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AAM Report

ASIA-PACIFIC

1H 2023

Features

EVTOL OEM OVERVIEW
JAPAN COUNTRY PROFILE
PSYCHOLOGICAL FLIGHT PATH
TRAINING EVTOL PILOTS
HONEYWELL
MAEVE
AIRTAXI 2023

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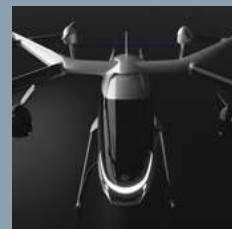
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SD-05

PUBLISHER'S NOTE



A significant change has taken place in the aerospace industry over the course of the past 12 months. Almost every single major airshow and conference across the world has included eVTOL manufacturers in their lineup of exhibitors and speakers.

Alongside this, traditional aerospace OEMs are banging the drum about their role in the growing sector by displaying their wares in the ecosystem, be it air traffic management control systems, airframes or electric propulsion systems.

One of the most anticipated worldwide events, will of course be the World Expo 2025 in Osaka, Japan. This is expected to be a major milestone for the AAM industry with many players racing to be the first to reach full commercialization in Japan. This is not limited to Japanese companies, as EHang, Wisk and Skyports have all stepped up to be included. This issue of the AAM report includes a feature about the Osaka World Expo which explains what the excitement is all about.

For our Asia-Pacific coverage of the eVTOL manufacturers, we set some parameters and criteria for the selection process. We set the cut-off date for our data at March 31, 2023 and included those OEMs with their headquarters in Asia-Pacific and that are actively engaged in the development of passenger eVTOLs or hydrogen VTOLs. In addition, these OEMs must already have built a demonstrator or prototype that was at least 1/4 scale in size as of the data cutoff date. Since our last edition, one notable new entrant is Neo Aeronautics from Singapore now has a full scale multicopter prototype which is primarily being tested in the United States.

As with our previous reports, we look at the background of each OEM and the aircraft they are developing at their various stages of prototyping, detailed design and testing. We cover the certification progress for the aircraft, funding for the company, orders that have been placed or order intentions that have been agreed, and the significant partnerships they have established. All of these factors being important to determining their ability to deliver models into production and commercial use within the next few years.

With Global Sky Media's 'global coverage' we decided to also investigate some of the up-and-coming eVTOL OEMs from Europe and MENA. Everyone knows about Airbus, Lilium and Volocopter, but have you heard of emerging players like eMagic from Germany or UMILES from Spain? We share their backgrounds, aircraft models and major milestones. You can find the data later in the report.

We have included a number of feature articles in this edition. For the first one, we decided to take a look at an area much considered for public acceptance which is the psychology of human beings when it comes to their perception of new modes of transport and in our case, first piloted eVTOLs and then autonomous ones. We interviewed Prof. Dr. Patrick Planing, Business Psychologist at Stuttgart University of Applied Sciences who explains the many different facets, technical and psychological, that need to be addressed in order to change peoples' perceptions and instill the confidence to fly. You can ask yourself the question of whether or not you would stand in line to be on one the first commercial flights coming soon to a Vertiport near you.

We already know that trained pilots are in shortage around the world for traditional rotorcraft, but what is happening to prepare for the explosion of eVTOLs that will emerge during the next decade for urban and regional mobility in missions ranging from search and rescue, emergency medical services, cargo and passenger transport? The development of training centers and the cost of training each

SPECIAL THANKS TO OUR CONTRIBUTORS



pilot may be prohibitively high to reach demand in the short term. The question is also raised that if the ultimate goal for eVTOL OEMs is to deliver unpiloted vehicles, who would want to train hard for a limited career life span? Our feature on 'Training the Next Generation of eVTOL Pilots' takes a look at the possible scenarios.

To provide a broader view of AAM, we also interviewed Joost Dieben Co-founder & Chief Commercial Officer of Maeve Aerospace. Electric airliners do fall under AAM and Maeve is building what is, at the time of writing, the biggest announced fully electric airliner. A significant opportunity for Maeve includes countries that are actually starting to ban domestic flights or ban short-haul flights to meet carbon emission reduction targets of 2050. Island countries like New Zealand and the Philippines will also be suitable territories due to the quick replacement of traditional short haul aircraft.

Our last feature is an interview with Jia Xu, CTO Honeywell UAM & UAS. For the past three years, Honeywell's UAM and UAS unit has been actively developing electric propulsion systems for eVTOLs. A clear differentiator for them is the ability to release motors that are fully integrated with avionics and fly-by-wire systems, which are an indispensable part of the whole operation system for electric aircraft. Honeywell recognizes that achieving excellence with these new flight technologies cannot be achieved in isolation and so are working closely with companies including Lilium, DENSO, Archer and Supernal in developing electric motors and achieving specific goals like safety and noise.

We hope you enjoy this latest AAM Report which was carefully compiled by our enthusiastic and committed analysts and reporters.



Sincerely,
Tan Rahman
Publisher
Global Sky Media

PUBLISHER

GLOBALSKYMEDIA

EDITORIAL & MARKET RESEARCH

Alud Davies
Ben Mirwani
Casper Zhuang
Jeffrey Tang
Liana Liu
Mia Yao
Samuel Gao
Tan Rahman

DESIGN

Amy Liu-Lhuissier
Zoe Xiao

ADVERTISING/ENQUIRIES:

Joey Wong
jwong@globalsky.media
(852) 9199 7751
www.globalsky.media

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ASIA- PACIFIC eVTOL OEMS

The Advanced Air Mobility sector presents a broad range of applications other than passenger carrying purposes, including agricultural, surveillance, cargo, and military uses. To ensure and maintain consistency in our core focus, we concentrate solely on presenting a subset of the AAM sector over developments in both crewed and uncrewed passenger carrying aircraft in this report.

This section will introduce the Asia-Pacific manufacturers that are actively developing passenger-grade eVTOL or hybrid-electric VTOL projects as of March 31, 2023. The exception to this is Alauda, whose racing eVTOLs demonstrate the sector's broad diversity. All OEMs presented in this section are headquartered in Asia-Pacific, and all have a 1/4 or larger scale demonstrator/prototype.



APAC OEM OVERVIEW

As of March 31, 2023, the Asia-Pacific region boasted a total of 17 original equipment manufacturers (OEMs) actively engaged in the development of passenger eVTOLs or hydrogen VTOLs. Notably, all OEMs had a demonstrator or prototype that was at least 1/4 scale as of the data cutoff date. The chart below summarizes the OEMs and their passenger eVTOLs that have a 1/4 or larger scale demonstrator or prototype. MuYu Aero also has a production model called VJET-7 that has a 1/5 scale prototype. ZEROG has two more production models under development: the ZG-VC2 and the ZG-T6.

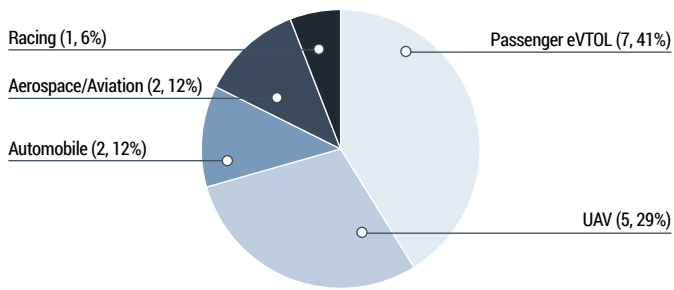
OEM	Country	Project Launch Year	Specified Funding (USD)	Production models
AEROFUGIA	China	2020	Undisclosed	AE200
Alauda Aeronautics	Australia	2016	\$30,264,813	Airspeeder Mk4
AMSL Aero	Australia	2017	\$35,000,000	Vertiia
AutoFlight	China	2017	\$100,000,000	Prosperity I
EHang	China	2014	\$164,000,000	EH216-S/VT-30
Frogs Indonesia	Indonesia	2017	Undisclosed	Frogs 282
KARI	South Korea	2019	\$37,170,276	OPPAV
MuYu Aero	China	2018	Undisclosed	EV-4
NEO Aeronautics	Singapore	2018	Undisclosed	Crimson S8
Pantuo Aviation	China	2019	Undisclosed	PANTALA Concept H
SkyDrive	Japan	2018	\$120,193,091	SD-05
TCab Tech	China	2021	\$24,415,650	E20
teTra aviation corp.	Japan	2018	\$4,229,093	Mk-5
Vertaxi	China	2021	Unspecified	Matrix1
Volant Aerotech	China	2021	Unspecified	VE25
XPENG AEROHT	China	2013	\$1,327,312,228	X3
ZEROG	China	2021	Unspecified	ZG-ONE

In addition to these OEMs, there were other companies that had created smaller-scale demonstrators or prototypes. For instance, Vinata Aeromobility in India and Honda in Japan were among those that had developed scaled-down models. Furthermore, certain companies that previously focused on passenger eVTOL models have since shifted their attention to other products, such as Aeronext in Japan. The South Korean government conducted the Korea's Urban Air Mobility (K-UAM) Concept Operations, which encourage new OEMs to enter the market. South Korean company, PLANA, is making progress on the sub-scale airframe development and performing various tests for demonstration, and airworthiness.

Within the group of 17 passenger-grade eVTOL OEMs discussed in this section, a notable portion of seven companies focused exclusively on passenger aerial vehicles. Interestingly, approximately 29% of the OEMs were also involved in the development of unmanned aerial vehicles (UAV) and had plans to leverage the technologies and experiences gained from their drone projects in the development of passenger eVTOLs.

Two companies, AEROFUGIA and XPENG AEROHT, received backing from automobile manufacturers Geely and XPENG, respectively. This highlights the potential collaboration between the automotive and eVTOL sectors.

OEMS BY CLASSIFICATION



The South Korean government funds the Korea Aerospace Research Institute (KARI), which works on a variety of projects, including those involving rockets, helicopters, satellites, unmanned aircraft systems (UAS), and lunar exploration. Prior to embarking on passenger eVTOL projects, both KARI and MuYu had already constructed aircraft, showcasing their expertise in aviation.

It is worth noting that Alauda stands out as the only OEM dedicated solely to racing aerial vehicles, highlighting its niche specialization in this exciting field.

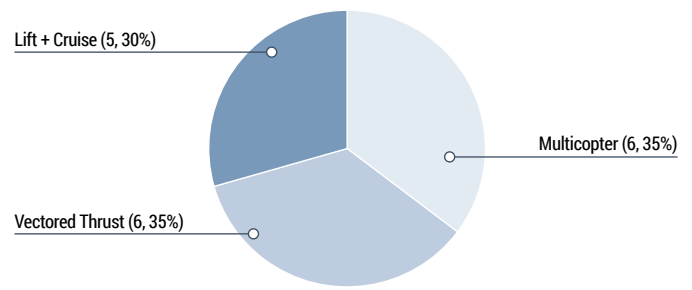
EVTOLs are typically classified into three categories: Multicopter, Lift + Cruise, and Vectored Thrust. Within the Asia-Pacific region, most OEMs are actively engaged in the development of at least one production passenger eVTOL model. However, there are a few OEMs that are working on two or even three models concurrently.

EHang, for example, is focusing on the development of both a Multicopter and a Lift + Cruise model. However, the emphasis is leaning towards its Multicopter EH216, which has made significant progress in its certification push, which is almost 90% at the time of writing.

MuYu Aero is conducting tests on a full-scale Lift + Cruise eVTOL demonstrator as well as a 1/5 scale Vectored Thrust demonstrator. This demonstrates its commitment to exploring multiple eVTOL configurations. ZEROG has outlined its plan to develop eVTOLs in three different configurations. Notably, its Multicopter model has already reached the full-scale prototype stage.

The accompanying diagram illustrates the eVTOL model that has made the most substantial progress for each OEM. It is worth noting

OEM'S MAIN MODEL BY CONFIGURATION



that the models are evenly distributed across the three categories of Multicopter, Lift + Cruise, and Vectored Thrust, highlighting the diverse range of approaches being pursued within the Asia-Pacific region.

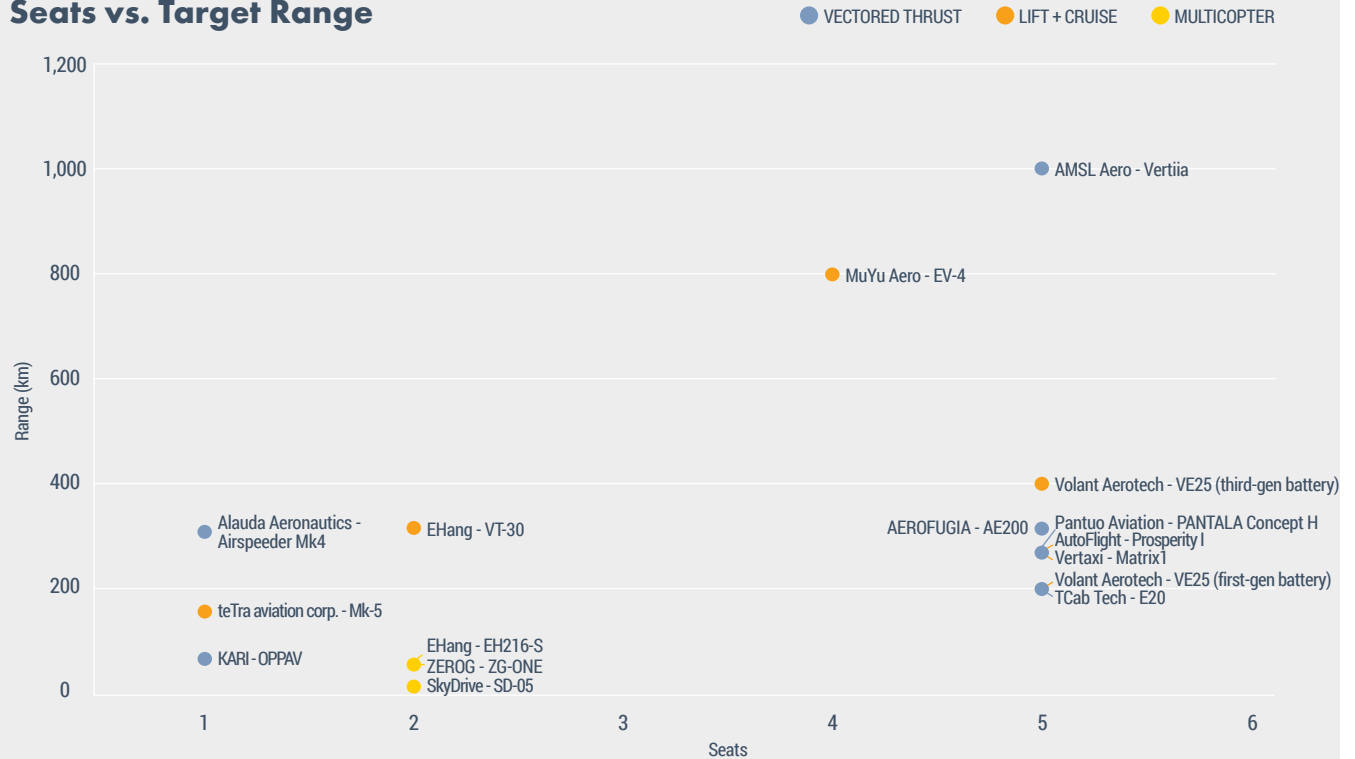
All OEMs covered in this section are working to create eVTOLs that are entirely electric, and battery powered; however, there is one exception—AMSL Aero. AMSL Aero is charting a different course by planning to concentrate on hydrogen-powered eVTOLs. Its target range for these hydrogen-powered aircraft is 1,000 kilometers.

For most of the eVTOLs in this section, the targeted range falls within the range of 10 kilometers to 300 kilometers. There are a couple of outliers, such as Volant Aerotech's VE25, which utilizes a third-generation battery and aims for a range of 400 kilometers. MuYu Aero's EV-4, on the other hand, targets a maximum range of 800 kilometers.

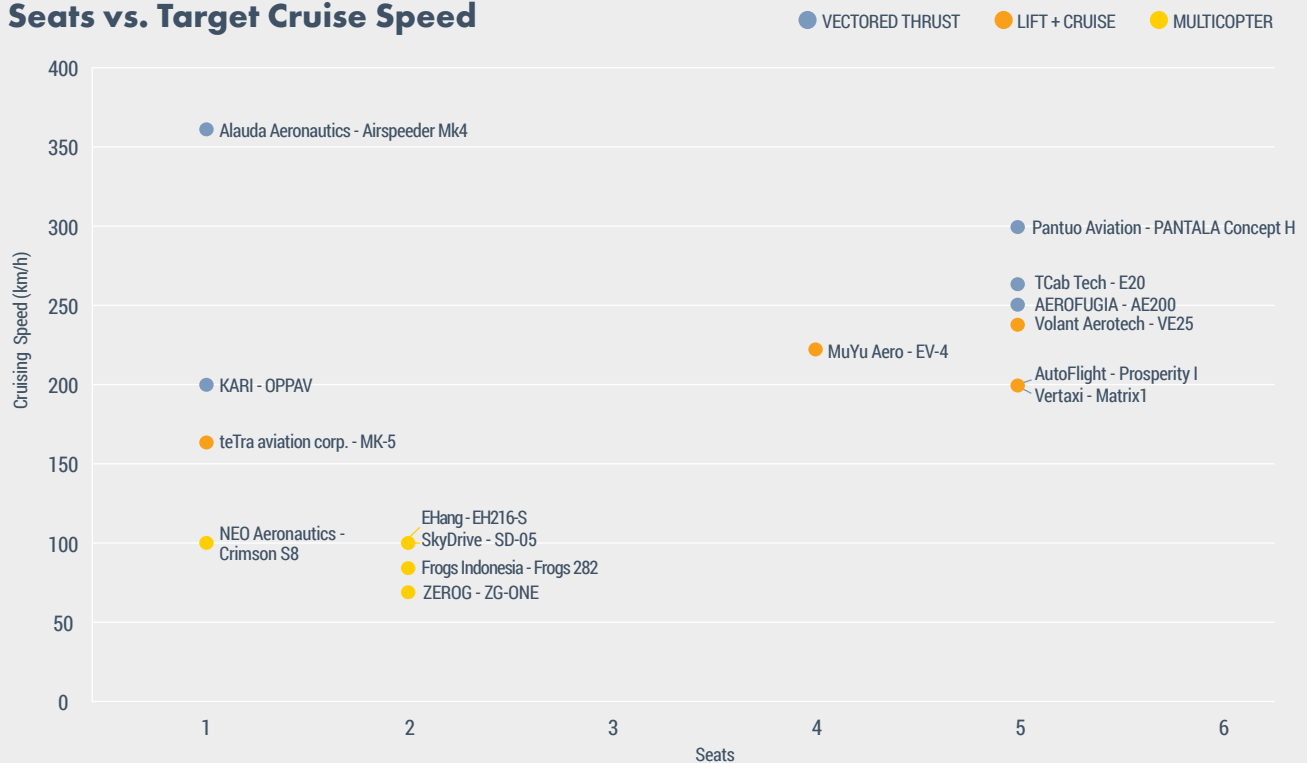
Interestingly, the range does not seem to have a direct correlation with eVTOL configurations, except for Multicopters, which have a disclosed range of around 10 to 30 kilometers. However, there appears to be a relationship between the range and the number of seats in Lift and Cruise aircraft and Vectored Thrust vehicles. Those with a single seat have an average range of about 170 kilometers, while the five-seater models (excluding Vertiia, which employs hydrogen power) have an average targeted range of 264 kilometers.

The Vectored Thrust configuration has an average speed of 279 kilometers per hour, higher than the average speed for Lift and Cruise of 202 kilometers per hour and 95 kilometers per hour for Multicopters. As a racing eVTOL, Alauda Aeronautics' Airspeeder Mk4 has the highest targeted speed of 360 kilometers per hour.

