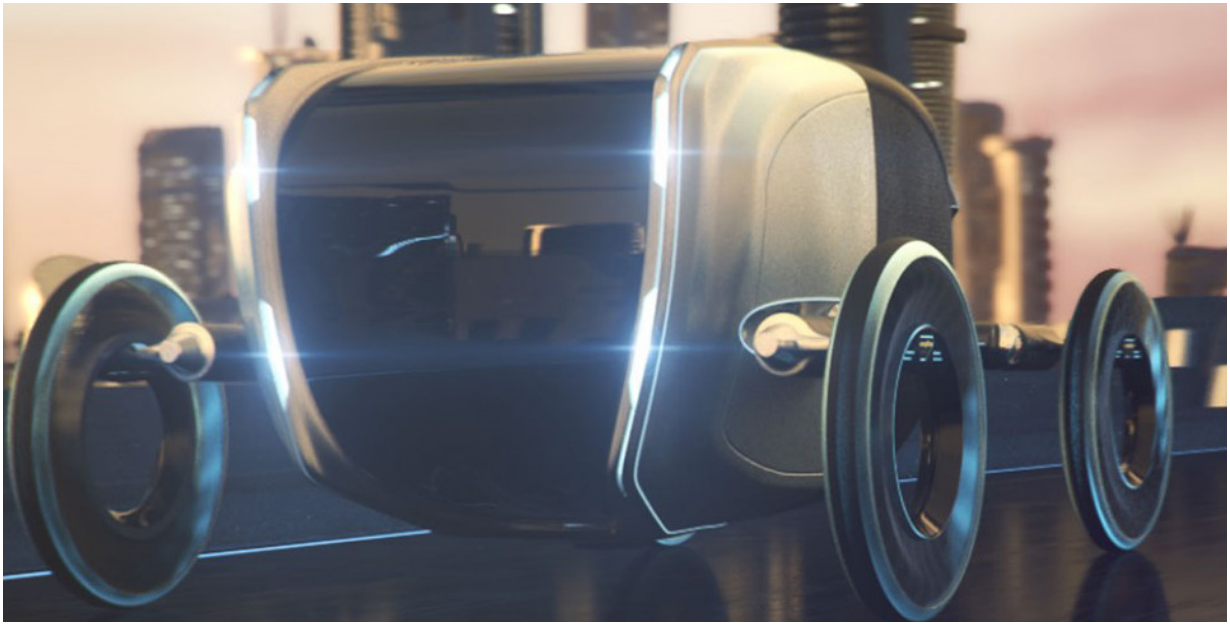









AERO by Goodyear



Concept: Goddyear **Released:** March 5, 2019

Thinking beyond the wheel

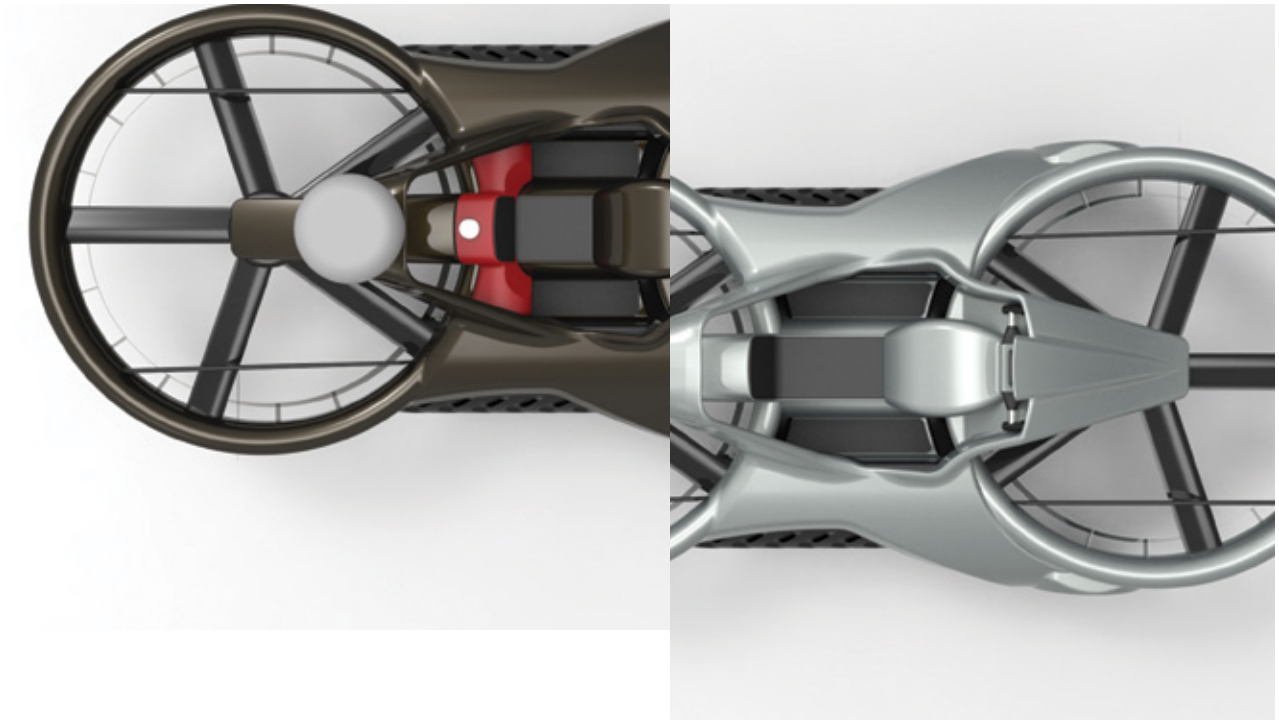
The AERO is a multimodal tilt-rotor concept. It would serve as a drive train to transfer and absorb forces to and from the road in a traditional orientation and an aircraft propulsion system to provide lift in another orientation. The concept's spokes would provide support to carry the weight of the vehicle and act as fan blades to provide lift when the tire is tilted.

The AERO would use magnetic force to provide frictionless propulsion. This would enable the high rotating speeds required to drive the vehicle on the ground and, when the wheel is tilted, lift a vehicle into the air and propel it forward. It would flexible enough to dampen shocks when driving on the road, and strong enough to rotate at the high speeds necessary for the rotors to create vertical lift.

The AERO would use light-based, fiber optic sensors to monitor road conditions, tire wear and the structural integrity of the tire itself. An embedded A.I. processor would combine information from the tire's sensors with data from vehicle-to-vehicle and vehicle-to-infrastructure communication. The A.I. processor would analyze these streams of data to recommend a course of action and identify and resolve potential tire-related issues before they happen.

Website: https://news.goodyear.eu/the-goodyear-aero--a-concept-tire-for-autonomous-flying-cars/

AERO-X by AEROFEX



Capacity: **2 PEOPLE** | Payload: **140 KG** | Altitude: **4 M** | Speed: **72 KM/H** | Autonomy: **75 min.**

Range: **1,5 KM** | Energy source: **AUTOMOTIVE GASOLINE** | Cost: **$85,000**

The **Aero-X** by Aerofex is a surface-effect craft that rides like a motorcycle but gets you off the ground. The air vehicle could be adapted for a variety of uses such surveying, search and rescue, border patrol, disaster relief, agricultural, ranching, and rural transportation.

Because it responds to people's movements just as a motorcycle would, the Aero-X is intuitive to fly. And as it is built with very few moving parts, its cost of ownership is a fraction of the most basic airplane or helicopter.

Website: https://aerofex.com **Location:** Manhattan Beach, CA, USA

AS2 SUPERSONIC BUSINESS JET

by Aerion

Aerion partnered with Boeing to accelerate supersonic travel and the AS2 supersonic business jet was created. Boeing will provide engineering, manufacturing and flight test resources, as well as strategic vertical content, to bring Aerion's AS2 supersonic business jet to market. This concept will help maximize the most valuable resource-time.

The AS2 will have the ability to fly up to 70 percent faster than today's business jets and will save approximately three hours on a transatlantic flight while meeting environmental performance requirements. The company outlined a goal of achieving product design review by June 2020, leading to a first flight of the AS2 in June 2023.