Seats vs. Target Range



Seats vs. Target Cruise Speed



Mainland China | Founded in 2020

AEROFUGIA, established in September 2020, is part of Geely Technology Group's innovative general aviation strategy. The company focuses on diversified low-altitude travel products, customer service, and continued airworthiness support. In September 2021, AEROFUGIA established a joint venture called Volocopter (Chengdu) with Germany's Volocopter to promote the commercialization of the passenger-grade eVTOL series from Volocopter in mainland China. In February 2023, Hoco Flow, a subsidiary of AEROFUGIA, released a vehicle-mounted drone that can realize functions such as vehicle take-off and landing from the car, automatic follow-up flight, throw and fly, and real-time image transmission to the screen on the vehicle.

AE200

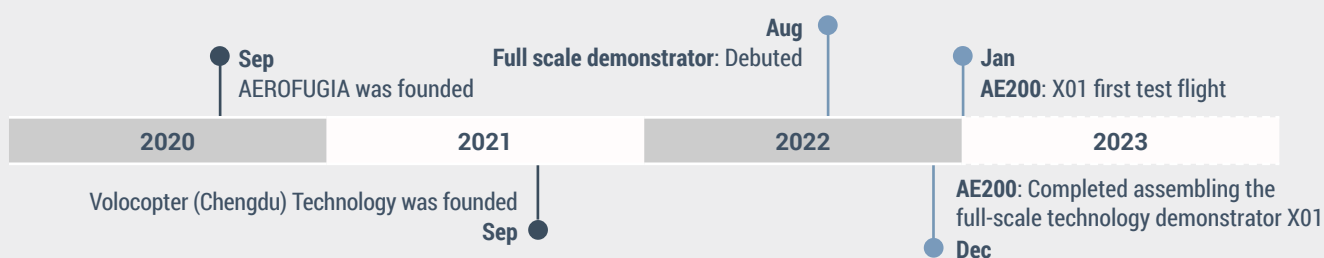
PROJECT PHASE	Prototype Development
TYPE	Vectored Thrust
OPERATION	Piloted
RANGE	200-300 km
CRUISE SPEED	250 km/h
SEATS	5-6
ELECTRIC MOTORS	8



The AE200 is a five to six-seater electric vertical take-off and landing vehicle (eVTOL)/flying car with tilting power that is undergoing research and development by AEROFUGIA, which is targeting urban trips, as well as intercity travel. This aircraft adopts a single wing with a tilting power design. The AE200 demonstrator X01 completed final assembly at the end of 2022 and conducted its first flight in early 2023.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Nov 23, 2022	Civil Aviation of China Southwest Regional Administration	Officially accepted the type certification application of AE200

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Apr 19, 2021	Geely Technology Group, AEROFUGIA and Volocopter exhibited an electric urban air mobility vehicle at the Shanghai International Automobile Industry Exhibition
Sep 22, 2021	AEROFUGIA and Volocopter formally established a joint venture company, Volocopter (Chengdu), in China
May 26, 2022	Signed a strategic cooperation agreement with China Southwest Geotechnical Investigation & Design Institute Co., Ltd. , to establish a digital smart construction site platform and to launch a new general aviation solution
Dec 15, 2022	Signed a strategic cooperation agreement with the Civil Aviation Flight University of China to jointly promote the development and testing of new energy aircraft

Information was provided by AEROFUGIA in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.

Alauda Aeronautics

Australia | Founded in 2016

Alauda Aeronautics, founded in 2016 in Sydney, Australia, later relocated to Adelaide, and focused on the development of hybrid electric vertical take-off and landing (eVTOL) racing aircraft. The eVTOL or hydrogen-electric VTOL racing series that Alauda competes in is called Airspeeder, where the Mk1, Mk2, and Mk3 were iterations of remote-piloted eVTOL aircraft, and the Mk4 is a hydrogen-electric VTOL racing aircraft. The first uncrewed race (EXA series) was held in May 2022.

AIRSPEDER MK4

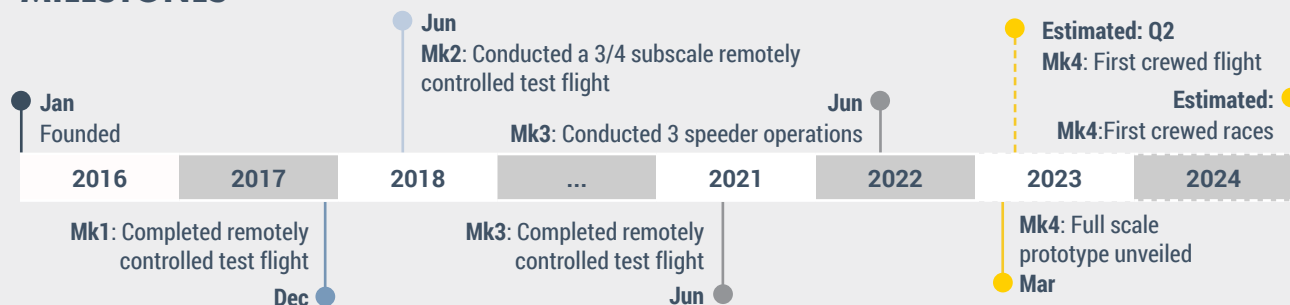
PROJECT PHASE	Prototype development
TYPE	Vectored Thrust
OPERATION	Piloted
RANGE	300 km
CRUISE SPEED	360 km/h
SEATS	1
ELECTRIC MOTORS	4



The Airspeeder Mk4 is a hydrogen-electric VTOL aircraft adopting a Vectored Thrust configuration. The aircraft has four sets of ducted, tilting coaxial rotors. The Mk4 is a racing aerial vehicle with an exterior design similar to a Formula 1 racing car. Its acceleration capability from standstill to the Mk4's maximum speed of 360 kilometers per hour is 30 seconds.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Unspecified	Australian Civil Aviation Safety Authority	Mk3 received experimental type certification

FUNDING

DATE	ROUND	AMOUNT(USD) ¹	INVESTORS
Nov 4, 2020	Seed round	\$1,000,000	Saltwater Capital, Jelix Ventures, and Rad Ventures
Dec, 2021	Series A	Undisclosed	Undisclosed
Mar 3, 2022	Government funding	\$29,264,813	Central government of Australia and South Australian Government

Note: 1. The original announcements of funding are expressed in Australian dollars, which were converted to United States Dollars using the exchange rate on the announced date.

ORDERS

Order information is not available. (Not for public purchase. Private purchase by nominated racing teams only)

GLOBAL PARTNERSHIPS

Sep 7, 2020	Partnered with Acronis and Teknov8 , where Acronis will provide the collision avoidance systems and Teknov8 will provide cybersecurity solutions
May, 2021	Partnered with NVIDIA for advanced processing units and collision avoidance technologies
Sep 22, 2021	Partnered with Telstra Purple , where Telstra Purple will provide virtual race-control system for Alauda's Airspeeder series
Jun 19, 2021	Entered into an engineering partnership with IWC Schaffhausen
Mar 2, 2022	New manufacturing facility announced in partnership with the state and federal government
Mar 25, 2023	Signed a strategic sponsorship agreement with Intel, where Intel will provide Intel Core and Intel Xeon Scalable processors

Information was provided by Alauda Aeronautics with an information cut off date of March 31, 2023.

AMSL Aero



Australia | Founded in 2017

AMSL Aero is a sustainable development aerospace company founded in 2017 by Andrew Moore (Co-Founder and CEO) and Siobhan Lyndon (Co-Founder and COO). AMSL Aero is a home-grown Australian aerospace company with headquarters in Bankstown, New South Wales, and flight test facilities in Wellington, New South Wales. AMSL Aero is privately backed by investors including IP Group Australia, Telstra Super, Host Plus, and the St. Baker Energy Innovation Fund.

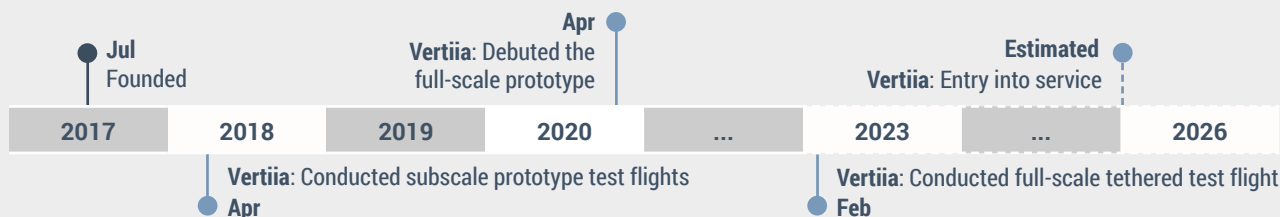
VERTIIA	
PROJECT PHASE	Prototype development
TYPE	Vectored Thrust
OPERATION	Piloted/Remotely piloted/Autonomous
RANGE	1,000 km
CRUISE SPEED	300 km/h
SEATS	5
ELECTRIC MOTORS	8



Vertiia is a hydrogen-powered eVTOL (Electric Vertical Takeoff and Landing) aircraft that targets to use less energy per seat than a high-speed train. The initial aircraft will be certified for piloted flight, with autonomy systems installed for future remote piloted applications. AMSL Aero expects the cost to operate Vertiia to be comparable with short-range (domestic) airliners. Vertiia’s aeromedical setup will seat a pilot, a paramedic, and/or a doctor and patient, or it will be configured to carry passengers (1 pilot + 4pax). AMSL Aero holds international patents for Vertiia, protecting its core technological features, including its unique wing tilting mechanism combined with its box wing design and control system. Vertiia is an eight-electric motor tilting wing aircraft that can operate from a helipad or similar-sized landing site.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Estimated: 2026	Australian Civil Aviation Safety Authority	Target to obtain the type certification

FUNDING

DATE	ROUND	AMOUNT (USD)	INVESTORS
Feb, 2018 - Present	Seed through to Series B	\$35,000,000	Investors include IP Group, St Baker Energy Innovation Fund, Telstra Super and Host Plus, in addition to support from Australian Government

ORDERS

Order information undisclosed

GLOBAL PARTNERSHIPS

Oct 12, 2018	Announced a Memorandum of Understanding with Qantas to explore commercial prospects for regional passenger connections following participation in the Qantas Avro program.
Nov 25, 2020	Announced partnership with and CareFlight to develop Vertiia for patient transfers as a light air ambulance
Feb 28, 2023	Announced the signature of a Memorandum of Understanding with Babcock Australasia
Mar 1, 2023	Announced continued partnership with CareFlight at the Avalon Air Show and exhibited aeromedical cabin

Information was provided by AMSL Aero and modified by Global Sky Media with an information cut off date of March 31, 2023.



Mainland China | Founded in 2017

AutoFlight, headquartered in Shanghai, is one of the first technology enterprises in China to invest in large-scale autonomous eVTOLs. AutoFlight established an R&D and certification center in Germany, an operation and test center in the United States, a composite material manufacturing plant in Shandong, China, and a manufacturing facility in Jiangsu, China. With the strategy “from small to big, from cargo to crew,” AutoFlight’s product lines comprise large autonomous cargo eVTOLs and autonomous passenger eVTOLs. AutoFlight actively advances various testing and certification processes for the Passenger eVTOL Prosperity I and Cargo eVTOL CARRYALL. The European Union Aviation Safety Agency (EASA) accepted the Type Certificate (TC) application of the Passenger aerial vehicle Prosperity I in early 2023, while the Civil Aviation Administration of China (CAAC) East China Regional Administration signed a Memorandum of Safety Partnership (MSP) regarding eVTOLs in August 2022. In April 2023, the CAAC approved the Certification Plan and Compliance Checklist for the V2000 CARRYALL

PROSPERITY I

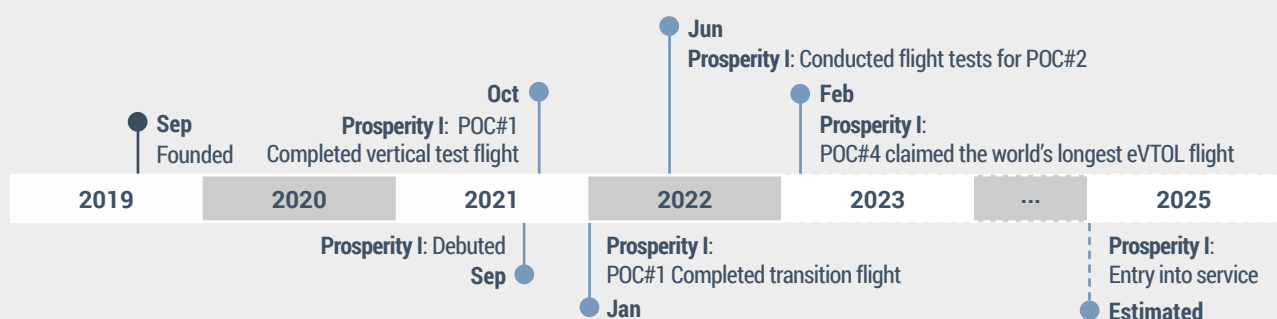
PROJECT PHASE	Review and testing
TYPE	Lift + Cruise
OPERATION	Autonomous
RANGE	250 km
CRUISE SPEED	200 km/h
SEATS	5
ELECTRIC MOTORS	13



The Prosperity I adopted a Lift + Cruise configuration with a pair of high wings. Each wing of the new design has two booms, a long and a short one, equipped with three and two lifting rotors, respectively. There is a cruising propeller at the end of the two long booms and at the rear end of the fuselage. The updated Prosperity I can accommodate five passengers and will be used for city and intercity connections. The Prosperity I completed its transition flight, and also set the record for the world’s longest eVTOL flight on a single electric charge.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Aug 5, 2022	East China Regional Administration of CAAC	Signed a Memorandum of Safety Partnership
Early 2023	European Union Aviation Safety Agency (EASA)	EASA accepted Prosperity I's type certificate application
Estimated: 2025	EASA	Expected to obtain type and airworthiness certificates

FUNDING

DATE	ROUND	AMOUNT (USD)	INVESTORS
Sep 18, 2021	Series A	\$ 100M	Team Global

ORDERS

DATE	COMPANY	COUNTRY/SUBREGION	TYPE	PROSPERITY I
Aug 31, 2022	Shanhejing Aviation Technology	Mainland China	Purchase order	100
Aug 31, 2022	Yijing Surfing	Mainland China	Purchase order	160
Sep 6, 2022	Air Tojoy	Mainland China	Purchase order	100
Mar 16, 2023	EVFLY	Singapore	Pre-order	205 (altogether with CARRYALL)

GLOBAL PARTNERSHIPS

Nov 25, 2020	Signed an MoU with the Aden Group to jointly work on air traffic innovation and carbon emission reduction
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Information was provided by AutoFlight in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.

Mainland China | Founded in 2014

EHang, founded in Guangzhou in 2014, is the first technology company in the global urban air mobility industry to go public on the NASDAQ in the United States, which it did in 2019. Building on electric vertical takeoff and landing aircraft, EHang combined autonomous driving technology to develop Autonomous Aerial Vehicles (AAVs). EHang has already launched two passenger electric vertical takeoff and landing vehicles, the EH216-S and the VT-30. These aircraft are used for firefighting (EH216-F, firefighting version), heavy cargo transportation (EH216-L, logistics version), industry applications (Falcon B series), and aerial media operations (GD series). EHang has established partnerships with local governments and companies in Greater China and countries and regions including Japan, South Korea, Southeast Asia, and Europe. These partnerships are targeted to foster the Advanced Air Mobility (AAM) industry.

EH216-S

PROJECT PHASE	Awaiting certification
TYPE	Multicopter
OPERATION	Autonomous
RANGE	30 km
CRUISE SPEED	100 km/h
SEATS	2
ELECTRIC MOTORS	16



The EHang EH216 series is an autonomous electric vertical takeoff and landing (eVTOL) aircraft designed with a multi-rotor configuration. It features eight booms located beneath the cabin and attached to eight axes with 16 propellers. The EH216-S model will be primarily used for urban air transportation or aerial sightseeing. The vehicle can accommodate two passengers. The other variants, EH216-F and EH216-L, are suitable for firefighting and cargo transportation, respectively. The EH216 series utilizes autonomous driving technology, eliminating the need for a pilot as it follows preset flight routes for takeoff and landing. All core flight components are designed with full redundancy, and a "Fail-Safe" system is incorporated to continuously assess the aircraft's status in real-time. Through a high-speed network, the aircraft can achieve real-time data transmission and interaction with a command and dispatch system center, enabling cluster management of the aircraft.

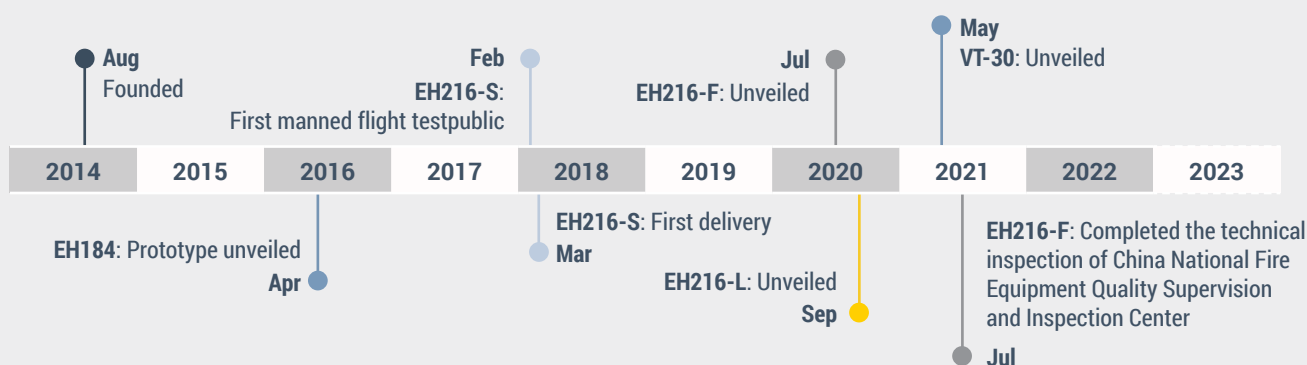
VT-30

TYPE	Lift + Cruise
OPERATION	Autonomous
RANGE	300 km
CRUISE SPEED	Unspecified
SEATS	2
ELECTRIC MOTORS	9



The VT-30 adopted a Lift and Cruise design, featuring a pair of fixed wings on either side of the fuselage and eight propellers for lifting. The aircraft is equipped with a vertical stabilizer at the tail section, along with an additional propeller providing cruising power at the rear. The VT-30 has a capacity of two passengers and is designed for intercity transportation. The maximum endurance of the VT-30 is 100 minutes.

MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Dec, 2020	Civil Aviation Administration of China	EHang Submitted its EH216-S Type Certification (TC) Application
Jan, 2021	Civil Aviation Administration of China	Officially accepted the TC application for EH216-S
Apr, 2021	Civil Aviation Administration of China	Established the TC certification working group for EH216-S
Feb, 2022	Civil Aviation Administration of China	Adopted the Special Conditions for EH216-S AAV Type Certification
Sep, 2022	Civil Aviation Administration of China	Approved the plan for EH216-S special certification

FUNDING

DATE	ROUND	AMOUNT (USD)	INVESTORS
Dec, 2014	Series A/Angel	\$10,000,000	GGV Capital, ZhenFund, PreAngel, Nick Yang
Aug, 2015	Series B	\$42,000,000	GGV Capital, ZhenFund, Microsoft Accelerator Beijing, PreAngel, GP Capital, LeBox Capital, Shenzhen Oriental Fortune Capital
Dec, 2016	Series C	\$22,000,000	United Therapeutics and others
Dec, 2019	IPO	\$40,000,000	Listed on Nasdaq
Jan, 2021	Private Placement	\$40,000,000	Carmignac
Mar, 2023	Private Placement	\$10,000,000	Qingdao West Coast New District

ORDERS

COUNTRY/SUBREGION	COMPANY	AIRCRAFT
Mainland China	Tourism customers in Jishou, Hunan, Huangshan, Anhui and others	Over 100
Japan	AirX and MASC	51
Indonesia	Prestige Aviation	100
Malaysia	AEROTREE	60
United States	United Therapeutics	995

GLOBAL PARTNERSHIPS

Nov 21, 2018	Announced the signing of a strategic partnership agreement with the FACC to enhance the current AAV design and foster the actual production together
Feb 28, 2019	Announced that ProSiebenSat.1 PULS 4 joined the partnership between EHang and FACC to promote the development of urban air mobility
Aug 6, 2019	Announced the signing of a strategic cooperation framework agreement with the Guangzhou government to enable Guangzhou as EHang's first AAM pilot city
Oct 18, 2019	Announced a strategic partnership with Vodafone to collaboratively establish an AAM ecosystem in Germany and eventually across Europe
Nov 30, 2019	Announced the forming of a strategic partnership with Heli Chuangxing Real Estate to accelerate the development of AAM in Guangzhou
Mar 14, 2020	Announced the signing of an agreement with the Seville city council to establish the first AAM pilot city in Spain
Mar 18, 2020	Announced the signing of an agreement with the Llíria city council to foster AAM services in Llíria
May 9, 2020	Announced the signing of a strategic partnership agreement with LN Holdings to jointly create a paradigm of new aerial traffic and tourism ecology
Dec 28, 2020	Announced the establishment of an agreement with Greenland Hong Kong Holdings Limited to explore the opportunity of UAM trial operation in Forest Lake in Zhaoqing
Jan 12, 2021	Announced a strategic partnership with Zhuhai Da Heng Qin Pan-Tourism Development, Zhuhai Huafa Sports Operations Management and Flying World (Zhuhai) Technology to implement AAM in Hengqin New Area jointly
Mar 16, 2021	Announced a partnership with Giancarlo Zema Design Group , planning to develop vertiports in Italy together
Apr 28, 2021	Announced the signing of an agreement with the Zaragoza city council to build another AAM pilot city in Europe
Apr 30, 2021	Announced the partnership with Aeroports de Catalunya to enhance autonomous aerial mobility solutions in Europe
Jul 12, 2021	Announced the formation of a strategic partnership with Globalvia to foster the development and implementation of AAM in Iberian Peninsula and the Latin America
Sep 15, 2021	Announced the signing of a strategic partnership agreement with HELI-EASTERN to explore and further implement the UAM operation mode of helicopters and autonomous aircraft in designated integrated airspace in Shenzhen, China
Oct 22, 2021	Announced the signing of a strategic partnership agreement with Shenzhen Expressway Operation and Development Company Limited to explore the innovative integration of land and air three-dimensional transportation networks in smart cities, and create a cooperation benchmark in the field of smart transportation
Dec 29, 2021	Announced a partnership with Guangzhou Development District Communications Investment Group to jointly launch a 5G Intelligent Air Mobility Experience Center in Guangzhou
Mar 10, 2022	Announced the signing of a strategic partnership agreement with Aerotree Flight Services to enhance AAM services in Malaysia
May 27, 2022	Announced a strategic partnership with Charoen Pokphand Group to promote EHang's AAV and foster AAM operations in Thailand
Jun 27, 2022	Announced a partnership with Tianxingjian Cultural Tourism Investment and Development LLC. to develop low attitude aerial tourism services in Aizhai Wonder
Jun 28, 2022	Announced a strategic partnership with ENAIRE to advance the U-Space project and the research, development and innovation of AAM in Spain and across Europe

GLOBAL PARTNERSHIPS

Oct 31, 2022	Signed a memorandum of understanding with Hong Kong Aircraft Engineering Company Limited to work together in various fields, including manufacturing and assembly, continued airworthiness, digital platforms, aircraft maintenance and training
Nov 21, 2022	Announced to participate in the EU-funded SBAS European Geostationary Navigation Overlay Service (EGNOS) Multi-rotor VTOL project, where this project will deploy EGNOS for eVTOLs
Dec 23, 2022	Announced the strategic cooperation with Qingdao West Coast New Area , including a confirmed equity investment of USD\$10 million and a potential additional investment of USD\$10 million in the future
Mar 28, 2023	Announced the collaboration with Spain's Center for Advanced Aerospace Technologies (CATEC) to successfully complete the BAUD project



Information was provided by EHang in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.

Frogs Indonesia



Indonesia | Founded in 2017

Frogs Indonesia, founded under the UMG Idea Lab in 2017, is headquartered in Bantul, Yogyakarta. It is one of the first companies in Southeast Asia to build passenger drones. Frogs Indonesia is dedicated to researching and developing various types of drones in various fields, including surveillance, spraying, logistics, and passenger transport. The company's mission is to "lead in smart transportation solutions in Indonesia."

FROGS 282

PROJECT PHASE	Prototype Devt. & Testing
TYPE	Multicopter
OPERATION	Autonomous
RANGE	Undisclosed
CRUISE SPEED	80 km/h
SEATS	2
ELECTRIC MOTORS	8



The Frogs 282 adopts a Multicopter configuration and a coaxial dual propeller design with four arms located beneath the cabin, equipping eight propellers. It is an autonomous vehicle with a maximum capacity of two passengers and is dedicated to intra-city commuting.





MILESTONES



CERTIFICATION PROGRESS

Not yet in the certification phase

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Mar 22, 2021	Signed an agreement with Gadjah Mada University to enhance the research, development and certification of Frogs Indonesia's vehicles
Mar 31, 2023	Collaborated with the Ministry of Industry to initiate the development of the automotive control system

Information was retrieved from Frogs Indonesia's official website as of March 31, 2023.

Korea Aerospace Research Institute



South Korea | Project launched in 2019

The Korea Aerospace Research Institute (KARI), established in 1989, is an aeronautics and space research institute headquartered in Daejeon, South Korea and funded by the South Korean government. KARI is dedicated to “contributing to [the] solid development of the national economy and enhancement of national life through [the] exploration and technological advancements, development, and dissemination in the field of aerospace science and technology.”

OPPAV

PROJECT PHASE	Detailed Design and Testing
TYPE	Vectored Thrust
OPERATION	Piloted/Autonomous
RANGE	50 km
CRUISE SPEED	200 km/h
SEATS	1
ELECTRIC MOTORS	8

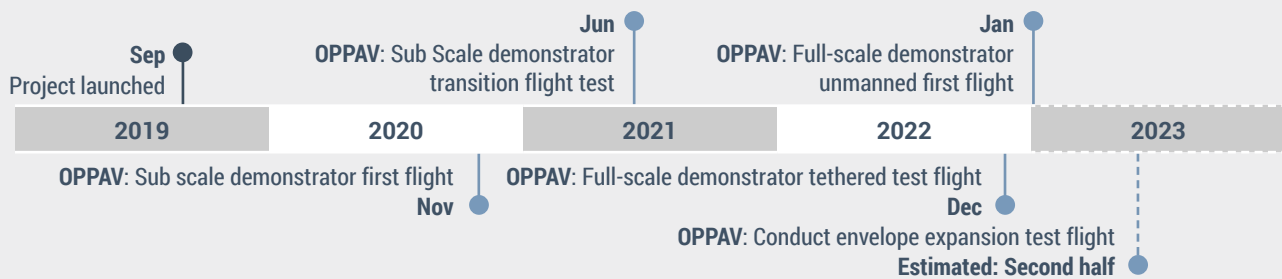


The Optionally Piloted Personal Air Vehicle (OPPAV) adopts a Vectored Thrust configuration with four booms beneath a pair of high wings. Each boom has one tilted rotor at the front and one fixed rotor providing lifting power at the rear. The vehicle can reach a max speed of 240 kilometers per hour. A future version of the vehicle will be a five-seater.





MILESTONES



CERTIFICATION PROGRESS

Not yet in certification phase

FUNDING

DATE	ROUND	AMOUNT(USD) ¹	INVESTORS
Sep 4, 2019	Government funding	\$17,672,475	the Ministry of Land, Infrastructure, and Transport (MOLIT)
Sep 4, 2019	Government funding	\$19,497,801	the Ministry of Trade, Industry, and Energy (MOTIE)

Note: 1. The original announcements of funding are expressed in South Korean won. The fundings were converted to United States Dollars using the exchange rate on the announced date.

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Consortium of the program: KAI, Hyundai Motors, Hanwha System, VesselAerospace, KAT, Duta, Hucentech, RealtimeWave, KIAST, KOTI, and Konkuk University

Funding information was retrieved from the Ministry of Trade Industry and Energy's official website and other information was provided by KARI with an information cut off date of March 31, 2023.

Mainland China | Founded in 2018

MuYu Aero, founded in 2018, is a privately held company based in Wuxi, China, and is one of the first enterprises to engage in the development of light sport aircraft. The predecessor company of MuYu began to develop and manufacture light sport aircraft in 2004, where aircraft design, aircraft molds, components, motors, and so on were all made by MuYu. In terms of non-eVTOL aircraft, MuYu developed the DOLPHIN 200 Amphibious LSA, the MY-ABC Amphibious Flying Car, and the MY-AH 500 Automatic Uncrewed Coaxial Helicopter. The company is currently developing and testing a four-seat (EV-4) and a seven-seat (VJET-7) passenger eVTOL, along with a 1.2-ton (AT1200) and an 8-ton (AT8000) hybrid-powered unmanned eVTOL drone. The VJET-7 completed a 20% subscale test flight and was marketed as an electric business jet. The AT8000 finished a 20% subscale test, while the full-scale prototype is under construction. The production model of the AT8000 will have a payload of 3.5 tons and a target range of 1,300 to 4,000 kilometers, depending on the load. MuYu Aero plans to conduct a test flight for the full-scale AT1200 in July 2023. The AT1200 has a payload of 500 kilograms and a target range similar to that of the AT8000. MuYu is planning to build an 8-ton VTOL UAV project with an annual output of 700 units in three phases.

EV-4

PROJECT PHASE	Prototype Development
TYPE	Lift + Cruise
OPERATION	Piloted
RANGE	800 km
CRUISE SPEED	216 km/h
SEATS	4
ELECTRIC MOTORS	10

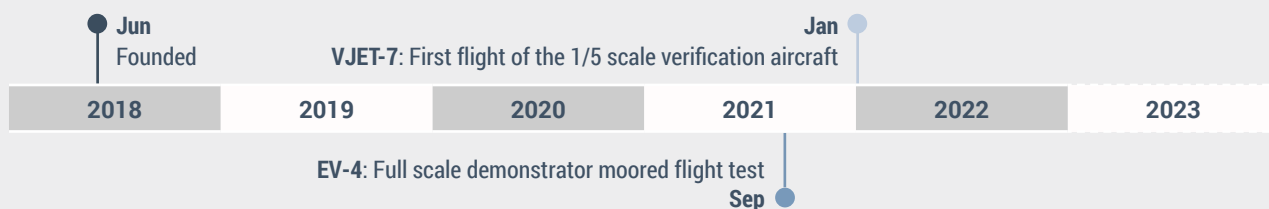


EV-4 adopted a Lift and Cruise configuration with a pair of high wings. There are four booms beneath the wings. Each boom has four propellers, proving lifting power, and the two propellers in front of the wings are used for cruising. The EV-4 can accommodate one pilot and three passengers, and will mainly be used for urban air mobility. MuYu plans to make major adjustments to the exterior of the EV-4 to further enhance the spacing of the vehicle.





MILESTONES



CERTIFICATION PROGRESS

Not yet in the certification progress

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Nov 8, 2018	Signed a strategic cooperation framework agreement with AVIC General Aircraft Co., Ltd. , to jointly promote the products of both parties to the market
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Information was provided by MuYu Aero in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.

NEO Aeronautics



Singapore | Founded in 2018

NEO Aeronautics is a Singapore-based company that was established in 2018. Dr. Neo Kok Beng, the company's founder, aspires to provide a new mode of urban transportation for all city dwellers. The full-scale prototype of the company's vertical take-off and landing aircraft aircraft, the Crimson S8, has been completed and tested. It has developed a partnership with Utah in United States, which will be the main base for the aircraft's future development and application for airworthiness certification.

CRIMSON S8

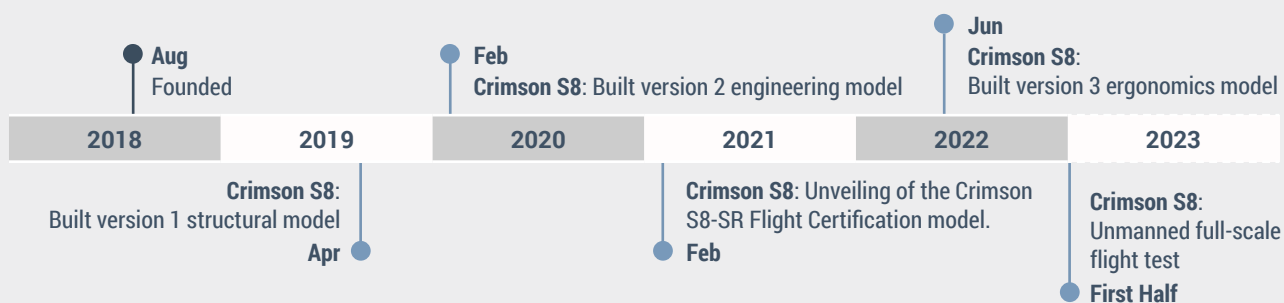
PROJECT PHASE	Detailed design and Testing
TYPE	Multicopter
OPERATION	Piloted
RANGE	40 km
CRUISE SPEED	80 km/h
SEATS	1
ELECTRIC MOTORS	4



The Crimson S8 is a single passenger eVTOL with four axes and eight propellers. Its cruising range is around 30 to 40 kilometers, with the potential to extend to 100 kilometers later. The maximum flight speed is 100 kilometers per hour, with an average speed of 80 kilometers per hour. The Crimson S8 is committed to providing rapid urban air travel that can fit into a typical U.S. parking slot.



MILESTONES



CERTIFICATION PROGRESS

Not yet in the certification progress

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Oct 16, 2019	Partnership with the Division of Aeronautics, Department of Transportation for the State of Utah (UDOT) , USA to assist development and deployment of Urban Air Mobility (UAM) in Utah.
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Information was retrieved from NEO Aeronautics' official website as of March 31, 2023.

Pantuo Aviation



Mainland China | Founded in 2019

Pantuo Aviation, founded on the west coast of Shanghai in 2019, has a vehicle testing center located in Moganshan, Zhejiang Province. The company’s vision is to “shape the future of sustainable human mobility through [the] symbiosis of design, experience, and technology.” The eVTOL vehicle developed by Pantuo is called PANTALA Concept H. It adopted ducted fans in the design, which is rare in the Chinese eVTOL market.

PANTALA CONCEPT H

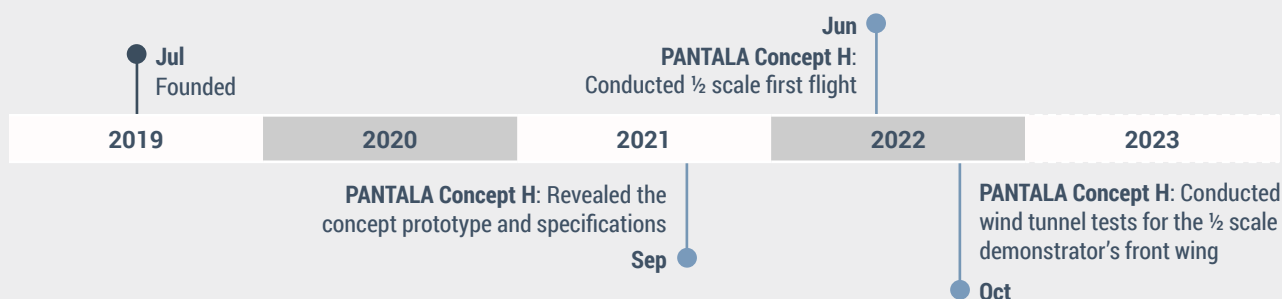
PROJECT PHASE	Detailed Design
TYPE	Vectored Thrust
OPERATION	Piloted/Autonomous
RANGE	250 km
CRUISE SPEED	300 km/h
SEATS	5
ELECTRIC MOTORS	22

The PANTALA Concept H adopted a Vectored Thrust configuration where the titling wings consist of multiple ducted fans. The front wings are comprised of four ducted fans on each side. The rear wings have winglets and are formed by seven ducted fans on each side. The PANTALA Concept H has a capacity of one pilot and four passengers. Pantuo is planning to build an autonomous version of the Concept H, where the vehicle can accommodate five passengers. This aerial vehicle will be mainly used for commuting in the city and will also be used in the medical rescue market. The ½ subscale model of PANTALA Concept H is called T1.





MILESTONES



CERTIFICATION PROGRESS

Not yet in the certification phase

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Sep 1, 2021	Partnered with studiokurbos of Germany for industrial design
Nov 2, 2022	Announced the strategic partnership with Porsche Consulting (Shanghai) to explore the global development of eVTOLs
Nov 8, 2022	AVIAGE SYSTEMS delivered key avionics component GPM-400

Information was provided by Pantuo Aviation in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.



Japan | Founded in 2018

SkyDrive was formally established in July 2018 after testing flying car concepts and prototypes since 2014 as a Pro Bono group. The SD-00 was a prototype model at that time. The company focuses on the development of passenger eVTOL (electric vertical take-off and landing vehicle) and 30-kg-payload cargo drones called SkyLift. The SD-01, SD-02, and SD-03 models were developed by SkyDrive and served as demonstrators of the SD-05, the commercial model. SkyDrive aims to put the SD-05 model into service in 2025, in time for Expo 2025, held in Osaka. SkyDrive has not only deployed in the Japanese market but is also planning to enter the United States and United Arab Emirates markets.

SD-05

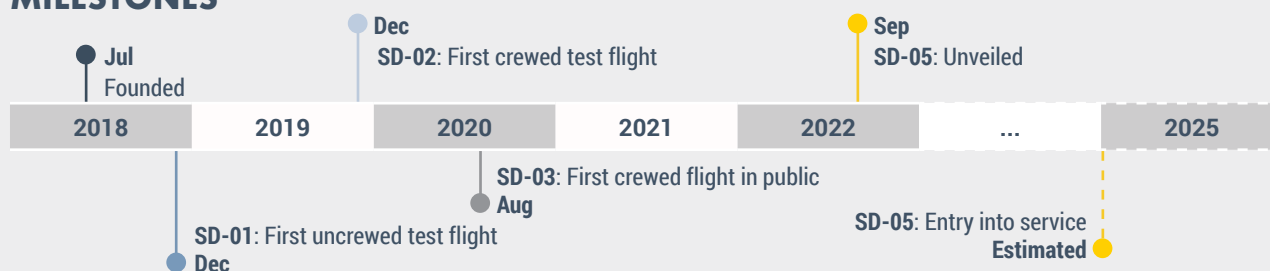
PROJECT PHASE	Detailed design
TYPE	Multicopter
OPERATION	Piloted
RANGE	5-10 km (subject to operational condition)
CRUISE SPEED	100 km/h (54 KIAS ¹)
SEATS	2
ELECTRIC MOTORS	12

The SD-05 adopted a Multicopter configuration with four long booms extended from the top of the fuselage. Each long boom has a shorter boom with a propeller at each end crossing it. The long boom also has one propeller at the end. The SD-05 is currently designed to travel up to 10 kilometers at a maximum cruising speed of 100 kilometers per hour. The vehicle can accommodate one pilot and one passenger. The target markets for the SD-05 are passenger transport, tourism, and emergency medical services.

Note: 1. KIAS stands for Knots-Indicated Air Speed.



MILESTONES



SD-01, SD-02 and SD-03 are prototype models

CERTIFICATION PROGRESS

SD-05

DATE	AGENCY	STAGE
Oct 29, 2021	Japan Civil Aviation Bureau (JCAB) of Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	Applied for type certification
Mar, 2022	JCAB of MLIT	The agency endorsed AIM Part II as the basis for type certification
Estimated: 2025	JCAB of MLIT	Expect to obtain the type certification

FUNDING

DATE	ROUND	AMOUNT (USD) ¹	INVESTORS
Nov 2, 2018	Seed Round	\$2,657,382	Drone Fund
Sep 30, 2019	Series A	\$13,890,211	Drone Fund, Z Corporation, STRIVE III Limited Liability Partnership, ITOCHU Technology Ventures, Inc. and Energy & Environment Investment, Inc.
Aug 28, 2020	Series B	\$37,059,175	Development Bank of Japan, ITOCHU Corporation, STRIVE, ITOCHU Technology Ventures, Drone Fund and five others
Apr 7, 2022	Partnership investment	Unspecified	Kintetsu Group
Sep 26, 2022	Series C	\$66,586,323	SCSK Corporation, The Kansai Electric Power Company, Kintetsu Group Holdings, SUZUKI MOTOR CORPORATION, Sampo Japan Insurance, Tokio Marine Holdings, TOYODA IRON WORKS, Nippon Kayaku, NHK SPRING, Pegasus Tech Ventures, Sumitomo Mitsui Trust Bank, MUFG Bank, Resona Group

Note: 1. The original announcements of funding are expressed in Japanese Yen The fundings were converted to United States Dollars using the exchange rate on the announced date.

ORDERS

DATE	COMPANY	COUNTRY/SUBREGION	TYPE	SD-05
Nov 28, 2022	Pacific Group	Vietnam	Pre-order	10
Nov 28, 2022	Pacific Group	Vietnam	Option	90

GLOBAL PARTNERSHIPS

May 9, 2019	Signed an agreement with Toyota City and CARTIVATOR to enhance the "Flying Car" industry in Toyota city
Jun 19, 2020	Reached 100 corporations that signed sponsorship agreement to support SkyDrive's development
May 31, 2021	Signed a supporter agreement with PERSOL R&D to accelerate the development of the "Flying Car"
Aug 4, 2021	Joined the industry network organized by Toyota City to enhance the development and commercialization of advanced air mobility
Aug 10, 2021	Collaborated with Japan Aerospace Exploration Agency (JAXA) to conduct aerodynamic research
Sep 14, 2021	Signed a partnership agreement with Osaka Prefecture and Osaka City to implement the practical use of eVTOLs
Oct 26, 2021	Selected as a company for the J-Startup program, where the program will provide expansion support to SkyDrive
Nov 2, 2021	Signed a supporter agreement with EY Strategy and Consulting to enhance SkyDrive's business development
Feb 2, 2022	Signed a supporter contract with Globe-ing to strengthen SkyDrive's development
Mar 22, 2022	Established a partnership with Suzuki to collaborate in the field of technology and expansion in overseas markets
Apr 7, 2022	Finalizing the partnership agreement with Kintetsu Group to implement flying cars by 2025
Jun 7, 2022	Signed a supporter agreement with JAMCO , where JAMCO's specialists of Aircraft Interiors temporarily transferred and joined SkyDrive
Jul 18, 2022	Announced the partnership with Toray Carbon Magic to jointly develop a composite vehicle's structure and conduct material conformity test
Jul 18, 2022	Selected Electric Power Systems, Inc as the battery system for SD-05
Sep 29, 2022	Announced the strategic alliance with Volatus Infrastructure to support each other business
Mar 15, 2022	Signed an initial set of agreements with VPorts to collaboratively expand the business and promote AAM industry

Information was provided by SkyDrive with an information cut off date of March 31, 2023.



Mainland China | Founded in 2021

TCab Tech, founded in May of 2021 in Shanghai, is dedicated to offering aerial mobility to the public. The name “TCab” stands for “time cab.” As a manufacturer of passenger eVTOL, TCab also plans to join the development of building infrastructure for eVTOL. On September 20, 2022, TCab Tech invited professionals from the Civil Aviation Administration of China (CAAC), East China Regional Administration, Civil Aviation University of China, and Shanghai Aircraft Airworthiness Certification Center (SAACC) of CAAC to the first meeting of the type certification basis for E20.

E20

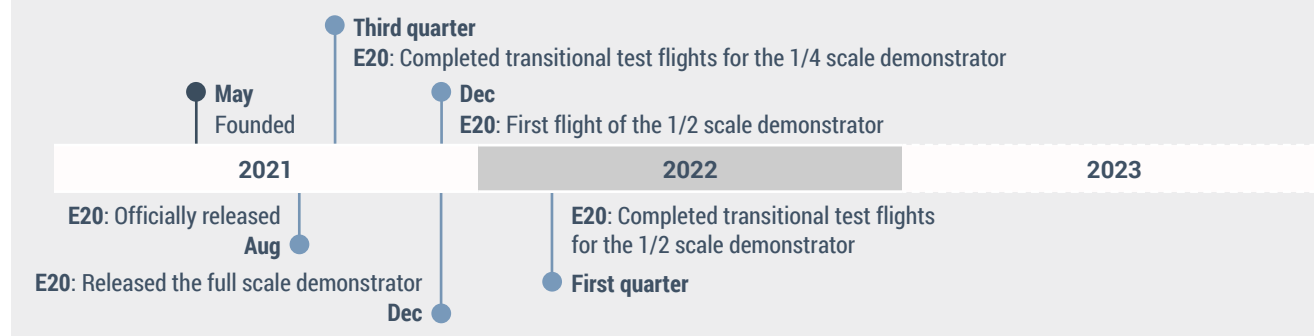
TYPE	Vectored Thrust
OPERATION	Piloted
RANGE	200 km
CRUISE SPEED	260 km/h
SEATS	5
ELECTRIC MOTORS	6



The E20 adopted a Vectored Thrust configuration with a pair of high gull wings. The four rotors near the tip of the wings and the cruciform tail can be tilted at different angles to provide lifting and cruising power. The two propellers at the booms of the wings provide lifting power. The E20 can accommodate one pilot and four passengers and can be used as an air taxi, for emergency rescue, or for transporting emergency supplies.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
May, 2021	Civil Aviation Administration of China	TCab Tech and the CAAC signed the Partnership of Safety Plan (PSP)

FUNDING

DATE	ROUND	AMOUNT (USD)	INVESTORS
Sep 6, 2021	Seed round/Seed round+	\$10,000,000	Bluerun Ventures and Decent Capital
Feb 8, 2023	Pre-A round	\$14,415,650 ¹	Grand Flight, Kun Lun, KIP, BlueRun Ventures and Decent Capital

Note: 1. The original announcements of funding are expressed in Chinese Yuan. The fundings were converted to United States Dollars using the exchange rate on the announced date.

ORDERS

DATE	COMPANY	COUNTRY/SUBREGION	TYPE	E20
Feb 17, 2023	Asian Express Aviation Group	Mainland China	Pre-order	50
Unspecified	Others (confidential clients)	Unspecified ¹		

Note: 1. TCab Tech stated the orders of E20 from confidential clients summed up to more than 100.

GLOBAL PARTNERSHIPS

May 31, 2022	Announced a partnership agreement with Safran to equip the E20 with a Safran motor
Sep 20, 2022	Signed the "E20 eVTOL Airworthiness Certification Cooperation Agreement" with Civil Aviation University of China
Feb 17, 2023	Signed a strategic cooperation agreement with Asian Express Aviation Group to jointly roll out air tourism and air travel services of the E20, and planned to let Asian Express Aviation Group become the MRO service provider for the E20

Information was provided by TCab Tech in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.

teTra aviation corp.



Japan | Founded in 2018

teTra aviation corp., a Tokyo-based eVTOL start-up company, was founded at the University of Tokyo. The company focuses on the development of personal Advanced Air Mobility (AAM) and aerial racing vehicles. teTra won the "Pratt and Whitney Disruptor Prize" in the GoFly Prize competition with its Mk-3 racing model. The full-scale Mk-5 has completed unmanned flight tests and is currently actively promoting commercial operations in the United States and Japan.

MK-5 (SN4)

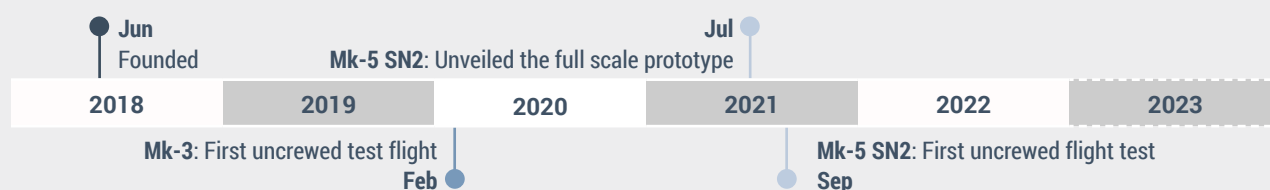
PROJECT PHASE	Prototype development
TYPE	Lift + Cruise
OPERATION	Piloted
RANGE	160 km
CRUISE SPEED	160 km/h
SEATS	1
ELECTRIC MOTORS	33



The Mk-5 eVTOL features a total of 33 propellers, with 32 strategically positioned around the two pairs of fixed wings to generate lift, while one propeller is located at the rear for cruising. During its testing phase, teTra exclusively employed the SN2 model, but subsequent iterations such as the SN3 and beyond have been equipped with a ballistic parachute for added safety measures.



MILESTONES



CERTIFICATION PROGRESS

Mk-3 and Mk-5 were not yet in certification phase

FUNDING

DATE	ROUND	AMOUNT(USD) ¹	INVESTORS
May 24, 2019	Seed Round	\$456,203	Drone Fund, Incubate Fund, TomyK
Aug 26, 2020	Corporate Round	\$470,281	Yoshimasu Seisakusho
Jun 21, 2022	Venture Round	\$3,302,609	mitsui sumitomo insurance Venture Capital, TS TECH, Kyowa Technica, TOKO and Mitsubishi Gas Chemical Company

Note: 1. The original announcements of funding are expressed in Japanese Yen. The fundings were converted to United States Dollars using the exchange rate on the announced date.

ORDERS

Mk5 (SN3 and SN4) received pre-orders, details were unspecified

GLOBAL PARTNERSHIPS

Aug 17, 2020	Yoshimasu Seisakusho announced that it will assist teTra in building titanium and aluminum components
Jul 7, 2021	Signed a partnership agreement with Minamisoma City, Fukushima Prefecture to strengthen the development of flying cars

Milestone information was retrieved from eVTOL News. Funding information was retrieved from Crunchbase. Information in the Global Partnerships section was retrieved from Nikkei Asia News and Nikkan Jidosha Shimbun. teTra aviation corp. had checked the profile with Global Sky Media. The information cut off date was March 31, 2023.



Mainland China | Founded in 2021

Vertaxi was founded in April 2021, with a presence in the Yangtze River Delta and the Guangdong-Hong Kong-Macao Greater Bay Area. The company's vision is to "let everyone enjoy the future of urban air travel." Vertaxi follows the strategic path of "cargo first, then passenger" and "segregated from the national airspace system first, then integrated into it." The company plans to first obtain certification for its cargo version, accumulate operational information, and then launch the passenger-grade version. Vertaxi's subsidiary, FCOURIER, has developed and manufactured the E6, E4, and other small to mid-size unmanned fixed wing eVTOLs that have entered the market.

MATRIX1

PROJECT PHASE	Detailed Design and Testing
TYPE	Lift + Cruise
OPERATION	Autonomous
RANGE	250 km
CRUISE SPEED	200 km/h
SEATS	5
ELECTRIC MOTORS	20

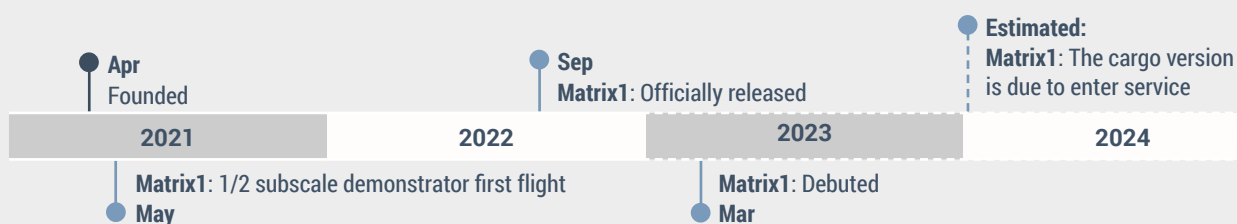


Matrix1 adopted a Lift and Cruise configuration with a pair of high gull wings with winglets. There are four booms attached to the bottom of the wings, where each boom has four propellers providing lifting power on the top and one providing cruising power at the front. Matrix1 will be used for cargo and urban air mobility.





MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Estimated: 2023	Civil Aviation Administration of China	Applied for Matrix1's airworthiness certification
Estimated: 2024	Civil Aviation Administration of China	Target to obtain airworthiness certification for the cargo version
Estimated: 2027	Civil Aviation Administration of China	Target to obtain airworthiness certification for the manned version

FUNDING

DATE	ROUND	AMOUNT (USD)	INVESTORS
May, 2021	Angel	Unspecified	Chengtian Network (Danian Chen)
Apr, 2022	Pre-A	Unspecified	V Fund, Winreal Investment
Apr, 2022	Pre-A+	Unspecified	Skyview Fund

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Jun 28, 2022 Signed a partnership agreement for FAM/eVTOL cabin simulator solution with **ACCEL (Tianjin) Flight Simulation**

Information was provided by Vertaxi in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.

Volant Aerotech

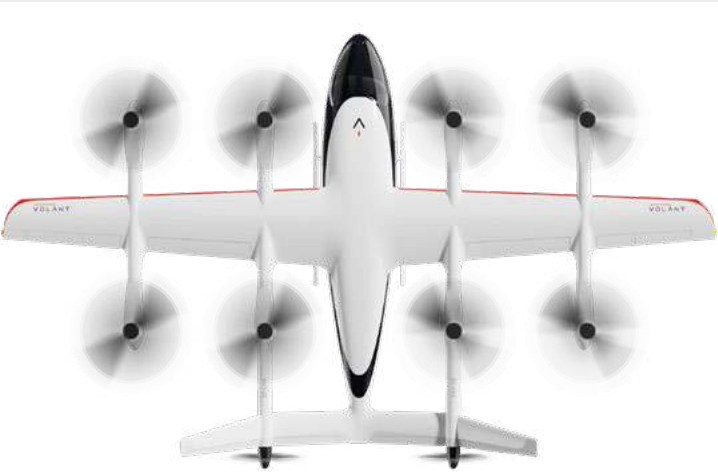


Mainland China | Founded in 2021

Volant Aerotech, founded in 2021 in Shanghai, has a research and development center in Shanghai and an assembly and testing center in Xingyi. The core business of Volant includes researching, developing, designing, and manufacturing passenger-grade eVTOLs, with the VE25 being its flagship product. Volant signed a Partnership for Safety Plan (PSP) with the CAAC (Civil Aviation Administration of China) East China Regional Administration. Together with China Southern Airlines General Aviation, Zhuhai Flight Training Center, ACCEL, and other leading enterprises, Volant published "New Air Mobility/Electric Vertical Takeoff and Landing Aircraft Pilot Training White Paper" and "Passenger eVTOL Applications and Market White Paper". Volant established a "type certification" (TC) team in January 2022.

VE25

PROJECT PHASE	Prototype Development
TYPE	Lift + Cruise
OPERATION	Piloted
RANGE ¹	200 km/ 400 km
CRUISE SPEED	235 km/h
SEATS	6
ELECTRIC MOTORS	10

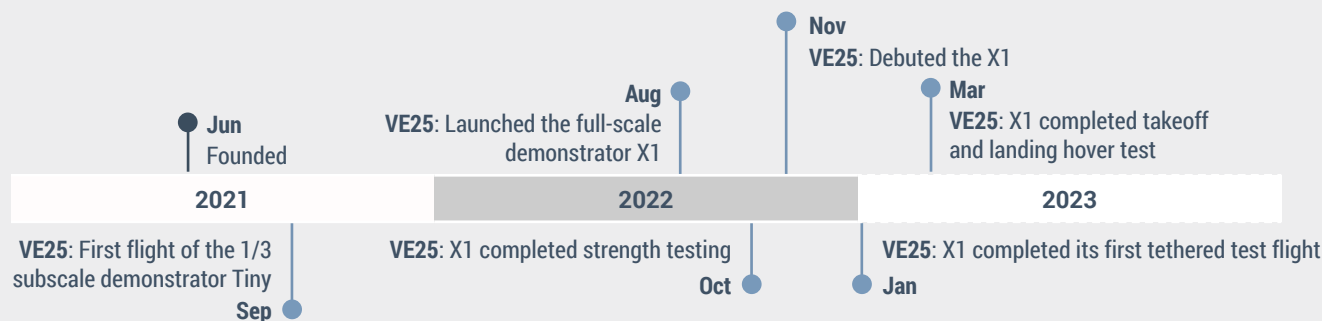


Note: 1. The VE25 will have a target range of 200 kilometers using first generation battery and 400 kilometers using third generation batteries.

The VE25 adopted a Lift and Cruise configuration with a pair of high gull wings and four booms with eight propellers on the wings. The maximum speed of the VE25 is 235 kilometers per hour. The vehicle can carry five passengers with one pilot and will be used for passenger transport, medical rescue, and cargo shipping.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Jan 2022	Civil Aviation Administration of China	Volant and the CAAC East Regional Administration signed a Partnership of Safety Plan (PSP)

FUNDING

DATE	ROUND	AMOUNT	INVESTORS
Sep, 2021	Seed Funding	Unspecified	Shunwei Capital, Ventech China
Jun, 2022	Pre-A Round	Unspecified ¹	Future Capital, Qingsong Fund, Welight Capital, Shunwei Capital

Note: 1. Volant stated the Pre-A round of funding is around 100 million Chinese Yuan.

ORDERS

DATE	COMPANY	COUNTRY/SUBREGION	TYPE	VE25
Feb 2022	Ruohang Industrial Technology	Mainland China	Intent orders	50
Mar 2022	Huaxia Feidi Technology	Mainland China	Conditional orders	200
Mar 2022	Others (confidential clients)	Unspecified	Conditional orders	180

GLOBAL PARTNERSHIPS

Feb 4, 2022	Signed an MoU with ACCEL Flight Simulation and Anhui Huaming Avionics System Co., Ltd. to jointly establish a cockpit maneuvering industry alliance
Aug 8, 2022	Signed a strategic cooperation Memorandum of Understanding with China Southern Airlines General Aviation Company Limited to jointly promote eVTOL market
Nov 10, 2022	Jointly released the "New Air Mobility/Electric Vertical Takeoff and Landing Aircraft Pilot Training White Paper" with ACCEL (Tianjin) Flight Simulation and Zhuhai Flight Training Center to jointly promote the standardization and system construction of eVTOL pilot training
Jan 13, 2023	Co-released the "Passenger eVTOL Applications and Market White Paper" with China Southern Airlines General Aviation Company Limited aiming to jointly promote the development of the eVTOL industry
Mar 18, 2023	Establish a strategic partnership with Huaxia Feidi Aviation Technology Co., Ltd. to determine procurement plans and jointly explore market opportunities in high-end tourism and public services sectors

Information was provided by Volant Aerotech and translated by Global Sky Media. The information cutoff date is March 31, 2023.