Website: https://www.aerionsupersonic.com **Location:** Reno, NV, USA

THE FLYING CAR by Bartini

Capacity: **4 PEOPLE** | Payload: **400 KG** | Altitude: **900 M** | Speed: **300 KM/H**

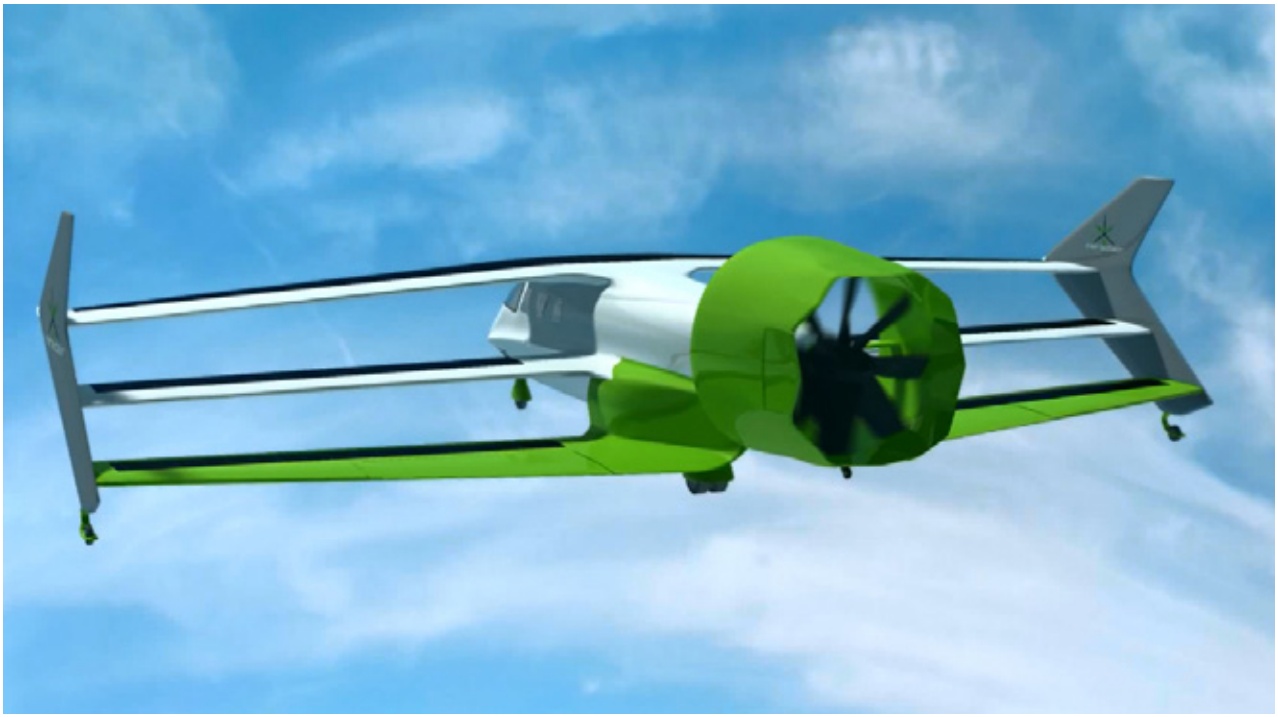
Autonomy: **30 min.** | Range: **150 KM** | Energy source: **ELECTRIC/HYDROGEN** |

Cost: **$100,000-120**

Start-up **Bartini** unveiled its VTOL concept in July 2017, announcing that it is working on two variants — a 2-seater and 4-seater — with the intention of providing an air taxi service. Bartini plans to launch the aircraft with a demonstration flight with the 4-seat version in 2020. The company is also considering hydrogen fuel-cells for the future, which would give it a 4x range increase.

Website: https://www.bartini.aero **Location:** Zhukovski, Russia

BEHA M1H by Faradair



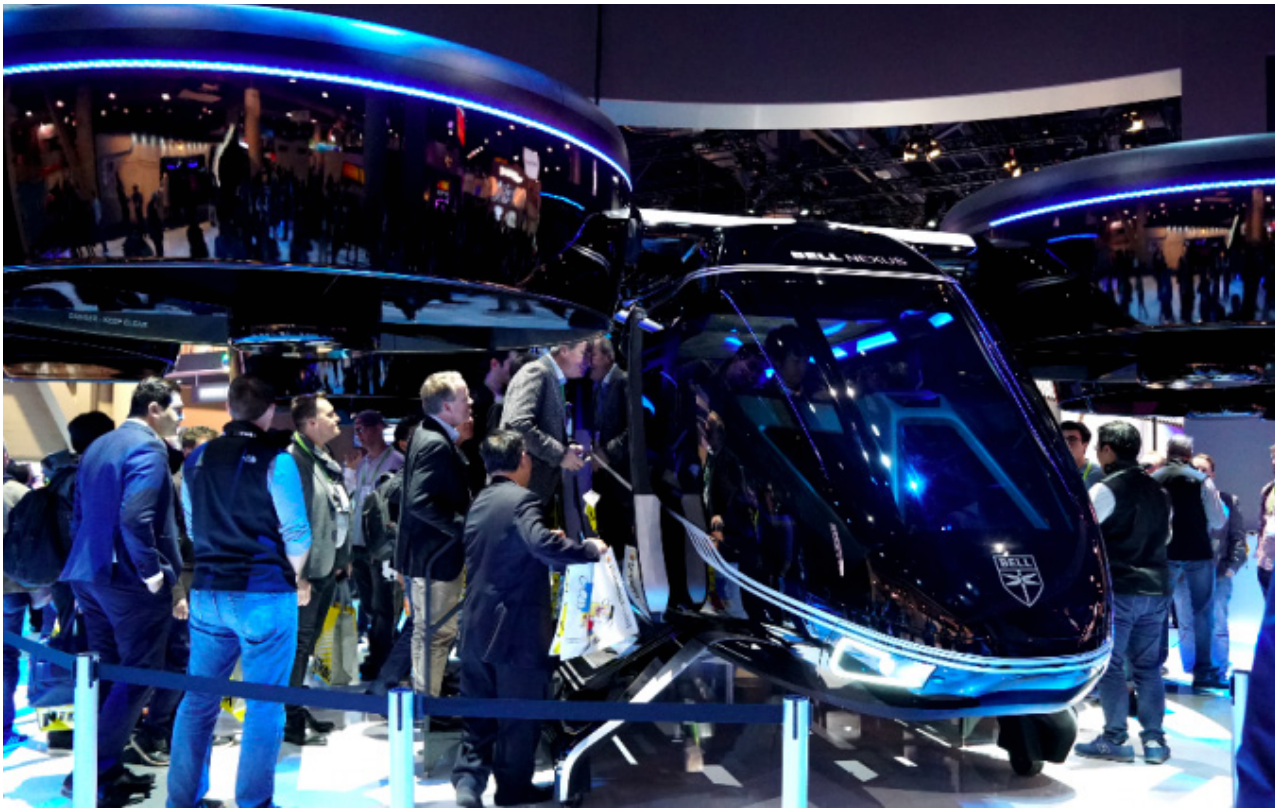
Capacity: **18 people** | Payload: **5,000 KG** | Altitude: **14,000 M** | Speed: **370 KM/H** |

Autonomy: **15 min.** | Range: **> 1,852 KM** | Energy source: **HYBRID** | Cost: **$4 MILLION**

The **BEHA** (Bio Electric Hybrid Aircraft) is a hybrid powered aircraft that utilizes a design patented 'Triple Box-wing' high-lift configuration, delivering Short Take-Off and Landing (STOL) capability requiring less than 300 meters of runway. Its hybrid propulsion system combining electric motors with a Turboprop engine will result in lower operating costs, lower emissions and increased safety redundancy. Furthermore, the aircraft will use existing battery technology for emergency power and ground operations. The BEHA M1H is expected to be launched by 2025 to the market.

Website: http://www.faradair.com **Location:** Cotswold's region in the UK

BELL NEXUS by Bell



Capacity: **5 people** | Payload: **2,720 KG** | Altitude: **: 76 m** | Speed: **288 KM/H**

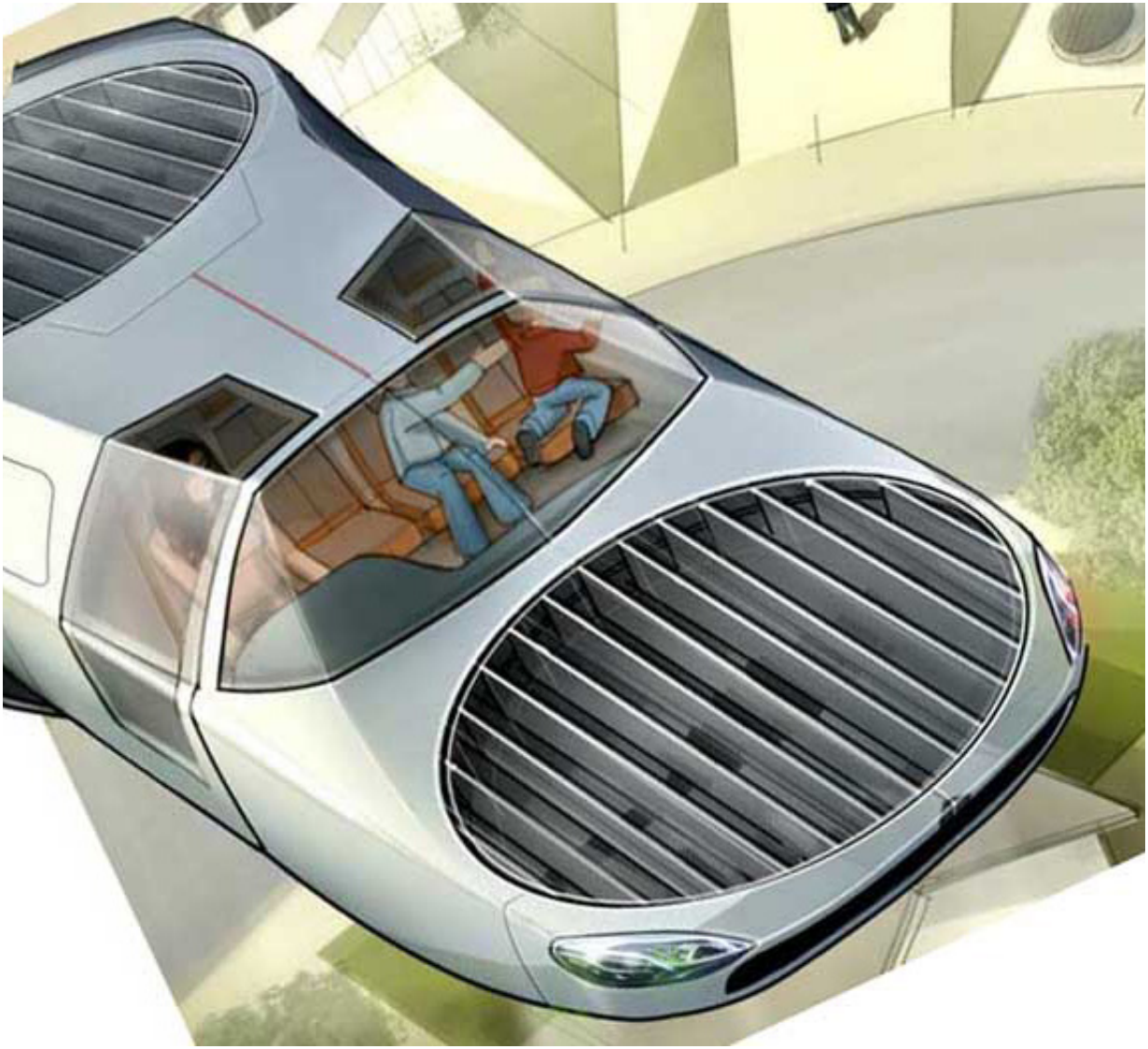
Autonomy: **: 60 min** | Range: **: 241 KM** | Energy source: **: Hybrid** | Cost: **: $0.8/KM**