XPENG AEROHT



Mainland China | Founded in 2013

Guangdong HT Aerospace, established in 2013, was the predecessor company of XPENG AEROHT founded by Deli Zhao, focusing on the research, development, and flight-testing a low altitude aerial vehicle. In 2020, Xiaopeng He and XPENG jointly invested and controlled the company, establishing XPENG AEROHT as a subsidiary of XPENG. XPENG AEROHT integrates intelligent automobiles and modern aviation to provide products and solutions for three-dimensional urban transportation. It has independently developed five generations of electric vertical take-off and landing (eVTOL) manned flying cars. Among these five models, the flying motorcycle and two-seater prototype are experimental prototypes of future flying cars, while the XPENG T1, X1, and X2 are technology verification products, providing experimental data support and technical validation for the next generation flying car X3 (internal code name). In July 2022, XPENG AEROHT's trial production factory was officially completed in Panyu District, Guangzhou.

XPENG X2

TYPE	Multicopter
OPERATION	Piloted/ Autonomous
RANGE	Undisclosed
CRUISE SPEED	130 km/h
SEATS	2
ELECTRIC MOTORS	8



The XPENG X2 is the fifth-generation electric flying car developed by XPENG AEROHT. It features a carbon fiber airframe and an enclosed cockpit that can accommodate two people. The XPENG X2 adopts a configuration with eight propellers. It has a flight endurance of 25 minutes and can reach a top speed of 130 kilometers per hour. It is suitable for low-altitude flights in urban areas and can be used not only for personal transportation but also for tourism and sightseeing. The X2 completed its maiden flight test with a full-scale prototype in June 2021 and obtained a special flight permit from the Civil Aviation Administration of China (CAAC) in mainland China in January 2023.

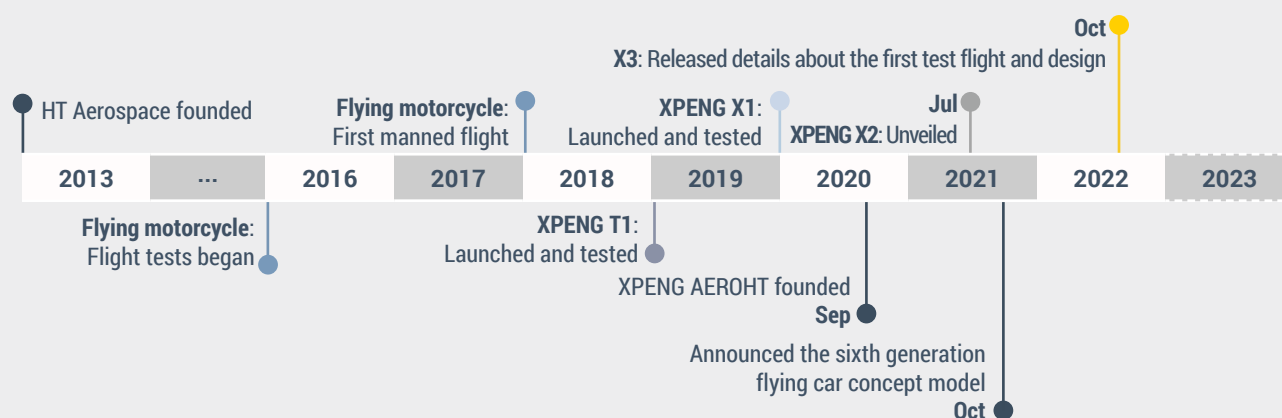
X3 (INTERNAL CODE)

The X3 is currently being developed with a focus on amphibious configuration, capable of both land and air operations. The version released in October 2022 is not the final configuration, as the product is still undergoing continuous iteration. The final version will take factors such as policies and regulations, airspace openness, and technological boundaries into account. XPENG AEROHT has revealed that the X3 is planned to enter mass production around 2025. The development will be driven within the million-dollar price range, and the specific pricing will depend on the accurate research and development costs in the future.



Note: The image above presented a conceptual model, the production model might be subject to change.

MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Sep, 2022	Dubai Civil Aviation Authority	Received Flying Permits during flight demonstration in Dubai
Jan, 2023	CAAC Central and southern regional administration	Issuing special flight certificate for XPENG X2

FUNDING

DATE	ROUND	AMOUNT(USD)	INVESTORS
Oct 19, 2021	Series A	\$ 500,000,000	IDG Capital, 5Y Capital and Xpeng leading investment. Sequoia China, Eastern Bell Capital, GGV Capital, GL Ventures, YF Capital and etc.
Jun 30, 2022	Series A+	Undisclosed	Rockets Capital
Nov 8, 2022	Line of credit	\$ 827,312,228 ¹	Agricultural Bank of China Guangdong Branch, China Construction Bank Guangdong Branch, China CITIC Bank Guangzhou Branch, Shanghai Pudong Development Bank Guangzhou Branch

Note: 1. The original announcements of funding are expressed in Chinese Yuan. The funding was converted to United States Dollars using the exchange rate on the announced date.

ORDERS

Order information is not available

Information was provided by XPENG AEROHT in Chinese and modified and translated by Global Sky Media with an information cut off date of March 31, 2023.

ZEROG

Mainland China | Founded in 2021

ZEROG, founded in 2021, is headquartered in the Hefei High-tech Zone. It has a research and development center, operational office, factory and testing base in Nanjing, Shenzhen, Wuhu, and Hainan, respectively. dedicated to establishing a new way of traveling and providing low-altitude travel solutions in line with the concept of being “futuristic, eco-friendly and innovative.” ZEROG is concurrently developing models in three different configurations. The company signed strategic cooperation agreements with several enterprises since 2022 to carry out in-depth cooperation in fields such as production, research and development, training, certification, and the purchases of passenger electric vertical take-off and landing (eVTOL) aircraft.

ZG-ONE

PROJECT PHASE	Detailed Design
TYPE	Multicopter
OPERATION	Autonomous
RANGE	30 km
CRUISE SPEED	75 km/h
SEATS	2
ELECTRIC MOTORS	6



The ZG-ONE adopted a Multicopter configuration with six propellers using six axles and a Whole Aircraft Rescue Parachute System. The design of the exterior is based on a space module. The ZG-ONE can accommodate two passengers and will be used for short-haul city commute and cargo transport.

ZG-VC2

TYPE	Lift + Cruise
OPERATION	Autonomous
RANGE	150 km
CRUISE SPEED	200 km/h
SEATS	2
ELECTRIC MOTORS	9



ZG-T6

TYPE	Vectored Thrust
OPERATION	Autonomous
RANGE	300 km
CRUISE SPEED	250 km/h
SEATS	6
ELECTRIC MOTORS	6



MILESTONES

● Mar
Founded

2021

2022

2023

● ZG-ONE: Officially released

● May

CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Estimated: beginning of 2024	Civil Aviation Administration of China	ZG-ONE expected to obtain airworthiness certification
Estimated: beginning of 2025	Civil Aviation Administration of China	ZG-VC2 expected to obtain airworthiness certification
Estimated: beginning of 2026	Civil Aviation Administration of China	ZG-T6 expected to obtain airworthiness certification

FUNDING

DATE	ROUND	AMOUNT	INVESTORS
2021	Seed	Unspecified	Bluerun Ventures
2022	Angel	Unspecified	Lenovo Capital QF CAPITAL Hefang Capital
2023	Pre-A	Unspecified	Nanjing Communication Engineering (NJCE)

ORDERS

Order information for ZG-ONE, ZG-VC2 and ZG-T6 is not available

GLOBAL PARTNERSHIPS

Sep 1, 2022	Signed a proposal for converting various aircraft into UAV with Hunan Xianglong General Aviation Co. to advance the development, certification and investigate real world scenarios
Dec 16, 2022	Signed a strategic cooperation agreement with Yellow River General Aviation and Yangtze River General Aviation to jointly deploy low-altitude tourism
Dec 16, 2022	Signed a strategic cooperation agreement with CETC Wuhu Diamond Aircraft Manufacture Co., Ltd. to cooperate in the R&D and production of eVTOL aircraft and convert traditional fixed-wing aircraft to VTOL

Information was provided by ZEROG in Chinese and translated by Global Sky Media with an information cut off date of March 31, 2023.



COME FLY WITH US: INDUSTRY HEAVYWEIGHTS TO DESCEND UPON AIRTAXI 2023

By Ben Mirwani

An annual event that brings together the biggest players in the advanced air mobility (AAM) sector, the AIRTAXI World Congress this October once again promises to showcase the latest advancements in the fast-evolving electric aircraft industry.

With an impressive lineup of speakers and exhibitors descending upon San Francisco International Airport, the official venue of the AIRTAXI World Congress,

and partake in wide-ranging discussions on the opportunities and regulatory challenges facing the industry.

“*The event is a must-attend for industry professionals looking to witness the latest eVTOL designs and technologies.*”

Over 400 attendees from 275 companies based all over the world will be in attendance, allowing plenty of networking opportunities. The potential to forge long-lasting relationships is also a possibility as over 3,000 one-to-one meetings will be held throughout the four-day event at the Grand Hyatt at SFO from October 2 to 5.

Volocopter, EHang, Rolls Royce, Emirates, and Skyports are just a few of the high-profile sponsors, exhibitors, and attendees the AIRTAXI World Congress will host this year. Lufthansa Innovation Hub, Groupe ADP, Vertical Aerospace, and Aeroporti di Roma will also be present, while Munich International Airport will be a Gold Sponsor of the event.

A diverse selection of events and showcases will take place throughout the four-day symposium, including an array of in-depth discussions between eVTOL firms and their partner airlines. Presentations from airports and their vertiport partners will also be held.

Countdown to Certification, Factors Behind Key Investments, Regional Airports Infrastructure & eVTOL Operational Readiness are a few of the other highlights this year's AIRTAXI World Congress will feature.

A spectacular conclusion has also been planned, with eVTOL aircraft conducting live take-off and landing demonstrations at San Francisco International Airport.

Rose Sokolova, Global Travel Investments's Chief Operations Officer, is looking forward to the impending gathering of the world's top eVTOL and AAM firms, adding that she is keen to see electric aircraft operating at San Francisco International Airport in the future.

"We are so thrilled to be working together with San Francisco International Airport, Joby Aviation, and Signature Flight Support on the integration of eVTOLs into SFO's operational system to WOW all attendees this October! Stay tuned for more," she said.

www.airtaxiworldcongress.com





THE RACE TO THE WORLD EXPO 2025 IN OSAKA IS ON

By Ben Mirwani

Like a scene taken straight out of one of the Fast and Furious films where every car is neck and neck in an adrenaline-pumping final dash to the finish line that determines the winner, the same picture can be painted about the electric vertical take-off and landing (eVTOL) aircraft industry in Japan. A growing number of players have decided to venture into the market as it is brimming with potential and there is a clear acceptance of the evolutionary concept of electric aircraft and the accompanying infrastructure that could revolutionize air travel as we know it.

Unlike the movies, the finish line is the World Expo 2025 in Osaka, which represents the proverbial checkered flag. With time running out, the competition within the eVTOL space is heating up as the various manufacturers invested in the Japanese market are rounding the final turn and approaching the finish line, each vying to be crowned the first to launch commercial operations in Japan. The competition has been fierce, with advancements in technology, infrastructure, and regulations happening at breakneck pace.

With the checkered flag in sight, it is time to buckle up and enjoy the ride as the past 12 months have been nothing short of a whirlwind

of activity. The emergence of key players, ever-changing industry developments, and the speedbumps that lie ahead have set the scene for a tense race to air travel stardom.

Land of the Rising Sun

Not only is this moniker Japan's alter ego but it also perfectly portrays the vast opportunities waiting to be seized. Japan has fast become one of the instrumental markets in the eVTOL and advanced air mobility (AAM) industries as the country has put all the pieces of the complex jigsaw in place to allow electric aircraft to

positively thrive. It is this commitment that serves as a testament to Japan's pledge to adopt sustainable vehicles, build the required infrastructure, and certificate electric aircraft through its Civil Aviation Bureau (JCAB).

The World Expo in 2025 is the target for many of the original equipment manufacturers (OEMs) but the possibilities extend far beyond that as air taxi services within major cities and to and from airports are on the radar. Shuttle services within resort facilities and sightseeing tours have also been outlined as potential areas where eVTOLs can flourish commercially.

Volocopter, the German eVTOL manufacturer, perfectly summed up the true potential of Japan, telling Global Sky Media the nation was "one of the first countries to nationally adopt the concept of urban air mobility and created a roadmap to implement this new mobility mode from 2025 onwards."

Who are the Players?

Over the past year, the race to take to the skies in Japan has been heating up significantly. An increasing number of OEMs have thrown their hats into the ring, signaling the start of an intense battle for market supremacy.

Below are a few of the major OEMs that have been making big moves to ensure they are primed for take off once the World Expo 2025 arrives.

SkyDrive

The big fish in the local pond, SkyDrive has been going from strength to strength in the 12 months that have passed. Partnerships were forged with Toray Carbon Magic and Electric Power Systems regarding the SD-05 eVTOL's composite structure and battery system respectively. SkyDrive is also making great headway in its bid to obtain certification from JCAB. Financially speaking, the company is in a healthy position, having raised in excess of 15 billion Yen (USD\$110 million) as of April 6, 2023. Orders have also been piling in since November last year, with Vietnam's Pacific Group pre-ordering up to 100 electric aircraft. Taiho has also placed a pre-order for SD-05s, while SkyDrive is also accepting pre-orders from individuals that want to soar through the skies in their very own eVTOL.

Tomohiro Fukuzawa, SkyDrive's CEO, has grand plans laid out for the company, starting with unveiling the commercial model of the SD-05 at the 2025 World Expo in Osaka. From there, SkyDrive aims to venture beyond the boundaries of Japan and take its business to a global level.

"Advanced Air Mobility (AAM) is included in the master plan for Expo 2025 Osaka, Kansai, Japan, and in February 2023, we were selected as a company to participate in the Advanced Air Mobility 'Smart Mobility Expo' project," Fukuzawa said. "We aim to unveil the SD-05 commercial model at the event in Japan and expand the business overseas."

Volocopter



A German-based company with plans to revolutionize air travel with its VoloCity air taxi, Volocopter has been laying the foundations for successful lift-off in Japan. Following the announcement of the European Union Aviation Safety Agency (EASA) and JCAB concurrent certification in March, Volocopter is working closely with both bodies to initiate technical discussions pertaining to certifying the VoloCity so that it can start operating in Japanese airspace by 2025.

Volocopter has raised plenty of capital from numerous parties, including Sumitomo Corporation, a Fortune 500 company, and Japan Airlines (JAL). The Bruchsal-based firm is also working with an environmental, social, and corporate governance (ESG) group in Tokyo to conduct a feasibility study on air taxis for smart city use.

In the lead-up to the 2025 World Expo, Volocopter plans to work closely with JAL regarding routes and permits. Flight regulations and local authority discussions will also begin in the near future.

"We also have support from strong partners and investors from Japan who share the vision of bringing UAM to Japan," a Volocopter spokeswoman said. "The use cases for Volocopter's family of aircraft (VoloCity, VoloRegion, VoloDrone) fit with our vision – densely populated megacities, urbanization, congestion, reducing emissions, remote area support, etc."

EHang

Based in China, EHang has been spreading its wings and making its presence known in multiple countries worldwide, including Japan.

The past 12 months have borne a lot of fruit for the manufacturers of the EH216 eVTOL as in July 2022, it conducted the first above-sea aerial tourism flight demonstrations in Japan in Fukuyama City, Hiroshima Prefecture. EHang also successfully completed Japan's first point-to-point aerial commute flight demonstration in Oita City, Oita Prefecture.

EHang has also dabbled in autonomous flight, flying an aircraft with the support of the Ministry of Land, Infrastructure, Transport and Tourism (MLTI) and other partners. This marked "Japan's first manned autonomous eVTOL flight," Xin Fang, EHang's Chief Operating Officer, said.

Orders-wise, the Guangzhou-based firm received an order for 50 EH216 eVTOLs from AirX - further growing its presence in Japan.

Wisk

Wisk is the curve ball that few saw coming this early as its prominent difference from the other OEMs is that its eVTOLs will operate autonomously. In May, the Mountain View, California firm signed a memorandum of understanding (MoU) with JAL to introduce its eVTOLs in Japanese cities. Under the agreement, the two parties will work together with JCAB and other government agencies in Japan regarding type certification, demonstration flights, and ultimately, the implementation of autonomous aircraft.

"From our perspective, a local partner like Japan Airlines is critical to future success in this important market," a Wisk spokesperson said.

The Infrastructure Progress

Japan's all-in approach extends beyond eVTOLs as the country knows that without the required infrastructure in place, all the electric aircraft preparing for take-off will remain grounded indefinitely.

To ensure a turbulent-free journey, the Public-Private Committee for Advanced Air Mobility was established in 2018 to focus on establishing vertiports and other types of infrastructure that will play an instrumental role in the daily operations of eVTOLs.

A number of key players have also risen to the challenge of creating a fully-functioning ecosystem that will serve as the lifeblood of Japan's vision of becoming a leader in the eVTOL market not just in Asia, but potentially around the world.

Skyports

One of the spearheads when it comes to the development of AAM infrastructure, Skyports has been highly active in Japan over the past

year. In 2022, the company secured projects in Tokyo and Osaka, whereby it will conduct a series of assessments to pave the way for the successful integration of vertiports and AAM technology. Skyports aims to kickstart commercial operations around 2025, which means it would have hit the ground running prior to the commencement of the World Expo.



Japan's AAM-enabled future is imminent and bright."

A 2022 study by Roland-Berger and Rolls-Royce predicted that the Asia-Pacific region will lead the global AAM market, with Japan as the top market in terms of volume of VTOL aircraft," Atsushi Okada, Japan Country Manager, Skyports, said.

"Skyports recognized the strong potential for AAM deployment in Japan and began our work in the country in 2020 when we signed a memorandum of understanding (MoU) with Kanematsu Corporation. Our decision was driven by three compelling applications in the context of Japan: intracity connectivity, urban to rural connectivity, and disaster relief missions.

"Skyports is committed to ensuring that the necessary vertiport infrastructure is in place as all parts of the ecosystem move ahead."

EHang

EHang has a lot of skin in the game not just from an OEM standpoint, but as an investor in AAM infrastructure. Over the past couple of years, EHang has partnered with the Japanese aerospace research institution MASC and air mobility digital platform AirX to develop the necessary infrastructure required for a fully-functioning AAM ecosystem.

In April 2023, the Chinese electric aircraft developer was inducted as a member of Japan's Public-Private Committee for AAM. As the only



autonomous eVTOL OEM among the 56 members on the committee, EHang will have a pivotal role to play in helping lay the groundwork for the introduction of a safe and reliable AAM network that will subsequently result in the seamless integration of eVTOLs in Japan.

Xin Fang, EHang's COO, acknowledged how important Japan's position is as a future eVTOL and AAM hub, pointing out the unwavering commitment and dedication shown by all parties involved. Considering the vast amount of investment put in, Xin knows that EHang can play a leading role in bringing a more sustainable means of air travel to the technologically-advanced nation and its citizens.

"We devoted ourselves to promoting safe, autonomous, eco-friendly air traffic solutions worldwide. We also hope to take this opportunity to implement EHang's urban air mobility solutions in Japan and assist Japan in establishing an ecosystem for Advanced Air Mobility (AAM) to allow passenger-grade, safe, autonomous, eco-friendly aerial vehicles to benefit the general public," he said.

The Certification Campaign

Obtaining certification from JCAB will be a long, arduous hard-fought campaign that requires OEMs to show plenty of grit, determination, persistence, and an almost sensei level of deftness. The hurdles that have to be cleared will grow in stature and require immense amounts of funding, representing a whole different battle that needs to be won.

Nonetheless, despite the road to certification being filled with potential pitfalls, plenty of eVTOL manufacturers have made steady

progress over the past 12 months. SkyDrive, Joby, Volocopter, Vertical Aerospace, and Wisk are just a few of the OEMs that have already plotted their flight paths to landing certification. That said, whether all the companies are able to accomplish this by 2025 is the billion-dollar question.

It is not just a case of submitting the required paperwork and getting approval. Flight tests, multiple checks and adjustments, and an eye-watering amount of funding are needed to earn the right to fly electric aircraft in Japanese airspace. From there, the next hoop to jump through is establishing a dedicated flight path, which the Japanese authorities have to set up.

All in all, it looks as if many eVTOL manufacturers face a long road ahead that will test their mettle and finances too. It is safe to say they will need deep pockets if they are to get through the certification tests and move on to the next stage of operations.

A Breakneck Battle to the Finish

The possibility of eVTOLs soaring above cities was once a scene straight out of *The Jetsons*, but it is now on the verge of coming to fruition in Japan in a couple of years. In fact, the country could well and truly become a mecca for electric aircraft and AAM, both in Asia and globally. However, the one perennial question that continues to linger in everyone's mind is, which of the OEMs will cruise across the finish line and stand atop the podium as the inaugural eVTOL operator in the Land of the Rising Sun and the 2025 World Expo in Osaka. It is cliché to say, but only time will tell.



The Psychological Flight Path: A Roadmap Towards Autonomous Modes of Transport on eVTOLs

An interview with Stuttgart University of Applied Sciences

By Jeffrey Tang



Prof. Dr. Patrick Planing
Business Psychologist
Stuttgart University of
Applied Sciences

The introduction of electric vertical takeoff and landing (eVTOL) aircraft has undeniably transformed the aviation landscape. However, as the industry embraces the shift from traditional piloted modes of transportation to autonomous operations, a multitude of psychological ramifications and considerations have emerged for operators, pilots, and passengers alike. In this feature, we delve into the intricate layers of evolving social dynamics, technological advancements, and the progressively defined regulatory framework, aiming to shed light on how manufacturers and operators can navigate the transition towards widespread acceptance and implementation of uncrewed eVTOL flights.

Autonomous Flight Testing: The Passenger Perspective

With the rise of autonomous and simulated flight testing, a pressing concern looms large in the minds of passengers: flight path operations. The absence of a human pilot in the cockpit can elicit feelings of unease, a hesitancy that numerous studies on perceptions of pilotless transportation have identified as a common thread. As eVTOL consultant Keith Sarich aptly questions, "What happens if communication and data feeds are disrupted due to a grid failure, and the autonomous system can no longer receive and respond to them accurately?" Additionally, how can autonomy convincingly assure users that it possesses robust security measures and redundancies to address unforeseen cyber threats or catastrophic mechanical failures?

These apprehensions are valid fears that automation must assuage in order to build a consensus that the system, in its processes and purposes, is finely calibrated to instill users with confidence, reliability, and an enjoyable experience. Picture a seamless Uber ride with breathtaking city vistas akin to an upscale helicopter charter.

Moreover, the subtleties of the passenger experience play a significant role. The takeoff and landing phases, widely acknowledged as the most nerve-racking aspects of any flight, remain a paramount challenge in ensuring passenger comfort within an autonomous eVTOL, especially considering the unique surroundings associated with each flight path.

To address these concerns, researchers and developers are striving to create intuitive and responsive autonomous systems that can emulate the expertise and human touch of seasoned pilots. Advancements in artificial intelligence, such as the AI pilot model developed at Carnegie Mellon University's Robotics Institute, leverage natural language processing and speech recognition capabilities to humanize interactions and coordination with pilots and air traffic controllers.

Thus far, simulation tests have yielded promising results, showcasing the AI's effectiveness in navigating complex and ever-changing conditions inherent to typical eVTOL flight paths operating under visual flight rules (VFR), potentially in segregated lanes.

Furthermore, ease of use and passenger interface are crucial factors. As passengers become more actively engaged in their flight experiences, operators in this emerging market must prioritize a seamless user journey as a key selling point. Initially, interacting with an autonomous system may feel unfamiliar and disconcerting to many. Therefore, an empathetic user experience (UX) design needs to be developed, one that fosters a sense of control, comfort, and safety, bridging the gap between users and automation.

Operator's Perspective: Refinement for Efficiency and Safety

From the operator's standpoint, autonomous eVTOLs present a distinctive array of challenges that need to be addressed. The paramount concern revolves around maintaining optimal levels of efficiency and safety in uncrewed operations.

Operators must develop robust fail-safe systems, ensuring their ability to conduct maintenance tasks swiftly and reliably, and regularly update the machine learning algorithms that govern the aircraft's functions. In this context, efficient data management and real-time monitoring systems play an indispensable role, allowing operators to predict and proactively address potential failures.

The second area of concern pertains to air traffic control for eVTOLs. As the skies become increasingly populated with autonomous aircraft, a sophisticated system must be in place to manage the escalating volume of air traffic and facilitate the safe coexistence of autonomous and piloted flights. Regulatory bodies like the Federal Aviation Administration (FAA) will undeniably exert a significant influence in shaping the management of competitive and uncontrolled airspace, with an unwavering commitment to ensuring absolute safety.

It is anticipated that substantial capital investment and collaboration with aviation regulators will be necessary to formulate and establish operational frameworks that fulfill the unique safety requirements of eVTOL systems. These



frameworks must also encompass compliance with existing aviation regulations, even as they factor in the integration of non-automated aircraft sharing the same airspace. The fact that Joby Aviation has taken the lead by becoming the first Advanced Air Mobility (AAM) company to receive certification from the International Standard for Business Aircraft Operators (IS-BAO™) is a testament to its dedication to safety commitments within this sector.

The resolution of these operational challenges will undoubtedly have a direct impact on user trust and the rate of adoption of eVTOLs as a viable mode of transportation.

Psychological Implications: Changing Perception is Key

In light of the current eVTOL landscape, the shift towards autonomous eVTOLs undeniably carries significant psychological implications for both users and operators.

“Potential users must overcome biased perceptions that inherently mistrust machine capabilities when compared to human competence.”

For pilots, an existential crisis looms on the horizon as the cockpit empties out. Their roles are undergoing inevitable transformation, transitioning from aviators to instrumental operators overseeing autonomous systems. Nevertheless, pilots are poised to remain indispensable in mitigating operational risks and ensuring passenger safety. They will serve as a vital component in a complex safety system that will likely involve advanced AI interventions for assistance.

As the pilot shortage looms large, exerting pressure on existing commercial aviation operations, automation developments within the eVTOL domain could potentially address the manpower shortfall while simultaneously safeguarding pilots from burnout resulting from overloaded flight schedules.

Trust emerges as the psychological linchpin in driving the implementation of autonomous eVTOLs. Drawing from the realm of self-driving cars, the concept of "trust in automation" becomes equally relevant here. However, it is important to emphasize that multiple levels of trust are at play in eVTOL operations. These

levels encompass trust and perceptions towards various aspects of the eVTOL ecosystem, including trust in flight technology, trust in automation and regulatory systems, and perceived trust in the operator.

Perceived trust simultaneously includes people indirectly involved within the ecosystem. The European Union Aviation Safety Agency (EASA) has conducted feasibility studies across Europe, shedding light on the significance of considering concerns from local residents and the broader public regarding their surrounding environment. Factors such as noise levels in an increasingly crowded airspace could potentially disrupt their way of life, necessitating careful attention. According to EASA Executive Director Patrick Ky, the agency's first worldwide assessment (Environmental Protection Technical Specifications) for regulating noise levels to facilitate type certification of eVTOLs will become a benchmark to both measure and limit aircraft noise emitted during different stages of an eVTOL flight.

Building trust among users and operators hinges on perceiving the autonomous ecosystem as reliable, transparent, and capable of effectively handling unforeseen circumstances. Therefore, operators must clearly communicate the capabilities of their autonomous systems, providing substantial evidence of their dependability. Business psychologist Prof. Dr. Patrick Planing suggests that eVTOL companies should take a crucial step by conducting additional pilot studies and test rounds, offering the general public more exposure to the technology and opportunities to witness or experience autonomous systems in close proximity.

Potential users could be afforded the chance to familiarize themselves with autonomous eVTOLs in controlled and simulated environments, potentially supported by virtual reality. This approach would undoubtedly alleviate embedded concerns and fears surrounding the flight experience. Through deeper interaction with automation in action, perceptions of flying autonomously can gradually change on a larger scale than currently available.

As of the time of writing, the Federal Aviation Administration (FAA) has recently unveiled a blueprint outlining plans to initiate small-scale air taxi operations utilizing existing infrastructure and implementing gradual procedural changes in flight corridors to accommodate the growing eVTOL traffic flowing in multiple directions. Created collaboratively with industry stakeholders and NASA, this blueprint aims to serve as a guideline to support further research endeavors and steps towards implementation. It also seeks to instill confidence among the general public by

demonstrating the presence of expert authority driving this solution forward and enhancing mobility for a diverse range of users.

Moreover, attention should be paid to the messaging when promoting and marketing eVTOL services. Emphasizing and educating users about the perceived benefits, such as time and cost savings, as well as enhanced convenience, will be crucial in shaping public perception. The framing of how accessible this mode of transport will be for the general public is likely to shape perception regarding the value proposition of autonomous flight; whether the service benefits a wide social demographic or is limited to the exclusively privileged will influence the extent of both acceptance and resistance to its introduction.

When it comes to the ambitious goal of achieving fully automated air travel, eVTOL manufacturers like Archer and Joby Aviation have recognized the single-piloted model as a practical starting point for scaled operations. However, unlike autonomous cars, the general public is accustomed to entrusting pilots with the safe navigation of aircraft through airspace. Professor Planing raises an important question about whether introducing autonomous flight from the outset would necessarily be met with a high level of apprehension, considering that passengers are often unaware of the extent to which automation controls the aircraft behind the cockpit door.

Assuming significant advancements in regulatory approval and seamless technological integration, the mounting concerns regarding security and safety can gradually subside. At that point,

the focus can shift optimistically towards the perceived benefits and advantages of autonomous travel.

Just as the introduction of commercial supersonic flight in 1976 provided passengers with a historic view of the Earth's curvature at 60,000 feet, the emergence of a new mode of travel that offers enhanced time efficiency, affordability, and personalized flight experiences will undoubtedly evoke a range of emotional responses. Whether it sparks amazement at the democratization of air travel, dictating our schedules on any given day, or triggers residual apprehension about potential system failures, the introduction of autonomous technology in the AAM sector is bound to become a fiercely contested area of opportunity.

The journey towards fully autonomous flight encompasses not only technological and regulatory challenges but also psychological ones. While the anxieties and concerns of passengers and operators are significant, they are not insurmountable. The future success of autonomous implementation has the potential to significantly impact the planning and construction of cities and civil infrastructure worldwide, considering this mode of transportation. By conducting continuous testing, adopting user-centric designs, fostering trust, and demonstrating empathy, the industry can navigate through these psychological obstacles toward a future where autonomous eVTOLs are as commonplace as hailing a cab.

www.acceptancelab.com





Training the Next Generation of eVTOL Pilots

By Keith Sarich

eVTOL (i.e., Archer, Joby) indicates a need for eVTOL pilots and with that, a training pipeline necessary to accommodate the requirement for single piloted eVTOL aircraft. Projections call for hundreds, if not thousands of eVTOL pilots in the near future. The ground-breaking white paper from Uber Elevate in October 2016 provided valuable data and metrics regarding aircrew, cost, and staffing. Projecting the need for eVTOL pilots by 2030 and with the current pilot shortages, the questions of what type of certifications and ratings will be required, who will conduct the training and where will the industry find eVTOL pilots are being discussed with greater frequency.

Certification

In the United States, eVTOL pilot certification has focused on a Part 61 training requirement. The FAA has indicated that it would provide detailed information in Summer 2023 regarding specifics on certification and eVTOL pilot training. If the FAA defines eVTOL as a powered lift category (Part 61.129 (e), 50 hours of powered lift flight time of the 250 hours of total time for the commercial certification would be required. If this is the case, the concern will be where would a student find a powered lift aircraft? Presently the only aircraft considered as powered lift and available in the US is the V-22 Osprey operated by the US military which would severely constrain efforts for civilian eVTOL pilot training. A second proposal, if the FAA prescribes a hybrid model of fixed and rotary wing certifications would follow Part 61 as well as Part 135.243 c (2). This requires 1,200 hours total time which would allow single pilot operations in instrument meteorological conditions (IMC) critical for UAM eVTOL flight

operations in marginal and instrument weather conditions such as in Chicago and Boston. Using this model, which would likely be the most cost-effective and accessible pathway, the eVTOL pilot would attain the commercial airplane single engine land with rotary wing add-on commercial certification and build hours to reach 1,200. At that time, follow-on specific aircraft/company simulator training would be completed prior to assuming eVTOL pilot in command duties.

Pilots

Where will eVTOL pilots come from? With the current pilot shortage expected to continue for several years in the United States as well as globally, a concern as to where will the multitude of required eVTOL pilots come from has arisen. Many believe that retired and current airline pilots (Part 121 carriers) could show interest in becoming an eVTOL pilot, citing an attractive work schedule and flexibility, that are often unavailable to an airline pilot. However, experts believe

that with the sheer number of eVTOL pilots required, retired airline pilots would not be able to provide the supply needed. This has brought up discussions for the need of eVTOL pilot training centers. These training centers would be either in-house or with Part 61/Part 141 flight schools. Additionally, the cost to train an eVTOL pilot is incredibly high. A concern has been “who” would pay for this training? With a Part 135.243 scenario and at least 1,200 hours total flight time required, training costs could easily reach \$100,000.00 USD from zero time to reaching certification and hour requirements. Adding to this most, if not all eVTOL concerns (Archer, Joby) have announced that ultimately their aircraft would operate autonomously. What would a perspective eVTOL pilot think about having a very finite career in the eVTOL cockpit? Additionally, another concern, extra space time accrued as an eVTOL pilot even be useful or credited by the regional, mainline, and corporate segments of aviation? Many of these questions remain unanswered.

Simulators

Without question, simulators will serve as an effective tool in the training/recurrent training of an eVTOL pilot. My recommendation is that simulator-based training, starting in the home with desktop flight simulators; XPlane or Microsoft Flight Simulator, be utilized and available for any perspective eVTOL pilot for familiarity and gauge of interest prior to flight training. Liberal use of flight simulation during and after flight training as well as prior to commencing operational pilot in command duties will prove a great asset. Companies such as CAE have developed a simulator targeting the eVTOL market tailored to single-pilot operations. Several other companies are developing training devices and full-motion flight simulators suitable for training pilots to operate multiple eVTOL types.

Autonomy

Autonomous flight (AKA no pilots in the cockpit) is generally considered to be the “end game” for eVTOLs. Eventually, piloted eVTOL aircraft would be replaced by fully autonomous platforms, thus eliminating the pilot. This has benefits in terms of cost-savings (pilot salary) as well as potentially providing a safer passenger experience. As indicated previously, a major downside to autonomy is why would a eVTOL pilot desire this path knowing that their career is finite, and they would be replaced by autonomy? This will certainly be a challenge for the sourcing, recruitment, and retention of any eVTOL company utilizing eVTOL pilots.

Final Thoughts

Along with a myriad of regulatory and government requirements to successfully bring eVTOLs to the marketplace in a commercial capacity, the requirement and need for eVTOL pilots could become a critical priority in the coming months as many eVTOL OEMs continue to target 2024-2025 to commence commercial flight operations. Knowing that the training time for a new pilot to become a certified eVTOL pilot can take 18 months or longer.



The time is now for the FAA and eVTOL OEMs to coordinate and commence eVTOL pilot training activities.”



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EMERGING OEMS IN EUROPE

Several studies show North America held the largest share in AAM OEMs as of 2023, while Europe will witness the fastest growth in the foreseeable future. In July 2019, the European Union Aviation Safety Agency (EASA) published its “Special Condition for VTOL and Means of Compliance” for the first time and has continued to roll out VTOL-related requirements and regulations since. EASA published the initiative “A Drone Strategy 2.0”, with one of the actions being “[adopting rules for] the operational requirements applicable to manned VTOL-capable aircraft.”

Besides well-known eVTOL OEMs like Airbus, Lilium, Volocopter, and Vertical, emerging OEMs are also sprouting in Europe. This section displayed ten emerging OEMs from Europe and one from the Middle East. Most VTOL aerial vehicles are entirely electric-powered, in contrast to the Asia-Pacific market. Six of the eleven vehicles shown in this section already have or will have a version with hydrogen cells or hybrid-electric propulsion. As the Asia-Pacific market matures, Asia-Pacific OEMs might shift towards using hydrogen as a power source.



Israel | Founded in 2017

AIR, founded in 2017, is a developer of eVTOL aircraft headquartered in Pardes Hanna-Karkur, Israel. Originally named Polarity Mobility, the Israeli company was founded by Chen Rosen (CTO), and later joined by co-founders Rani Plaut (CEO) and Netanel Goldberg (COO). The company is focused on bringing the reality of personal flight to the consumer market. Individual consumers can hire pilots through AIR or drive the vehicle themselves with appropriate certificates. AIR plans to relocate a large portion of its R&D and operations to the United States and continue collaborating with the Federal Aviation Administration (FAA) for certification.

AIR ONE

PROJECT PHASE	Prototype Development
TYPE	Multicopter
OPERATION	Piloted
RANGE	161 km
CRUISE SPEED	161 km/h
SEATS	2
ELECTRIC MOTORS	8

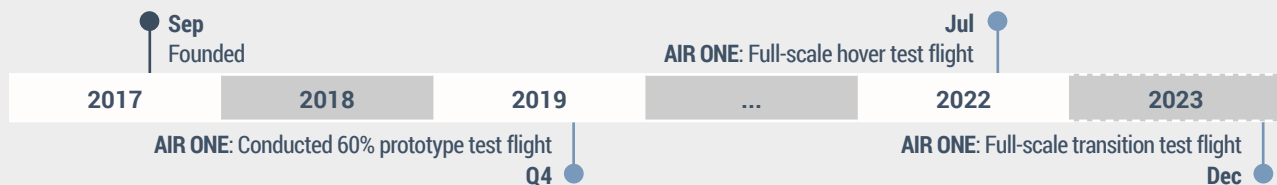


The AIR ONE has a Multicopter configuration with a pair of fixed wings. The vehicle has four booms extended from the fuselage, where each boom has two electric motors powering two propellers rotating in opposite directions. The vehicle is a two-seater. The proprietary “Fly-By-Intent” software built into the AIR ONE affords anyone operating the aircraft an extremely high level of safety. Personal air mobility for individual users is the target market for AIR ONE.





MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
2022	Federal Aviation Administration	Applied for type certification

FUNDING

Funding information undisclosed

ORDERS

AIR has received 400 preorders for its AIR ONE eVTOL for personal use as of March 31, 2023.

Information was provided by AIR and modified by Global Sky Media with an information cut off date of March 31, 2023.

Bellwether Industries



United Kingdom | Founded in 2019

Bellwether Industries originated in 2013 and gained recognition by introducing Gazelle, an operational hovercraft prototype, in 2015. In January 2019, the company was officially registered in London, UK, with a focus on developing advanced solutions for Urban Air Mobility. Bellwether has developed a new type of aircraft called "Volar," which is an eVTOL (electric vertical take-off and landing) with a hidden propulsion system. By building intelligent systems around the vehicle, Bellwether aims to elevate people's experience of movement in urban mobility.