The **Bell Nexus** is an air taxi vehicle which utilizes a hybrid electric propulsion system with six tilting ducted fans. The Nexus has been unveiled in the form of a full-scale mock-up at CES 2019 in Las Vegas, Nevada. However, a real one is reportedly under way at Bell headquarters in Texas, with flight testing said to start in 2023.

The Nexus captures the long-sought-after vision of quick air travel with a unique in-flight experience, keeping passengers connected to their lives and saving valuable time. Moreover, the company believes the Nexus will fit onto most traditional helipads, with a footprint under 12 m by 12 m.

Website: https://www.bellflight.com **Location:** Fort Worth, TX, USA

CITYHAWK by Urban Aeronautics



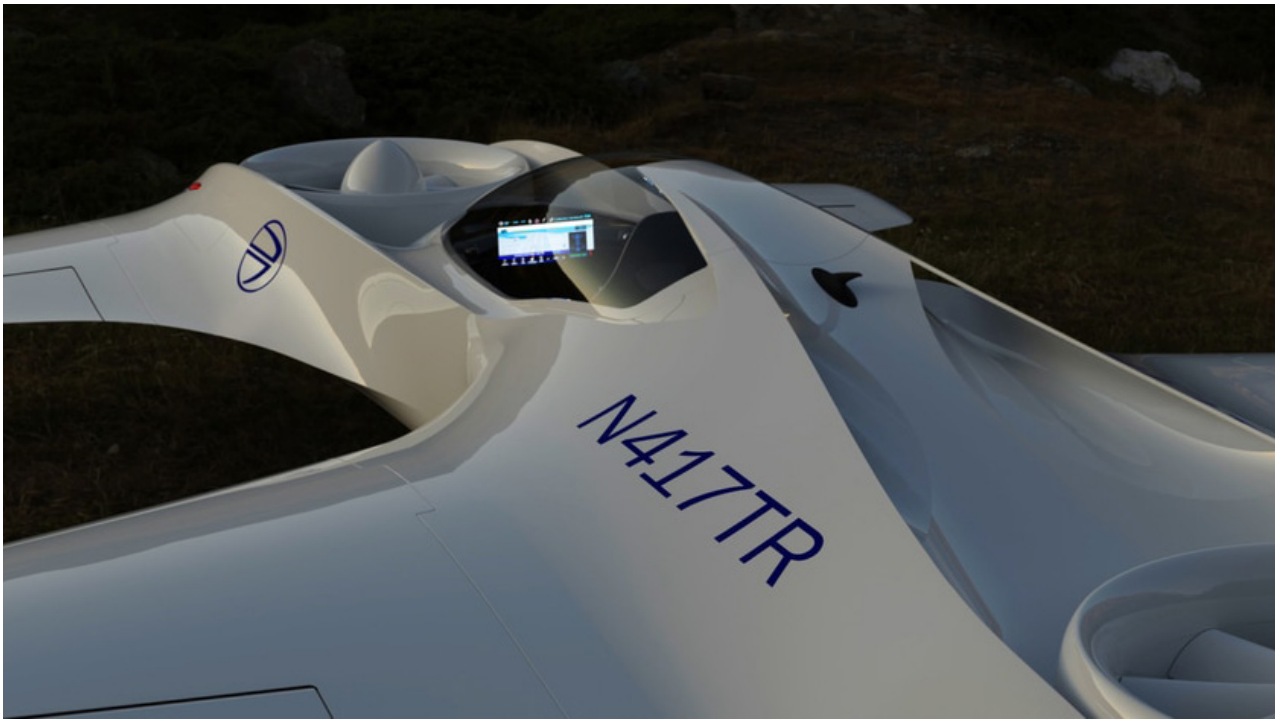
Capacity: **6** | Payload: **760 KG** | Speed: **250 KM/H** | Range: **150 KM** |

The CityHawk is Urban Aeronautics' flagship Fancraft model. A twin engine Fancraft designed to existing FAA standards including "Category A" takeoffs. It is built as one platform but has multiple configurations such as private/executive flying car, air taxi or emergency response.

As an Executive Aircraft for private/corporate use, CityHawk offers an exceptional "upgrade" in space and comfort and the convenience of being able to take-off and land just about anywhere. Likewise, as an air taxi, CityHawk's spacious cabin and minimal footprint results in more passengers per trip therefore in more arrivals and departures in real-time. Lastly, the Fancraft can also bring emergency services precisely where they are needed. Even to places that helicopters cannot be able to reach.

Website: http://www.urbanaero.com **Location:** Yavne, Israel

DR-7 by DeLorean Aerospace



Capacity: **2 people** | Payload: **2,720 KG** | Altitude: **3,048 m** | Speed: **241 KM/H**

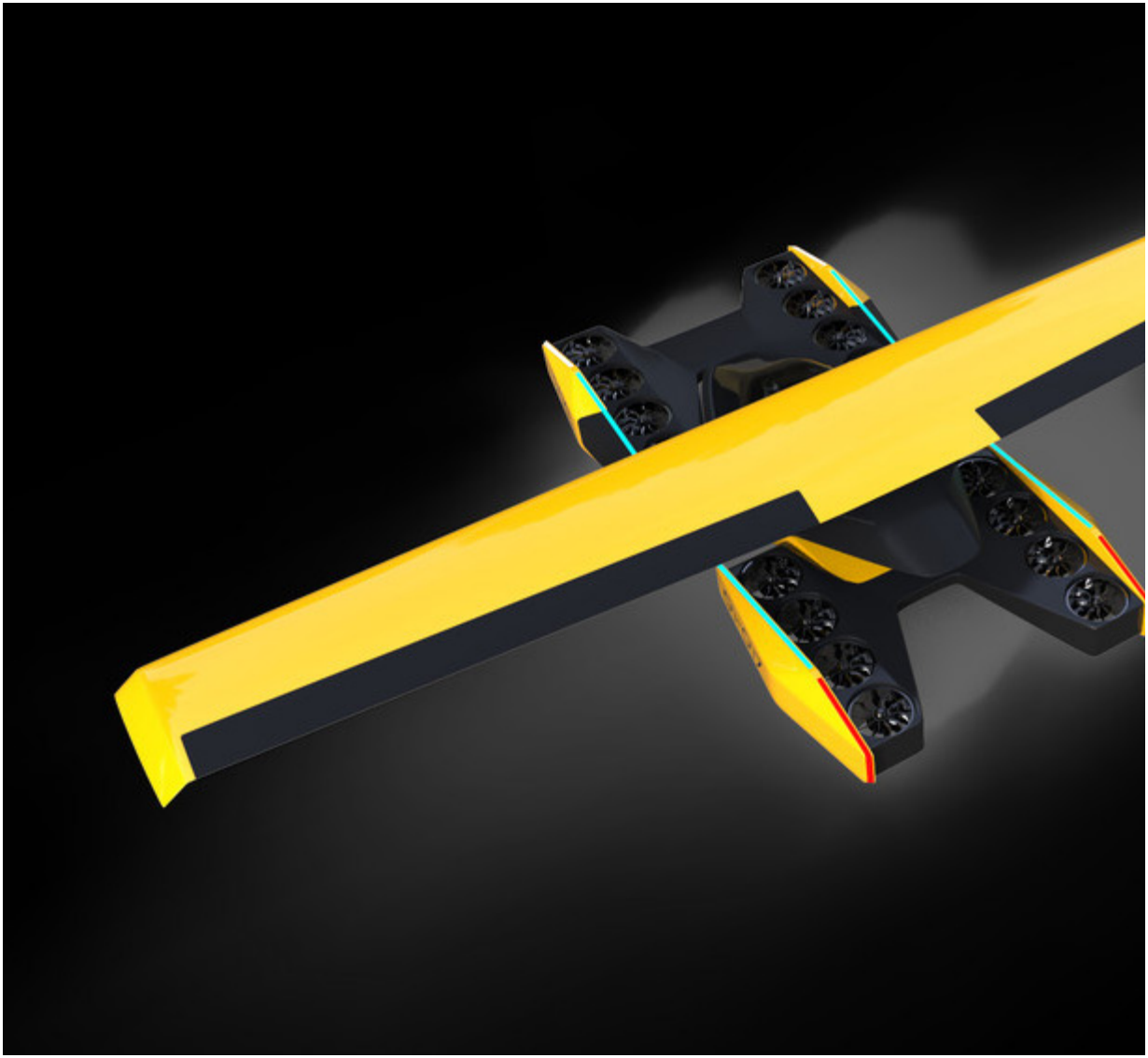
Range: **193 KM** | Energy source: **Electric** | Cost: **US$ 250,000-300,000**

Engineered for maximum efficiency, the **DR-7** is built like a formula one race car for the sky. The DR-7 features monocoque composite construction, an ultra-low drag body, and a tandem seating configuration. Weight is kept to a minimum for unrivalled performance and range.