VOLAR - MODEL ORYX (THE THIRD GENERATION)

PROJECT PHASE	Detailed Design
TYPE	Wingless
OPERATION	Piloted / Autonomous
RANGE	100 km
CRUISE SPEED	140 km/h
SEATS	230 km/h
ELECTRIC MOTORS	3

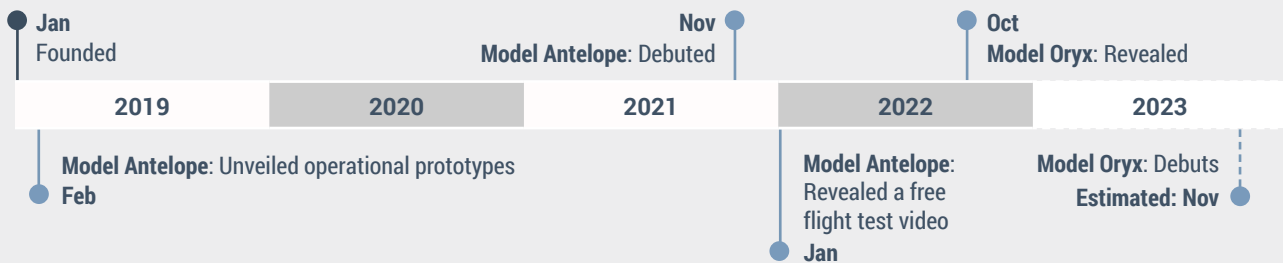


Bellwether's Volars' exterior design is reminiscent of a sports car. Its airframe conceals the propulsion system that allows for unparalleled agility and precision, creating car-like accessibility in urban mobility. The commercial model, set to be launched in 2028, will have an autonomous flying system and can carry up to four passengers. A Volar is intended for short to medium-range flights, reducing travel time in congested, highly populated areas simultaneously.





MILESTONES



CERTIFICATION PROGRESS

Not yet in the certification phase

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Dec 2020	Partnered with ENATA Aerospace FZC for Aircraft Manufacturing
Oct 2021	Signed MOU with Excel Helicopters for market application
Apr 2021	Signed MOU with Inmarsat for connectivity technology

Information was provided by Bellwether and modified by Global Sky Media with an information cut off date of March 31, 2023.

Deep Blue Aviation



Austria | Founded in 2016

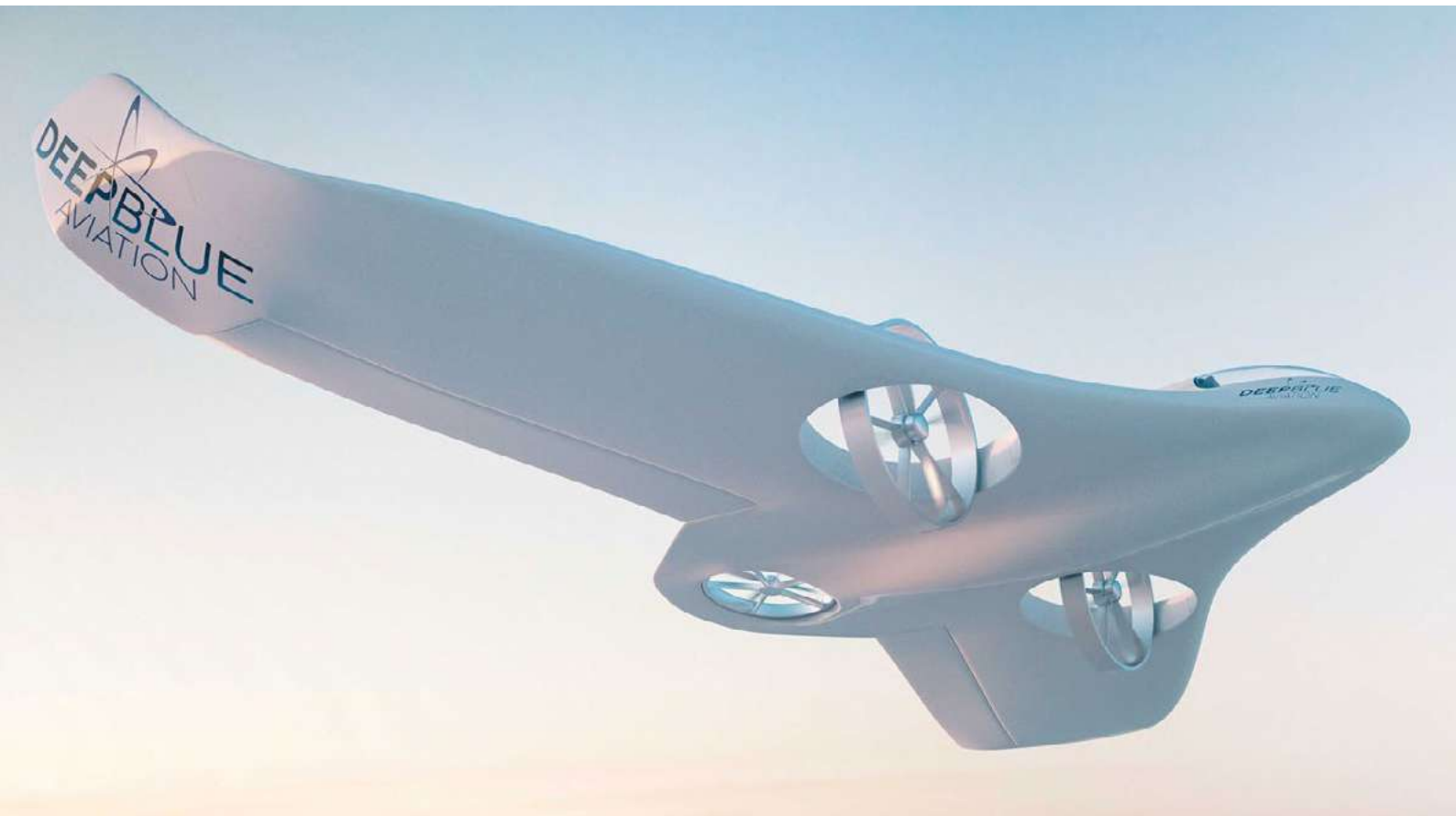
Deep Blue Aviation, founded in 2016, is a privately held company headquartered in Austria. Deep Blue Aviation plans to launch three production models – Silhouette S (unmanned), Silhouette M (a two-seater) and Silhouette X (five-seater) passenger eVTOLs. The specification of Silhouette X has not yet been released. The company is working on its next prototype which will have a second tail rotor providing additional redundancies.

SILHOUETTE M

PROJECT PHASE	Detailed Design
TYPE	Vectored Thrust
OPERATION	Autonomous
RANGE	150 km
CRUISE SPEED	240 km/h
SEATS	2
ELECTRIC MOTORS	3

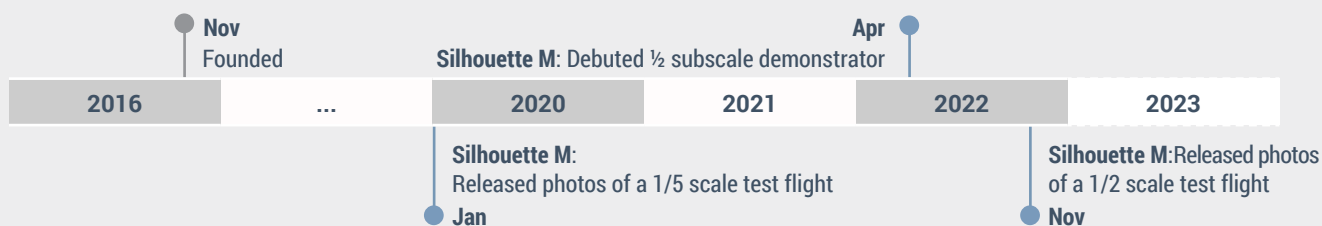


The MX 18 Silhouette M adopted a Vectored Thrust configuration with three motors powering six propellers. The propellers are all embedded in the fuselage and wings where they can be tilted at different angles to provide lifting and cruising force. The Silhouette M will carry two passengers and will be mainly used for passenger and cargo transporting.





MILESTONES



CERTIFICATION PROGRESS

Not yet in the certification phase

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

No disclosed partnership agreements prior to March 31, 2023

Information was provided by Deep Blue Aviation and modified by Global Sky Media with an information cut off date of March 31, 2023.

Dufour Aerospace



Switzerland | Founded in 2017

Dufour Aerospace is a privately held company headquartered in Valais, Switzerland, with a base of operations in Montreal, Canada. The company focused on developing electric and hybrid-electric VTOL (vertical takeoff and landing) aircraft for cargo and passengers. The unmanned drone of Dufour Aerospace is called Aero2, and the aircraft can be operated remotely or autonomously. The Aero2 can equip an RGB camera and an additional ADU (Auxiliary Drop Unit), enabling the aircraft to serve as a SAR (search and rescue) vehicle. Dufour Aerospace is currently testing the second and third-generation prototypes of Aero2, where these prototypes can also serve as 1/3 scale demonstrators of Aero3, the passenger VTOL.

AERO3

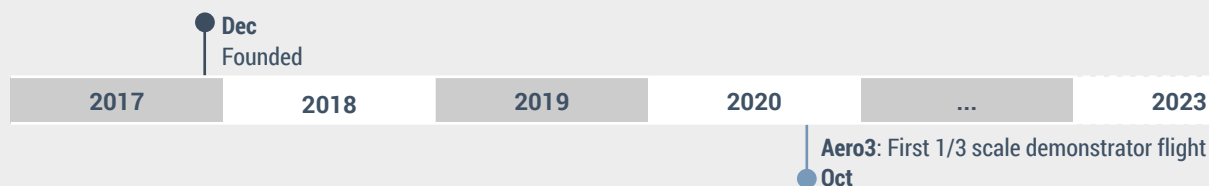
PROJECT PHASE	Preliminary Design
TYPE	Vectored Thrust
OPERATION	Piloted
RANGE	1,020 km
CRUISE SPEED	350 km/h
SEATS	8
ELECTRIC MOTORS	8

A 3D perspective rendering of the Aero3 aircraft, showing its white fuselage, high-tilt wings, and eight propellers. The aircraft is shown from a side-on, slightly elevated angle, highlighting its unique vectored thrust configuration.

The Aero3 adopted a Vectored Thrust configuration with a pair of high-tilt wings. Six propellers are connected to the tilt-wings, and two other stationary propellers are located on the top and bottom at the center of the H-tail. The vehicle has a capacity of seven passengers and one pilot. The target markets of the Aero3 are medical, regional air mobility, and cargo and logistics. The Aero3 has a hybrid-electric propulsion system.



MILESTONES



CERTIFICATION PROGRESS

Not yet in the certification phase

FUNDING

ANNOUNCED DATE	ROUND	AMOUNT (USD) ¹	INVESTORS
Oct 22, 2018	Grant	Undisclosed	Undisclosed
Apr 11, 2019	Series A	\$10,916,175	Session.vc
Jun 3, 2020	Series B	Undisclosed	Vista Global Holding Limited

Note: 1. The original announcements of funding are expressed in Swiss Franc. The fundings were converted to United States Dollars using the exchange rate on the announced date.

ORDERS

DATE	COMPANY	COUNTRY/SUBREGION	TYPE	AERO3
Apr 5, 2022	Blueberry Aviation	Monaco	Pre-order	100
Aug 17, 2022	V-Star Powered Lift Aviation	Australia	Option	100
Mar 31, 2023	Swiss Helicopter	Switzerland	Pre-order	1

GLOBAL PARTNERSHIPS

Jun 22, 2021	Signed a distribution agreement with AirMobility Inc. to open new distribution channel in Japan
Sep 8, 2021	Announced the partnership with Swiss Air-Rescue Rega to collaborate the development of the air ambulance module of Aero3
Jan 11, 2022	Announced the partnership with Savback Helicopters to create new distribution channel
Apr 4, 2022	Signed a partnership agreement with Blueberry Aviation, where Blueberry Aviation will provide marketing advisory and placement support
Jul 12, 2022	Announced the partnership with V-STAR Powered Lift Aviation
Mar 31, 2023	Signed a frame contract with Suter Industries, where Suter Industries will provide power units for the Aero2.

Information was retrieved from Dufour Aerospace's official website, where Dufour provided additional details in the company overview, product description and milestones sections. The information cut off date is March 31, 2023.

Germany | Founded in 2018

eMagic, founded in 2018, is a German company that focuses on developing electric aircraft. The in-house team and the Technical University of Munich worked together on the aircraft. The eMagic One, a one-seater, is a proof-of-concept and began as a personal project. The vehicle has a permit to fly in Germany. eMagic plans to build a three-seater, eMagic Next, that can accommodate two passengers and one pilot with a possibility longer range for commercialization. The company is developing a third generation lifting system as of publication.

EMAGIC ONE

PROJECT PHASE	Prototype development
TYPE	Lift + Cruise
OPERATION	Piloted
RANGE	Undisclosed
CRUISE SPEED	144 km/h
SEATS	1
ELECTRIC MOTORS	9

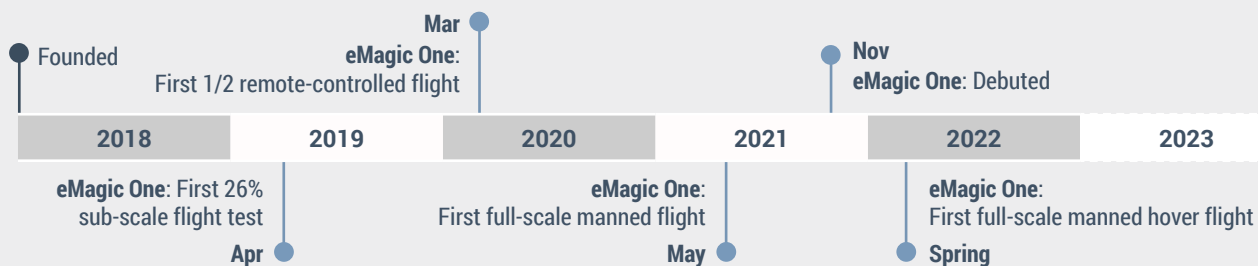


The eMagic One adopted the Lift + Cruise configuration and is equipped with nine electric motors and nine rotors, with eight rotors and motors used for vertical takeoff and landing, and the remaining one used for cruising. eMagic One can also use short takeoff and landing besides VTOL ability. The vehicle has independent hover and cruise battery packs for energy supply in different scenarios. eMagic One has a 60-minute endurance for cruise flight and four minutes for hover.





MILESTONES



CERTIFICATION PROGRESS

Working towards the certification for the hover flight

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Has not disclosed partnership agreements prior to March 31, 2023

Germany & Australia | Founded in 2016

FLUTR, headquartered in Germany and Australia, creates aerial vehicles for widespread personal and commercial use, with an emphasis on widespread availability at the lowest cost possible. FLUTR plans to first enter the Dubai and German markets. Its strategy in Dubai includes implementing an all-day urban aerial mobility service between buildings, main airports, and local suburbs for apartments and brand-name hotels. FLUTR is releasing three versions: FLUTR DTEH (Diesel Turbine Electric Hybrid), FLUTR HEH (Hydrogen Electric Hybrid), and FLUTR FE (Full Electric). The FLUTR DTEH will be the first model to enter the market. The name "FLUTR" stands for Flying Urban Transporter. The FLUTR X1 displayed at the Paris Motor Show is a prototype model. FLUTR will release the launch date of the production model, X2, in 2023.

FLUTR FE

PROJECT PHASE	Pre-production Design
TYPE	Vectored Thrust
OPERATION	Piloted/ semi-autonomous/ fully autonomous
RANGE	200 km
CRUISE SPEED	250 km/h
SEATS	2-3
ELECTRIC MOTORS	8



The FLUTR FE utilizes a tilt rotor, tilt wing and shrouded rotor configuration where the four ducted wing fans can rotate to provide both lifting and cruising power. FLUTR FE is a personal vehicle focused on mobility by designing for street, rooftop, and driveway capability. It can also be used for emergency medical services and other industry missions with a reconfigurable platform. The current two seat version can accommodate either one pilot and one passenger or two passengers in semi-autonomous and fully autonomous modes. FLUTR also plans to launch a three-seat model in the future.





MILESTONES

● Founded

2016

2017

2018

...

2023

● FLUTR: Debuted the full-scale model X1 demonstrator
Oct

CERTIFICATION PROGRESS

Not yet in the certification phase

FUNDING

Funding information undisclosed

ORDERS

FLUTR received 1,000 orders or expressions of intent.

GLOBAL PARTNERSHIPS

Sep 13, 2022

Announced the partnership with **wasl** to provide AAM services in Dubai

Information was provided by FLUTR and modified by Global Sky Media with an information cut off date of March 31, 2023.

Manta Aircraft



Italy | Founded in 2020

Manta Aircraft, founded in 2020 and headquartered in Sesto Calende, Italy, is a privately held company engaged in developing a modular hybrid-electric eVTOL/eSTOL (electric short take-off and landing) ariel vehicle platform as the base to generate multiple adaptable and reconfigurable models (2-Seater, 4-Seater, 6-Seater, Cargo-Version, Unmanned/UAV) for several different missions. Manta Aircraft is taking a modular approach: the same subsystems are used across multiple models, with the goal of minimizing the cost of versioning while maximizing synergies. The platform is designed for long ranges, high speeds, and high independence from ground structures.

ANN PLATFORM

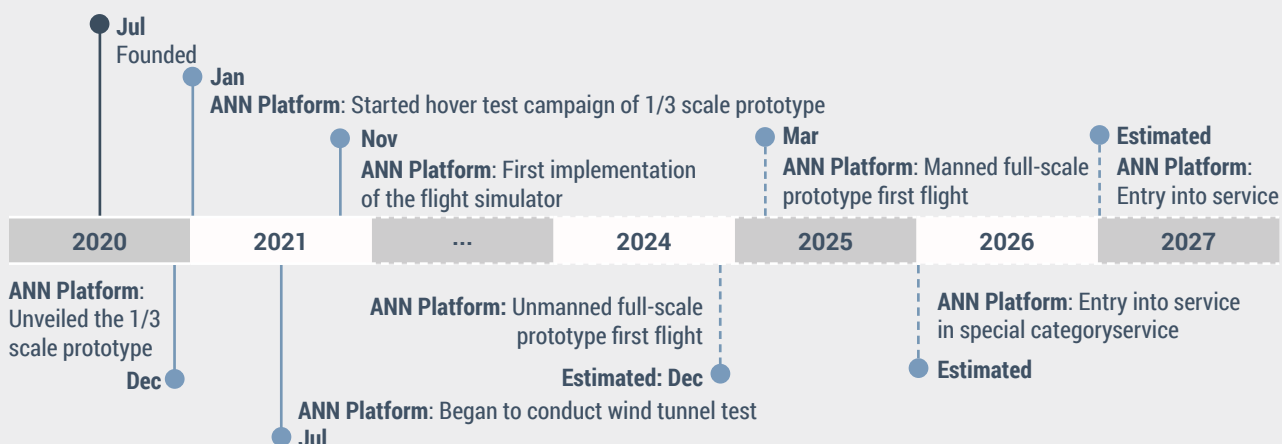
PROJECT PHASE	Preliminary Design
TYPE	Vectored Thrust
OPERATION	Piloted
RANGE	300-800 km
CRUISE SPEED	250-300 km/h
SEATS	0-6
ELECTRIC MOTORS	8



The ANN platform adopted a Vectored Thrust configuration with a pair of fixed wings. There are four propellers in the fuselage providing lifting power and four tilting propellers under the wings optimized for cruising. The vehicle uses a hybrid-electric propulsion system, which allows the aircraft to cover long distances at high speed without recharging. The ANN platform is designed for surveillance, rapid intervention (e.g., disaster/emergency response), and transportation of specialty material and persons insert comma Manta is preparing to adopt new markets in the future.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Unspecified	ENAC Italian Civil Aviation Authority	Proof of Concept

FUNDING

DATE	ROUND	AMOUNT (USD)	INVESTORS
Nov, 2020	Seed round	Undisclosed	Undisclosed
Jan, 2022	Series A	Undisclosed	Undisclosed

ORDERS

DATE	COMPANY	COUNTRY/SUBREGION	TYPE	ANN2	ANN PLUS
2022	AVIONORD	Italy/South Europe	Pre-order	Unspecified	
2022	NAYLAM	Saudi Arabia/United Kingdom/ Morocco/Egypt	Pre-order		Unspecified

GLOBAL PARTNERSHIPS

Jul, 2020	Partnered with YCOM S.r.l. for composite structures of the scale prototypes
Jan 14, 2021	Partnered with BSIM Engineering on simulation / digital twin
Aug 17, 2021	Partnered with D3 Technologies to integrate the ANN vehicles and new air traffic management systems
Nov 9, 2021	Partnered with Pantecnica and Powerflex for the structural analysis

Information was provided by Manta Aircraft and modified by Global Sky Media with an information cut off date of March 31, 2023.