Additionally, The DR-7 is fully electric and has been designed with a number of unique technologies to increase its safety and overall functionality. With an industry-first centreline twin vectoring propulsion system and stall-resistant canard design, this aircraft aims to be reliable and safe.

Website: http://www.deloreanaerospace.com **Location:** Orange County, California, USA

DRONE TAXI R-1 by HOVERSURF



Speed: **241 KM/H** | Autonomy: **1.2 hours** | Range: **300 KM** | Cost: **$0.29/KM**

The **Drone Taxi** is a lift-and-cruise or hybrid type of aircraft. Unlike other VTOLs, the Drone Taxi's systems are independent. If the wing fails, the copter will land. If the copter motors fail, the plane will allow you to glide and land. Hoversurf has also included an advanced ballistic parachute for emergency situations.

Further, the Drone Taxi will have a low noise level due to its use of venturi engines, which utilize noise-cancelling technology; and it will be able to take-off and land in an ordinary parking space, allowing the aircraft to access more landing spaces in cities.

Website: https://www.hoversurf.com/formula **Location:** California, USA

FLYTCYCLE by Flyt

Capacity: **1 person** | Payload: **110 KG** | Altitude: **2 m** | Speed: **60 KM/H** |

Autonomy: **30 min** | Range: **30 KM** | Energy source: **Electric/batteries** | Cost: **: $99,000**

The **FlytCycle** is an electric Over Terrain Vehicle (OTV) that will become Flyt's first production model. Flyt is at the forefront of re-imagining the way modern flight is perceived. No longer tied to our terrestrial surroundings, Flyt is designing airborne platforms to serve many different purposes.

The company is designing a VTOL aircraft with the lofty goal of making the world a better place. Whether you want to race your friends on a hover bike course, hail a vehicle to take you to work, or fly around for fun in your personal VTOL, Flyt is designing an aircraft for you.

Website: http://flytaerospace.com **Location:** Cupertino, California, USA

MOBI-ONE by ASX

Capacity: **5 people or 453 kg cargo** | Payload: **453 KG** | Altitude: **305 m** | Speed: **241 KM/H**

Autonomy: **26 min** | Energy source: **Hybrid-electric or full-electric** | Cost: **: $4 TO 6 / KM**

MOBi-ONE aircraft design merges the versatility of a helicopter and the speed; and the proven safety and efficiency of an airplane. Its key innovation is the use of Distributed Electric Propulsion (DEP) System which provides for quiet and scale-free propulsion where electric motors provide high power to weight, efficiency, reliability, and compactness at different scales.

ASX's mission is to make private air mobility accessible to everyone. By offering an eco-friendly, quiet and connected VTOL that leverages the perfect fusion of automotive grade and aviation technology, ASX can re-imagine the daily commute and give commuters time back to be more productive. MOBi-ONE will be operated initially with a pilot onboard and is expected to fly fully autonomous by 2030.

Website: https://www.iflyasx.com **Location:** Detroit, Michigan, US

ONYX2 by ASX

Capacity: **5 people or 453 kg cargo** | Payload: **453 KG** | Altitude: **305 m** | Speed: **241 KM/H**

Autonomy: **26 min** | Energy source: **Hybrid-electric or full-electric** | Cost: **: $4 TO 6 / KM**

The **Onyx2** is a fully electric and autonomous aircraft capable of vertical takeoffs and landings. Our concept is propelled by smalls electric ducted fans, which removes the hazard of large exposed blades, therefore making it safer and less intimidating for passengers.

This type of propulsion also allows sound supressing materials to be installed in the duct, to significantly reduce the sound generated by the fans. The Onyx2 is designed to be an air taxi operating in densely populated urban areas, where space is often limited. For this reason, the wings are equipped with our GLDTRK technology, allowing the wings to fold near the body to reduce the footprint.

Website: https://www.aeronyx.ca/ **Location:** Montreal, Canada

POP.UP NEXT by Italdesign
with collaboration of Audi and Airbus

Capacity: **2 people** | Payload: **600 KG** | Altitude: **: <3,000 m** | Speed: **100 KM/H**

Autonomy: **: 50 KM** | Range: **: 100 KM** | Energy source: **: Electric**

Pop.Up Next, is the evolution of the first fully electric and zero-emission modular system, designed to help resolve traffic congestions. The Pop.Up Next represents a vision of the potential offered by future technologies, the new concept of transportation and the new solutions for resolving the problems linked to city planning and traffic in large urban centers.

As the original 2017 project, the Pop.Up Next system aims to give time back to commuters, freeing them from the need to drive, through a flexible, shared and adaptable new way of moving within cities introducing a new user-focused transportation system concept.

Website: https://www.italdesign.it/project/pop-up-next **Location:** Moncalieri, Italy

PRANDTLPLANE by Parsifal

Capacity: **310 people** | Payload: **31,751 KG** | Altitude: **10,973 m** | Speed: **833 KM/H**

Autonomy: **17,280 min.** | Range: **: 4000 KM** | Energy source: **Jet Fuel**

The main objective of (Prandtlplane ARchitecture for the Sustainable Improvement of Future AirpLanes) (PARSIFAL) is to establish the scientific and engineering basis to improve civil air transport in the future by introducing an innovative aircraft, known as **PrandtlPlane**. The project is focused on the medium-size commercial aircraft category.

PARSIFAL is a consortium of both public and private bodies lead by UNIVERSITY OF PISA and the name PARSIFAL is the acronym of Prandtlplane ARchitecture for the Sustainable

Improvement of Future AirpLanes. «This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.723149»

European Commission | Innovation and Networks Executive Agency

Website: http://parsifalproject.eu **Location:** European Countries

S-512 by Spike Aerospace

Capacity: **18 PEOPLE** | Payload: **11,482 KG** | Speed: **MACH 1.6** | Range: **6200 NM**

Since 2013, Spike Aerospace has been designing and engineering the **Spike S-512** quiet Supersonic Jet. The company has spent thousands of hours studying various configurations and optimizing the aircraft's performance to meet the needs of very demanding customers and regulators. The design continues to be improved upon as they learn from further analysis and their first prototypes. The Spike S-512 is the only supersonic jet in development that will fly at twice the speed of other jets without creating a loud sonic boom. It will also be a fuel-efficient design.

Location: Boston, Massachusetts **Website:** http://www.spikeaerospace.com

SKYDRIVE by Cartivator

Capacity: **2 people** | Payload: **150 KG** | Altitude: **: 50 m** | Speed: **100 KM/H**

Autonomy: **20-30 min** | Range: **20-30 KM** | Energy source: **: Electric** | Cost: **: $45,228**

SkyDrive is a flying car with 8 counter-rotating propellers located at its four corners. Cartivator's goal is to light the Olympic flame with the SkyDrive at the 2020 opening ceremony of Tokyo's Olympics game and begin mass production in 2026.

Moreover, by 2050, the company aims to create a world where anyone can fly, anytime and anywhere. And for this to be possible, we would need a compact flying car with vertical take-off and landing technology that does not need roads and runways.

Website: http://cartivator.com

Location: Toyota and Tokyo, Japan

STARLING JET by Samad Aerospace

Capacity: **10 people** | Payload: **980 KG estimated** | Altitude: **9,100 M** | Speed: **740 KM/H**

Autonomy: **11,760 min** | Range: **2,414 KM** | Energy source: **HYBRID-ELECTRIC** | Cost: **$10 MILLION**

The Samad Aerospace **Starling Jet** is a Vertical Take-Off and Landing (VTOL) electric jet that will carry passengers on regional and short-haul flights. It is a fixed wing aircraft with a V-tail and three jet engines fixed above the wings and tail.

The Starling was first announced at the Singapore Air Show in February 2018 and has already generated substantial press, industry and market interests. Additionally, a 20% sized model completed testing in June 2018, a full-scale aircraft for tests is expected in 2019, and sales for the public are expected to begin by 2024.

Website: http://www.samadaerospace.com/starling-jet **Location:** Bedfordshire, United Kingdom

TF-2 by Terrafugia

Daily commute at 230 km/h

Capacity: **4 PEOPLE** | Payload: **544 KG** | Speed: **230 KM/H** | Autonomy: **4,680 min** |

Range: **300 KM** | Energy source: **hybrid-electric**

The TF-2 is designed to make travel by air and ground part of nearly everyone's daily commute. The vehicle is a three-part system that combines a passenger cabin that transfers between a road vehicle and an air vehicle. Therefore, passengers travel their full journey, through the air and on the ground, without having to switch vehicles along the way.

Additionally, the TF-2 will take off like a helicopter, fly an airplane, and drive on the roads using the latest technology in electric propulsion, construction materials and manufacturing processes to ensure safety and reliability.

Website: https://terrafugia.com/tf-2/ **Location:** Massachusetts, United States

UBER AIR & SKYPORT
by **UBER ELEVATE**

Uber's Elevate team is developing an urban aviation ridesharing product called **Uber Air**. A network of small, electric aircraft that take off and land vertically (called VTOL aircraft for Vertical Take-off and Landing, and pronounced vee-tol), will enable rapid, reliable transportation between suburbs and cities and, ultimately, within cities. Starting in 2023, Uber customers will be able to push a button and get a flight on-demand with Uber Air in Dallas, Los Angeles, and a third international city.

Website: https://www.uber.com/info/elevate **Location:** San Francisco, California

VY 400 by Transcend Air

Capacity: **6 people** | Payload: **998 KG** | Altitude: **4,600 m** | Speed: **652 KM/H**

Autonomy: **4,020 min** | Range: **724 KM** | Energy source: **Electric** | Cost: **$3.5 MILLION**

The **VY 400** is a single-engine vertical take-off and landing (VTOL) aircraft being developed by Transcend Air. Designed to deliver fast and cost-effective inter-city transportation, the aircraft offers three times faster and 50% cheaper journeys compared to similar-sized helicopters.

Moreover, the VY 400 requires no runway to take-off and land as its wing structure tilts vertically to enable the take-off and landing operations. The first flight is planned for 2021-2022 and the introduction to market for 2024.

Website: https://transcend.aero/aircraft **Location:** Rancho Santa Fe, CA, USA

ZA10 by Zunum Aero

ZA10 – Early 2020's aircraft

Capacity: **6-12 PASSENGERS, 1-2 PILOTS** | Payload: **1,454 KG** | Autonomy: **240 min** |

Powertrain class: **1 MW** | Generation class: **500 KW**

Zunum Aero is developing regional hybrid-to-electric aircraft and underlying propulsion technologies with disruptive economics over ranges from 700 miles at entry in 2023 to 1,500 miles by 2035. By scaling airliner-grade economics to mid-sized platforms and design for quiet door-to-door service to tens of thousands of secondary airports, our aircraft will usher in a new era of fast and affordable regional travel. Door-to-door journeys will be 2 to 4 times faster than today, reversing the stagnation of the past 50 years. Meanwhile, our hybrid-to-electric propulsion will place aviation on pathway to zero emissions on all short-haul departures by 2040, 50% of emissions generated by the sector, aligned with the goal set by the Norwegian government this year.

Website: https://zunum.aero **Location:** Bothell, Washington, U.S.

OVERTURE by Boom Supersonic

Capacity: **55-75 people** | Altitude: **18,288 M** | Speed: **2,335 KM/H** | Range: **8,334 KM** |

Energy source: **JET A (AND SUSTAINABLE EQUIVALENTS)** | Cost: **$200 MILLION**

Ouverture is a Mach-2.2 commercial airliner by Boom Supersonic that will be the fastest airliner ever created and history's most efficient supersonic jet. Overture will make supersonic travel mainstream and affordable, offering pricing comparable to today's business class. Its vision is to bring families, businesses, and cultures closer together through supersonic travel, making the world dramatically more accessible.

With over 500 daily transoceanic routes, Boom aims to fly passenger flights by the mid-2020s. Overture will only fly routes that are primarily over water--such as New York to London or San Francisco to Tokyo, flying supersonically over water and subsonically over land.

Website: : https://boomsupersonic.com **Location:** Denver, Colorado, USA

X01 by Electric Visionary Aircrafts (EVA)

Capacity: **2 PEOPLE** | Payload: **250 KG** | Altitude: **305 M** | Speed: **300 KM/H** |

Autonomy: **3,000 min** | Range: **250 KM** | Energy source: **Electric** | Cost: **$281,787**

The X01 was born from the thought of giving traffic a solution. Its folding wing architecture allows an efficient and battery-friendly safe travel; and its advanced dual battery solutions and capability to charge on the current infrastructure removes not only traffic from the ground but pollution from the air. Besides air taxi missions, the X01 can accomplish ultra-fast rescue requests. Its compact size allows landing in tiny areas where helicopters cannot go. Moreover, the X01 remote control capability and advanced sensors can rescue people and firemen trapped in wildfires.

Website: https://www.eva.xyz/x01 **Location:** Cugnaux, France

BY IMAGINACTIVE

Aeole
Aerostratos
Alkonos
Ambular
Arc Angel
Ascent
Blue Edge
Ekranoto
Elektra
Fountainhead
Glico
Katroli
Mistral
PDM25
Riwoka
Singapore special
Snowlifter
Transvolution

CONCEPTS









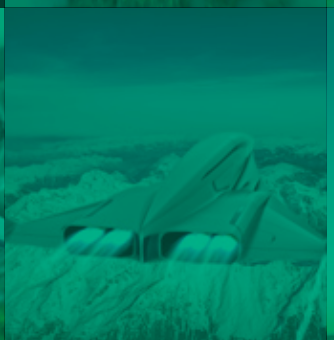
« The concept section provides a glimpse of what the future of aviation might look like. Some of these concepts aim to evolve into real projects others were solely created to inspire and foster discussions. Concepts are classified in alphabetical order. Please note that all specifications are estimated, please visit each company's website for official numbers.»












AEOLE by Imaginactive

Created by: Charles Bombardier **Designed by:** Jorge Ciprian **Imagined:** June 2019

Reach out new space with side-by-side vehicles

The Aeole is a radical SSV / eVTOL hybrid concept which combines both air and trail (A/T) capabilities, allowing powersports riders to reach new destinations and discover unexplored territories. This electric, autonomous, vertical take-off aircraft (eVTOL) would be designed to pick up and fly a fully loaded side-by-side vehicle (SSV) for a duration of 30 minutes.

The flying Aeole module could fly by itself to the nearest solar charging station using it's eVTOL capacity. When needed, the Aeole drone could be summoned from it's charging point to transport a side-by-side vehicle across a specific area. The powered Aeole unit could be rented and charged 'à la carte' based on the passage required, with units stationed near points of interest.

The Aeole might be the future of 3D powersport transportation. People could own powersports vehicles (Snowmobiles, ATV, PWC, SSV, Spyder, etc.) that could be transported across 'delicate' or 'hazardous' terrain with various types of eVTOL machines like the Aeole. You could use them to cross a lake by flying a few feet above the water or getting an air lift up a hazardous trail to a plateau, saving hours of impractical road travel, and only pay for the short 'hop'.

Website: Imaginactive.org/aeole

AEROSTRATOS by Imaginactive

Created by: Charles Bombardier **Designed by:** Ashish Thulkar **Imagined:** August 2018

A new century of airship travel?

The Aerostratos is a regional airship system designed to ferry passengers across regions of the world where roads are poorly maintained, clogged by traffic, or nonexistent. It includes a proposal to finance the deployment of regional docking stations and a way to simplify the whole flying experience.
The Aerostratos is more a vision than a concept. Imagine in the future that there are hundreds of airships like this one in operations around the world. They would dock on regional bases located on the outskirt of towns, on plateau and valleys inaccessible by plane. In large cities, they can dock on high-rise towers built especially for them. Further, the airship's docking bases would be designed to issue tickets, handle security, and process passengers very efficiently.

In addition, the front of the airship would be attached automatically by robotic grips and winches and smaller drones would be deployed to fix lateral mooring lines. The general goal would be to automate the docking process so it can be done in less than five minutes. The Aerostratos concept was created to make us think about and discuss the new generation of airships. How will they evolve into our airspace, how they will be used, and how can we

Website: Imaginactive.org/aerostratos

ALKONOS by Imaginactive

Created by: Charles Bombardier **Designed by:** Martin Rico **Imagined:** August 2018

Hybrid powerpacks engineered into eVTOL aircraft

The Alkonos is a radical VTOL aircraft concept that uses a distributed layout to power micro-propellers embedded in its wings. It could cover ten times the range of similar aircraft with its recuperated Brayton cycle ceramic turbine and ground effect capabilities. The Alkonos uses a hybrid powerpack made comprising a 250hp gas turbine that uses a recuperated Brayton cycle engine. and ion lithium batteries that would handle peak power demands during take-off (500hp+).

The turbine's blades would be made of alumina ceramic held within a composite rim to withstand internal temperatures of 1850 Kelvin, thus achieving very high efficiencies. Power from the turbine and batteries would be distributed to electric propellers embedded between the wing and the flaps. By using a distributive and hybrid power approach, it would be possible to increase the range of the Alkonos compared to other aircrafts.

The cockpit is roomy enough for two occupants and their luggage. Most of the flight would be automated.The Alkonos could be used to commute to work. It could also be used as an entry-level business aircraft. With its VTOL capacity, you would be able to land it directly on top of a tower equipped with urban airport facility.

Website: Imaginactive.org/alkonos

AMBULAR by Imaginactive

Created by: Charles Bombardier & Yuri Fattah **Designed by:** Martin Rico **Imagined:** November2018

Autonomous eVTOL ambulance to fly over traffic

The Ambular is a medical transit drone designed to ferry patients by lifting them in the air and carrying them over short distances. It would be used by paramedics anywhere to rapidly send patients to hospitals or medical care facilities simply by stabilizing them and pushing an existing stretcher inside like a regular ambulance.

The Ambular would be equipped with six rotating propellers with a diameter of 1.2 meters each. The props would be powered by electric motors capable of producing 50hp each. Since a patient plus a stretcher can weigh over 300 pounds, the Ambular should be able to lift them up and transport them over distances of a few miles at a speed of 50 knots. In addition, small jet thrusters could be used to provide an extra boost to the aircraft to get it airborne.

Even though the ergonomics will be a limitation, the main objective is for the vehicle to keep the patient alive during the transit and drop them off at the hospital.

Website: Imaginactive.org/ambular

ARCANGEL by Imaginactive

Created by: Yuri Fattah **Designed by:** Ashish Thulkar **Imagined:** December 2018

Surveillance and communication for natural disaster

The ArcAngel is an aircraft concept thought to provide surveillance and relay communication during the early stages of a disaster. However, it could also be used by scientists studying remote mountainous areas by providing 3D images in several wavelengths. The aircraft will initially be towed to its operational area by a transport plane. Once deployed, it will use thermal lift, ridge lift and wave lift to stay aloft.

In case of disasters near mountains, it can use wave lift to get up to 35, 000 feet by storing potential energy in order to glide down to the disaster area. Moreover, the ArcAngel would use its large propeller to convert wind into electrical energy to recharge its batteries
On top of that, more advanced versions of the ArcAngel would be able to use very high-altitude winds — even beyond 100,000 ft. Although, this would definitely require significant developments in new materials and energy storage technology.

Website: Imaginactive.org/arcangel

ASCENT by Imaginactive

Created by: Charles Bombardier **Designed by:** Ashish Thulkar **Imagined:** October 2018

An affordable rocket ride at your local spaceport

The Ascent is a portable rocket pod designed for spaceports as a thrill ride. It would allow space tourist to experience lift off and landings. The fuselage of the Ascent has a large glass door allowing passengers to view the scenery on the way up. It's also used as a large exit door when a skydiver reaches his desired 'freefall' altitude.
The base of the jet pod houses turbine jets which provide high power to weight ratio and create the thrust required to propel the Ascent at 150 km/h up to 15 000 feet. Once the pod has reached the desired altitude, it will automatically initiate a landing protocol. A custom trailer would be designed to manoeuver the vehicle in position and owners could transport it with a car. The Ascent would also be equipped with two parachutes and airbags.

The Ascent could be offered as an entry level ride at spaceport facilities. Would be space tourists could purchase a ticket ride to experience a brief but exciting lift off and landing without having to exit the aircraft. Such ride could provide a revenue stream and introduce

Website: Imaginactive.org/ascent

BLUE EDGE by Imaginactive

Created by: Drew Blair **Designed by:** Martin Rico **Imagined:** January 2019

A commercial jet flying at the edge of space...

The Blue Edge is a hypersonic aircraft concept that would fly at an altitude of 125,000 feet at Mach 10 —double the altitude of the Concorde. It could either be used to transport 220 passengers; or cargo. Which would take 90 minutes from the UK to Australia with hydrogen as a green fuel source.

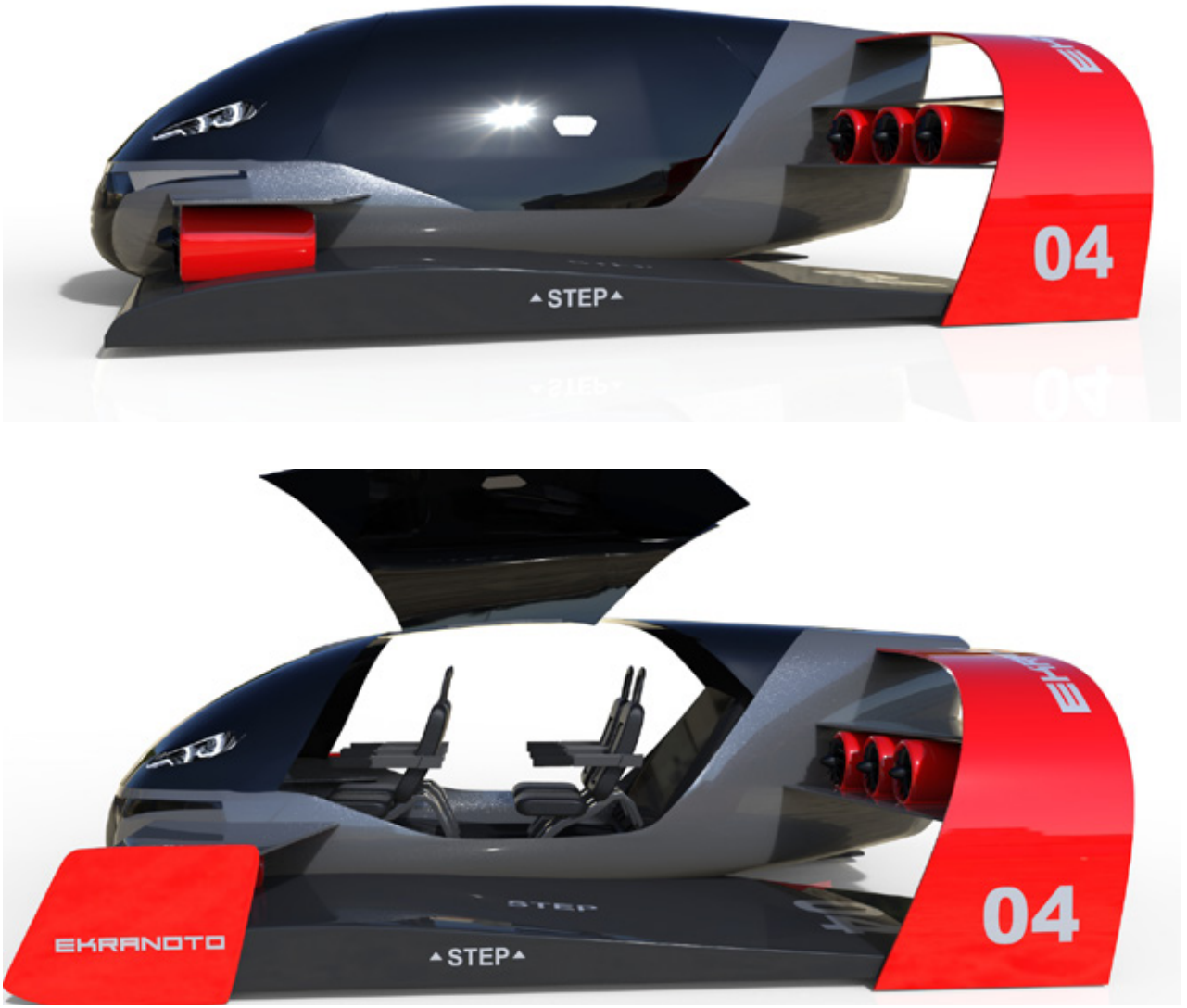
The concept was submitted to the ICAO innovation contest by Drew Blair, who gave it the name Blue Edge from the aircraft's ability to fly right on the edge of space. At this height, the full curvature of our 'blue planet' can be observed and the aircraft would slice through the stratosphere like a razor.

Furthermore, the foundation of the Blue Edge is a single-stage-to-orbit fixed wing aircraft. From an engineering perspective, the engines used in the Blue Edge are enough to push a Falcon 9 into orbit. For commercial flights, this means much lower throttling, which is more efficient and causes less stress on the scramjets during hypersonic velocity.

On cost basis and flight times alone, Blue Edge offers a more economical method of commercial travel. Coupled with the use of hydrogen fuel, it could lead to a massive reduction in hydrocarbons to help preserve our world for future generations.

Website: Imaginactive.org/blue-edge

EKRANOTO by Imaginactive



Created by: Charles Bombardier **Designed by:** Jorge Ciprian **Imagined:** February 2019

Flying down the highway...

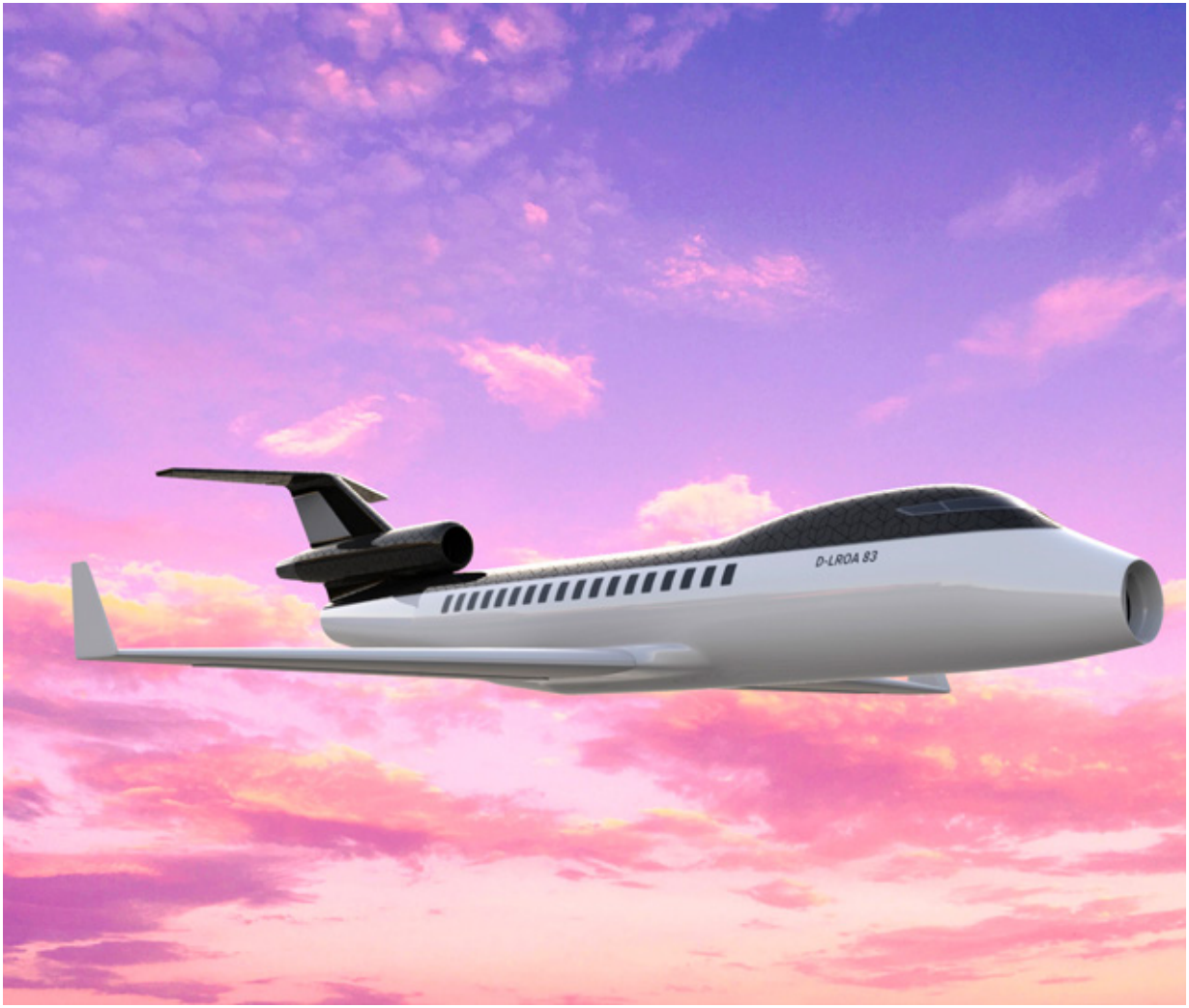
The Ekranoto is a gliding car concept thought to offer a seamless, comfortable and rapid method of transport. It would float on a cushion of air above the pavement like a ground effect vehicle. This notion would provide a completely smooth ride as it would essentially act as a shock absorber on a car which would be extremely beneficial to people with disabilities, doctors and paramedics.

The gliding car would be able to reach speeds over 300 km/h and would be the width of 1.5 or 2 cars, meaning it would take the full space of a two-lane highway. Moreover, it would have a single side door that could tilt up like a gull wing. Thus, part of the highway could be covered in solar panels to act as a green and renewable source of energy and recharge the vehicle 'on the fly'.

Even though the cockpit would be based on the seating arrangement of a standard car, it could also be adapted based on customers' needs. For instance, as a method of public transport, the Ekranoto would have long rows of seats for space maximization. Alternatively, the inner cabin may be converted into a high-speed ambulance that can care for up to two patients at a time.

Website: Imaginactive.org/ekranoto

ELEKTRA by Imaginactive



Created by: Charles Bombardier **Designed by:** Jorge Ciprian **Imagined:** March 2019

The first generation of eVTOL regional jet

The Elektra is a radical regional aircraft concept that uses a distributed system to direct air into its wings and take off vertically. It was inspired in part by the 1950's Ouragan, the Mystère IV Fighter jet and more recently, by the Lilium electric jet.

Power from batteries would be distributed to electric propellers embedded inside set of flaps. These electric propellers would pull the air over the wings and direct it rearward or downward depending on the flaps' position. A turbine installed within the tail section would be used to generate electrical power for the microprops as well as pushing and balancing the aircraft using thrust vectoring.

By using a distributive and hybrid power approach, it would be possible to offer new kinds of regional jet service compared to current models. For instance, when taking off or landing on a eVTOL pad, the Elektra could capture power momentarily from a ground transformer to save its onboard energy for a quick 10 minutes 'commuting' flight.

The Elektra could be developed as a new generation of regional jet. With its eVTOL capacity, it would be able to land directly on top of future commercial towers or inside suburb town.

Website: Imaginactive.org/elektra

FOUNTAIN HEAD by Imaginactive

Created by: Charles Bombardier **Designed by:** Jorge Ciprian **Imagined:** March 2019

A parking tower model for drones and flying cars

The Fountainhead is a futuristic building designed to serve as a parking tower for autonomous cars and VTOL electric drones like the EHang 216 and the Lilium jet. It could be designed for specific consumer needs and developed to have many new and interesting architectures to fit with the client's structural vision. Such as an urban airport for people commuting from their cottage during the weekend to their residence in the heart of the city.

Moreover, there would be incorporated into the building three different purpose elevator systems. The first one would be designed to bring the owners and their VTOL aircraft up to the take-off deck where they would easily be able to fly off; the second one, would be connected to the street level which would also allow autonomous cars to be parked in the multi-story building during flights; and finally, the Fountainhead would also contain elevators and stairs for passengers. A large lobby below the roof comprised of large panoramic windows offering a bird-eye view of the city along with units for coffee shops or restaurants, public areas, and a private waiting room have also been thought to be incorporated.

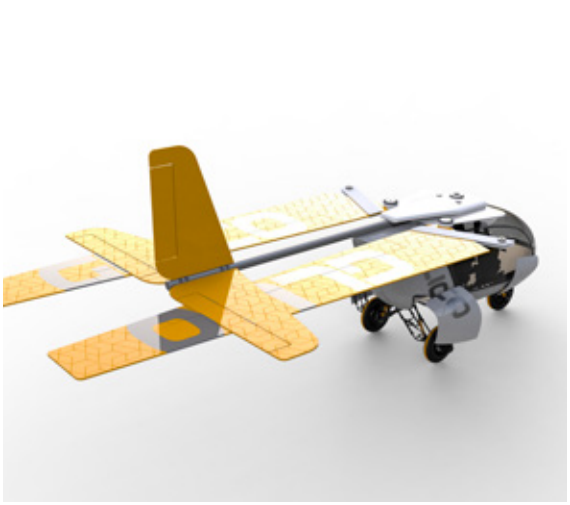
Furthermore, the Fountainhead may also be situated near or on top of a transport hub allowing commuters to park their cars further outside the city and avail of affordable public transport. Thus, reducing travel times, traffic and stress for commuters.

Website: Imaginactive.org/fountainhead

GLICO by Imaginactive

Created by: Marco Merens, Charles Bombardier **Designed by:** Jorge Ciprian
Imagined: September 2018

Simpliflying’ inside controlled airspace



The Glico is a next generation of autopilot / flight computer that would use the development and progress made with autonomous drones and cars to facilitate flying nearby or inside busy airspace. Nowadays, private pilots are basically not exploiting all the airspace they are entitled to use. Most of them avoid going into large and busy airports because the regulations are ever-changing and becoming increasingly complex. So, what if we could simplify things with connected and intelligent systems?

The Glico flight assistant would include an autopilot, communication system, cameras, and sensors. Moreover, The Glico’s flight computer would take over the controls of the aircraft when a pilot is passing into zones covered by the ATC or inside the airspace of busy airports by assisting at different levels at the discretion of each pilot (slight assistance up to fully autonomous flight).

For ground, approach and takeoff, would be similar to self-driving cars. The system would be able to handle the approach and comms at any airport, as well as descend and land by itself. Thus, the Glico would be able to reduce the throttle, brake, take an exit and taxi to the appropriate FBO.

Website: Imaginactive.org/glico

KATROLI by Imaginactive

Created by: Charles Bombardier **Designed by:** Jorge Ciprian **Imagined:** January 2019

Four technologies to create a new type of helicopter

The Katroli helicopter concept brings together four existing technologies, which have been successfully developed and implemented independently, and could now be combined to create a new generation of helicopters.

First of all, the Katroli's power source is electrical. The air is injected at the bottom of the stationary (non-rotating) mast. The air flows up inside the mast and out along the inside of the blades, with most of the air exiting from a nozzle mounted on the tip of each blade, allowing the blades to rotate. Each blade is attached to a hub equipped with sealed bearings to reduce air loss. This technology is called ¨Tip Jet¨.
The remainder of the air exits from thin slots along the trailing edge of each blade, modifying the air flow and pressure distribution around the blade and potentially yielding at least double the lift of a similar airfoil. This principle is known as "Circulation Control" (CC), the second Technology.

The third technology would be the Advancing Blade Concept (ABC), using two coaxial contra-rotating rotors to make use of the aerodynamic lift of the advancing blades. At high speeds, most of the load is supported by the advancing blades, offloading the retreating blades and eliminating retreating blade stall.
The fourth and final technology involved in the Katroli is ¨Command by Mast Tilt¨ (CMT), already used on Delta glides, Autogyros, and the Nolan light helicopter.

Website: Imaginactive.org/katroli

MISTRAL by Imaginactive

Created by: Charles Bombardier **Designed by:** Jorge Ciprian **Imagined:** January 2019

Camping with a flying RV...

The Mistral is a recreational eVTOL designed for backcountry camping. It would be powered by a hydrogen fuel cell and propelled by four rotors. Its lower storage space would be used for camping gear and outdoor sports equipment. Its propellers could be tilted up to serve as a windmill to store energy for the aircraft's batteries when it is parked for the night.

The Mistral was imagined as a futuristic recreational vehicle of the 21st century. It would be able to reach hard-to-reach spots inside national parks (like hidden valleys across mountains). It could be offered as an alternative to conventional helicopters and of course slow and road-limited RVs.

The Mistral would be designed to carry a family of 4 autonomously to any remote spots that are currently unreachable by land or water. Its lower cargo pod would come equipped with a custom designed tent that would easily attach itself to the Mistral. The seats of the aircraft would convert into a comfortable bed large enough to accommodate 2 adults, and the tent would feature two additional foldable beds.

The four propellers of the Mistral could be raised to capture wind and generate power or recharge the Mistral's batteries. It would also be possible to plug it into ground-based solar arrays (previously installed on the most popular sites).The Mistral would be designed to fly autonomously to specific spots using preapproved flight routes, which would reduce the risk of incidents. It would also be possible to purchase a version certified for private pilots.

The Mistral could be operated by national parks to allow campers to access new hard to reach campsites. It could also be used to fly to existing ones faster. This kind of aircraft could also be acquired by companies to transport wealthy tourists on daily outdoor excursions or sold to private owners. Additionally, the vehicle could double as a search and rescue air ambulance for emergency responses.

Website: Imaginactive.org/katroli

PDM25 by Imaginactive

Created by: Charles Bombardier **Designed by:** Martin Rico **Imagined:** February 2019

Integrating eVTOL landing pads into urban revitalization projects

PDM25 is a futuristic 'microairport' concept that would be located at Pointe-du-Moulin in the heart of Montréal's waterfront. Electric personal aerial vehicles like the Lilium, the Blackfly and the Hoversurf, arriving from nearby cities, provinces and states would be able to safely fly and land on its rooftop pads autonomously. Company executives, clients and board members would also be able to meet in its high tech conference room designed for the decentralized office of the future.

In February 2019, the Canadian government, the Canada Lands Company and the Old Port of Montréal requested a call for proposals for the revitalization of the Pointe-du-Moulin and Silo 5 sector. The PDM25 concept was thus created as a vision that will breathe new life into the area and become an emblematic project for the city while conserving the site's architectural heritage.

The PDM25 proposes a 'touch & go' service allowing passengers of autonomous aerial vehicles to land on the rooftop's landing pads. The building complex would feature 10 floors of new office space. The existing silos would be converted into premium boardrooms equipped with the latest AI-enabled conference technologies. This transport hub would allow executives to meet with their teams, clients and board members using AR/VR to review projects and conduct live meetings and business in a decentralized way.

The PDM25 would be connected to Montreal's REM Peel Basin train station. Elevated rapid moving walkways would allow travellers to reach Montreal's downtown district and the Quartier des spectacles within a few minutes. The whole site would also be connected directly to Montreal's projected baseball stadium.

Montreal is one of the world's leading cities for the aerospace industry. The Pointe-du-Moulin site would make an excellent test bed to develop, improve and demonstrate how we can integrate personal aerial vehicles with infrastructure related to urban mobility (light rail trains, elevated walkways, autonomous cars, etc.). The PDM would also provide a test for regulations, air traffic management, etc.
The conversion of the silos into high tech boardrooms and the construction of office floors dedicated to decentralized company HQ would also bring new life into the area.

Website: Imaginactive.org/pdm25

SINGAPORE SPECIAL by Imaginactive

Created by: Charles Bombardier **Designed by:** Martin Rico **Imagined:** February 2019

A hypersonic ‘business scramjet’ concept

The Singapore Special aircraft concept would fly at an altitude of 90,000 feet at Mach 2.5 and transport 18 passengers from New York to Singapore under 6 hours using hydrogen as a fuel source. It was inspired by the Blue Edge concept and was created to inspire future engineers and designers to create the next generation of faster business jets powered by greener fuels.

The Singapore Special will be able to fly at speeds of 1,650 mph at an altitude of 90,000 feet. This aircraft also reduces weight by having a lighter landing envelope. At Mach 2.5 and with a 10,000+ mile range, the aircraft could be on the other side of the planet in less than 6 hours. This is beneficial not only for commercial travel, but also during emergencies. The Singapore Special will be able to transport people away from areas of danger or deliver relief supplies faster.

In subsonic, The Singapore Special could cruise at Mach 0.95-0.99, which would result in 20% faster regional flights and thus lower operating costs. The main gear will use load-tensioning brakes (similar to train locomotives), which reverse polarity. This provides rapid braking capability without the possibility of catching fire.

Website: Imaginactive.org/singapore-special

RIWOKA by Imaginactive

Created by: David Scorer **Designed by:** Martin Rico **Imagined:** March 2019

A walk-in VR experience

Each chair is aligned beside a huge screen so that passengers can view stunning panoramas as the aircraft flies across the world. The screen displays the curated exterior views of the terrain below, filmed previously at low altitude by drones. The screen could also show live views of the sky or relaxing bird's eye view clips.

Wall panels are engineered with the latest noise absorbing materials. Noise and vibration cancelling systems would be integrated inside the fuselage near the jet engines, and each passenger would be able to adjust their personal ambient lighting. Finally, hyper-directional speakers could limit sounds around the head of each passenger, eliminating the need for headphones or earplugs.

Holographic projectors could display 3D shows right in front of the passenger. The ticket price would include everything without hidden fees or add-ons, including unlimited high speed Wi-Fi to stream movies on your tablet.

In the premium version, the goal is to help passengers really relax and enjoy their flight, so service is provided by flight attendants who actually know you based on your smart traveller's preferences. The system uses machine learning to improve service based on current and past experiences from booking to luggage claim. It can detect and predict your moods and emotions to work in combination with flight attendant and airline personnel feedback.

Website: Imaginactive.org/riwoka

SNOWLIFTER by Imaginactive

Created by: David Scorer **Designed by:** Martin Rico **Imagined:** March 2019

A new vision for Heliskiing

The Snowlifter is a 6-8-person drone for backcountry skiing and snowboarding access with six rotors and storage space for batteries and equipment. It would be an alternative to conventional helicopters and ski lifts that also has mountain rescue and avalanche response capabilities as a secondary but equally important role.

The Snowlifter concept was created to inspire future engineers and designers to design and build a revolutionary way of serving in hard-to-reach zones in the mountains to pick up, drop off, or rescue skiers and snowboarders.

The Snowlifter would shuttle passengers from a low altitude pick-up point to high altitude drop-off points. It would then return to its departure point or another preprogramed location to wait for the next pick-up. It would enable skiers and snowboarders to access terrain that is not served by conventional ski lifts, offering an alternative to conventional helicopters and cat skiing operations.

The drones could be operated by resorts, independent companies, or wealthy private owners, with year-round usage for heli-biking, backcountry expeditions, skiing, snowboarding, mountain rescue and avalanche response capabilities.

Website: Imaginactive.org/snowlifter

TRANSVOLUTION by Imaginactive

Created by: Charles Bombardier **Designed by:** Martin Rico **Imagined:** March 2019

Flying to work and driving on week-ends

The Transvolution is a radical concept which combines both air and road travel allowing passengers to reach their city centre destinations much more quickly and efficiently. The concept tries to envision a way in which autonomous electric cars and air travel can be combined. The vehicle would be designed around a central cabin.

A ‘drone wing’ could detach itself easily from the cabin and fly to the nearest charging station using its eVTOL capacity. The car’s lower base would be similar to an electric sports car designed for road use. The autonomous base of the Transvolution would be engineered to capture the cabin and lock it in place. When needed Transvolution wings could be summoned from their charging point. Same principle would apply to the autonomous base. The cabin could thus be the property of the owner while the powered unit (Wing or car base) could be rented and charged based on time and energy required.

The Transvolution might be the future of intermodal transportation. People could own cabins [cockpits] that could transpose on various types of machines including trains and hydrofoils. Maybe this concept could also be scaled down for powersport application. (See the Aeole).

Website: Imaginactive.org/transvolution

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VISIONARY AIRCRAFT
CONCEPT OR PROTOTYPE?

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Photo: Christine Muschi

ABOUT THE AUTHOR
CHARLES BOMBARDIER, ing. C.Dir. M.Sc.A.
FOUNDER, IMAGINACTIVE

Charles Bombardier holds a master's degree in mechanical engineering from the École de Technologie Supérieure. In 2013, he founded Imaginactive, a NPO whose mission is to imagine concepts on the future of mobility with designers, inventors and scientists. In 2017 Charles started collaborating with the International Civil Aviation Organization to create a vision on the future of aviation. Charles currently works on his Ph.D. in engineering at the University of Sherbrooke, he's also an active angel investor and he sits on the Board of Bombardier inc.

ICAO