Germany | Founded in 2020

NEX Aero, founded in 2020, is headquartered in Berlin, Germany. The company focused on developing long-range hybrid-electric powered VTOL (vertical take-off and landing) vehicles using hydrogen fuel cells, with the mission to provide sustainable and low-noise hydrogen regional air mobility. The first-to-market product will be a heavy cargo drone with a payload of around 150 to 200 kilograms, and the fully autonomous version is targeted to obtain type certification from EASA (European Union Aviation Safety Agency) and is planned to enter service by 2026. NEX Aero had a research partnership with BAM (Bundesanstalt für Materialforschung und -prüfung) to investigate the procedures and safety protocols regarding ground handling and flight tests for hydrogen aerial vehicles.

NEX AIRTAXI

PROJECT PHASE	Preliminary Design
TYPE	Lift + Cruise
OPERATION	Piloted/Autonomous
RANGE	500 km
CRUISE SPEED	260 km/h
SEATS	5
ELECTRIC MOTORS	10



NEX used a hydrogen-electric propulsion system, which enables inter-city connections. The vehicle had a pair of high wings with winglets. It adopted a Lift and Cruise configuration where eight of the propellers were mounted on the booms on the wing, providing lift, and the two propellers on the front of the tail provided cruising power. NEX can accommodate one pilot and four passengers and can carry five passengers once the vehicle becomes autonomous.



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Estimated: 2026	EASA	NEX cargo, type certification
Estimated: 2029	EASA	NEX Aero plans to obtain the type certification for the NEX airtaxi

FUNDING

DATE	ROUND	AMOUNT (USD) ¹	INVESTORS
March 22, 2023	Seed	\$3,774,750	Heatchy Investments

Note: 1. The original announcement of funding are expressed in Euro. The funding was converted to United States Dollars using the exchange rate on the announced date.

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Jul 5, 2022	Announced the partnership with Intelligent Energy to co-design fuel cell system for NEX; announced the partnership with APUS Group to collaborate on the engineering development of NEX Aero's full-scale prototype.
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Information was provided by NEX Aero and modified by Global Sky Media with an information cut off date of March 31, 2023.

Skyfly Technologies

SKYFLY

United Kingdom | Founded in 2019

Skyfly Technologies, a private limited company founded in 2019, is headquartered in London, United Kingdom. The public launch of Skyfly and its eVTOL was in June 2022. The company focuses on the development and commercialization of a personal two-seat eVTOL vehicle called Axe. The company is certifying the Axe under a Permit to Fly through the Light Aircraft Association. It will seek complete type certifications from various regulators once the first Axe is delivered. Skyfly is currently producing a full-scale prototype of the Axe.

AXE

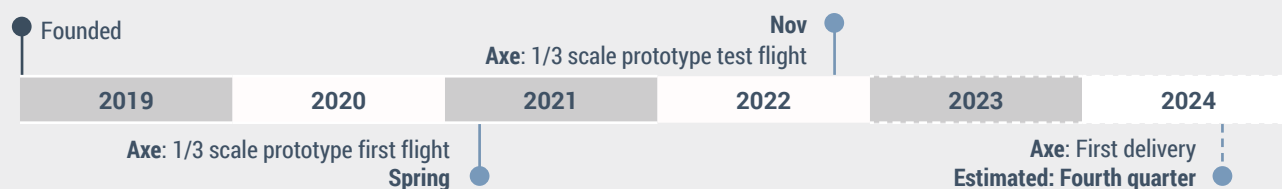
PROJECT PHASE	Preliminary Design
TYPE	Fixed-angle Rotors
OPERATION	Piloted
RANGE	482 km
CRUISE SPEED	161 km/h
SEATS	2
ELECTRIC MOTORS	8



The Axe has 45-degree fixed-angle motors and rotors, two pairs of fixed wings, and four propellers suited to the wing. Each propeller was powered by two motors to provide single-failure tolerance. The Axe is designed to be piloted and will be autonomous in the future, with a capacity of two passengers. The primary markets for Axe are personal use and training. When the Axe is fully powered by electricity, the range is around 161 km (100 miles); the vehicle also has a hybrid version with a longer range of 482 kilometers (300 miles).



MILESTONES



CERTIFICATION PROGRESS

DATE	AGENCY	STAGE
Estimated: 2024	Light Aircraft Association of United Kingdom	Target to obtain the Permit to Fly

FUNDING

DATE	ROUND	AMOUNT (USD)	INVESTORS
Feb, 2023	Angel	Undisclosed	Edwin Brenninkmeyer
Mar 23, 2023	Undisclosed	Undisclosed	AltiSky

ORDERS

Skyfly Technologies received 21 pre-orders from individual customers and three from EVfly

GLOBAL PARTNERSHIPS

Jul 11, 2022	Announced the partnership with Geiger Engineering , where Geiger will be the supplier for the propulsion system
Nov 2, 2022	Partnered with Tuthill Porsche for assembling the Axe
Dec 15, 2022	Selected Norco for building and manufacturing the fuselage, wings, and composite components for the Axe
Feb 10, 2023	Announced the partnership with Embention , where Embention will provide the flight control system for the Axe
Feb 22, 2023	Announced the partnership with Air Courtage Assurances to offers insurance to private eVTOL owners

Information was provided by Skyfly Technologies and modified by Global Sky Media with an information cut off date of March 31, 2023.

Spain | Founded in 2016

UMILES GROUP is a Spanish unmanned aerial systems (UAS) company operating globally. Grupo Ibérica acquired the business in 2020 after its founding in 2016. UMILES provides remote-controlled aircraft services, mainly drone operations, as well as manufacturing, marketing, sales, maintenance, training, technical consulting, and commercial services. The company also designs and develops advanced air and ground mobility solutions. UMILES comprises three companies: UMILES UAV, 4uJet, and UMILES Next. UMILES UAV operates six business lines, offering tailored end-to-end services in Spain and worldwide. Its core activities include the operation, training, manufacturing, and management of unmanned aerial systems. UMILES Group also owns 4uJet, an executive aviation company that offers short-haul air transport services for passengers and organs for the ONT (National Transplant Organization). UMILES Next offers ground and air mobility solutions alongside technology partner Tecnalia R&I. The company is currently working on a new piloted fixed wing eVTOL for several passengers that includes the FlyFree technology tested in the Concept Integrity.

CONCEPT INTEGRITY

PROJECT PHASE	Prototype Development
TYPE	Vectored Thrust
OPERATION	Piloted/Remotely piloted/Autonomous
RANGE	15 km
CRUISE SPEED	80 km/h
SEATS	1
ELECTRIC MOTORS	16

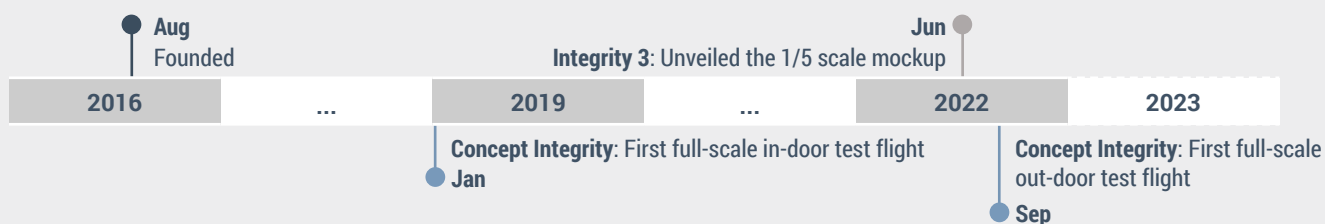


The Concept Integrity adopted a Vectored Thrust configuration with four booms extended out from the fuselage, where each boom had a tilting set of four smaller booms with propellers suited at the end. The vehicle was originally designed by Tecnalia, a Spanish R&D center, and UMILES Next acquired the patent in 2021. The first phase of the vehicle has been remotely piloted, with increasing autonomy representing the different milestones to full autonomy. The Concept Integrity can be used for different scenarios, but it is mainly focused on the daily commute and tourism market.





MILESTONES



CERTIFICATION PROGRESS

Not yet in certification phase

FUNDING

Funding information undisclosed

ORDERS

Order information is not available

GLOBAL PARTNERSHIPS

Has not disclosed partnership agreements prior to March 31, 2023

Information was provided by UMILES Group and modified by Global Sky Media with an information cut off date of March 31, 2023.



Czech Republic | Founded in 2017

Zuri SE, founded in early 2017, has a goal to provide on-demand and door-to-door mid-range flights. The company is privately held and based in Prague, the Czech Republic. Zuri had performed flight tests with different wingspans and scales on its first-generation model. The company changed the configuration from Lift and Cruise to Vectored Thrust in 2022 and renamed the model Zuri 2.0.

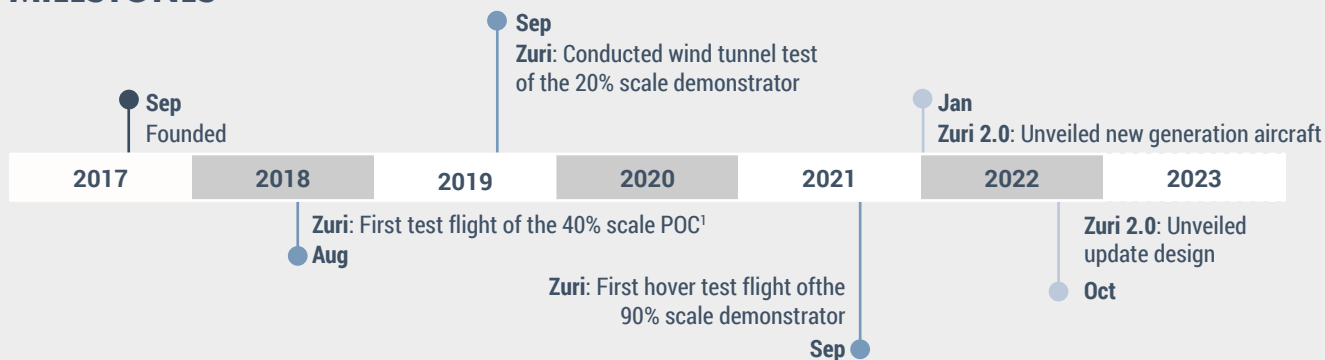
ZURI 2.0

PROJECT PHASE	Detailed design
TYPE	Vectored Thrust
OPERATION	Piloted
RANGE	700 km (+30 min reserve)
CRUISE SPEED	300-350 km/h
SEATS	5
ELECTRIC MOTORS	8

The Zuri 2.0 adopts a Vectored Thrust configuration and has a pair of high wings with winglets. There are four tilt-propellers on the wings, and the other four are located on the V-shaped tail. The vehicle has a turbine and a generator, where the turbine engine can continuously charge the battery during the flight, with the intention of not needing long recharging stops. The primary market for Zuri 2.0 is mid-range regional connections. The first-generation model of Zuri was a Lift and Cruise. In 2022, Zuri SE decided to use tilting rotors after flying a 3.5-meter-wingspan model in June. Later in December, the company changed the tail from an inverted T-shape to a V-tail and planned to equip the tail with larger propellers.



MILESTONES



Note: 1. POC stands for proof of concept.

CERTIFICATION PROGRESS

Order information is not available

FUNDING

ANNOUNCED DATE	ROUND	AMOUNT (USD) ¹	INVESTORS
Oct 22, 2018	Angel	\$689,640	Pale Fire Capital
Apr 11, 2019	Angel	\$225,280	Kiwi.com
Jun 3, 2020	Angel	\$335,820	Marek Rosa and Zdenek Polach
Oct 27, 2021	Angel	\$1,510,210	Jaroslav Beck, Jakub Nesetril, Jan Habermann and Rasty Turek

Note: 1. Original announcements of fundings are expressed in Euro. The funding was converted to United States Dollars using the exchange rate on the announced date.

ORDERS

Order information is not available.

GLOBAL PARTNERSHIPS

Has not disclosed partnership agreements regarding the development of aircraft prior to March 31, 2023.

Information was provided by Zuri SE and modified by Global Sky Media with an information cut off date of March 31, 2023.

Soaring to New Heights: Maeve's Vision for Key Markets and Type Certification

An interview with Maeve

By Ben Mirwani



Joost Dieben
Co-founder & chief commercial officer
Maeve Aerospace



Bans on short-haul flights and business jets are starting to spread throughout countries in Europe, potentially curbing the travel dreams of numerous passengers and business executives. Swooping in to provide opportunity in the midst of a shifting aviation landscape is Maeve Aerospace. Born from a desire to offer a cleaner, more environmentally viable means of flying, the Dutch start-up possesses grand plans to revolutionize air travel with its all-electric Maeve 01 44-passenger airliner.

In a wide-ranging exclusive interview with Global Sky Media, Joost Dieben, the company's co-founder and chief commercial officer, delved into a myriad of topics pertaining to the firm's development. He spoke in depth about the exciting growth markets ripe with potential, the eye-watering amount required to fund the aircraft's road to market, and the multiple stepping stones that must be crossed to obtain type certification.

Opportunities from Crisis

As an all-electric airliner producer, Maeve is integrating into certain markets that are embracing new advancements in aviation and advocating for environmentally-friendly aircraft that can fulfill the job of their traditional counterparts.

Among the markets that fit this profile are France, the Netherlands, and multiple Scandinavian countries as they are taking radical

steps to eradicate air and noise pollution through a zero-tolerance approach to short-haul flights.

In France's case, the drastic change was implemented as part of the country's Climate Law in 2021, which seeks to combat carbon emissions. The move will see the nation eradicate flights between cities that can be reached in less than two-and-a-half hours by train. It will also have a major impact on business aviation as private jets are also in the crosshairs.

“Looking at the biggest target what we have now are continent countries in this case that are actually starting to ban domestic flights or ban short-haul flights. Think about what’s happening in the Scandinavian markets - Norway, Sweden, and Denmark are putting a ban on their short-haul flights,” he said.

“Or France who are putting a ban on flights less than 500 km. Those are very clear markets that our aircraft could actually support. We could still fly because that’s the quickest means and for a lot of these routes, there is no other alternative.”

On top of the environmental aspect, Dieben said Maeve will also look to target nations where congestion is a major problem. He highlighted the Netherlands as a perfect example as Schiphol Airport in Amsterdam announced it would be cutting 60,000 flight slots in January. The move, which will come into effect from November 2023, aims to slash noise and air pollution in the region while improving the quality of life for residents that reside close to the airport. This isn’t the only drastic step taken by Schiphol Airport as it also unveiled further plans to ban business jets by 2025. Given the shifting trend towards cleaner, more environmentally-friendly air travel, Dieben feels the Maeve 01 “could be a very good solution”.

The Americas and island countries such as New Zealand are also among the markets on Maeve’s radar.

“North America and South America is, of course, a very big growth market for us as a regional aircraft,” he said. “Other markets you can think about are the islands where you have no alternative. Think about Greece or the ABC islands (Aruba, Bonaire, and Curaçao).”

Potential in India and China

Looking to countries brimming with potential, Dieben acknowledged that India and China are the two that stand out most since both are economic powerhouses and are growing steadily as regional aviation

hotspots. That said, he admitted there is a need for the necessary advanced air mobility (AAM) infrastructure to be built for the Maeve 01 and other electric aircraft to operate.

Both India and China are committed to introducing electric aircraft in their respective markets but have made limited progress on the infrastructure front. While countries like the U.S., Italy, and France are working with infrastructure companies to build vertiports as part of their efforts to develop AAM, developing countries with large populations like India and China are still at the starting line. So far, Chinese eVTOL firm EHang has spearheaded the drive in China, having developed a vertiport in Guangzhou.

“India and China are growth markets for the regional aviation sector purely because the infrastructure is not there yet. At the economic level, the inhabitants are going up, so they want access to travel,” Dieben pointed out.

Plenty of Unique Selling Points

Maeve is not the only company involved in this space and Dieben is well aware of the other competitors that have ventured into this territory. Rather than bristle at the prospect of having to stave off numerous competitors, he is happy to coincide with other firms like Sweden’s Heart Aerospace. That said, he noted Maeve is currently the biggest announced fully electric airliner, which “gives us a leading edge of a few years to any of the competitors out there”.

Apart from a head start, the Maeve 01 is also a viable commercial airline solution for companies that want to adhere to changing industry standards when it comes to sustainability.

The zero-emissions aspect further adds to the Maeve 01’s already impressive pedigree as it does not emit any carbon dioxide or nitrogen oxide. It also scores points for not emitting contrails, which, in Dieben’s eyes, is “a very big polluting aspect which kind of gets overlooked”.





Battery technology may be the only drawback for the electric airliner right now, but given the significant advancements already being made, Dieben sees immense potential in the future to increase passenger capacity and flight distances.

He mentioned there are a growing number of companies entering the market that are looking to establish themselves as the leading provider of batteries for electric aircraft. Among those making great headway are Amprius Technologies, which has partnered with Maeve, China's CATL, and Sweden's Northvolt. With the industry getting increasingly crowded, Dieben acknowledged "the race to get higher-density batteries is on".

"We know that our battery pack needs replacing every one to one-and-a-half years. It needs switching out because the battery degrades over time, which is, of course, a drawback," he added. "The flip side of it is that it allows us to replace that battery with the latest in battery technology.

"Battery technology is progressing and that's where we've been focusing on the last few years. So it means over time, we could go up to 52 passengers and actually extend the range and get more and more routes up to 700 to 1,000 kilometers going forward."

A Long Road to Type Certification

The road to type certification will be a long and arduous one for Maeve as there are many hurdles to clear along the way. The company aims to get certificated by the European Union Aviation Safety Agency (EASA) by the end of Q4 in 2029 before setting its sights on the United States' Federal Aviation Administration (FAA), which Dieben described as a "natural next step". He expects the process of obtaining type certification from the FAA to be seamless as the requirements are closely aligned with that of EASA.

Once the Maeve 01 is officially certificated, Dieben acknowledged that production of the aircraft, which can travel distances of up to 460 km at a



cruising speed of 488 kph, will be greenlit from that exact moment.

"Ultimately, what we're talking about, is the actual certification, which is type certification, which in our case is the CS-25 category," he said. "We've planned for the end of 2029. Our launch date is the actual approval date and that's the moment that we can start producing and flying commercially with our Maeve 01 aircraft."

The ultimate destination has been set and is a shining beacon in the distance, lighting the way for the Maeve 01's scheduled arrival into the market. But there are more pressing matters at hand that will get the wheels turning and put everything in motion, and that is to secure Design Organisation Approval (DOA) and Production Organisations Approvals (POA), which are significant milestones on the pathway to certification. Dieben hopes to attain the DOA from EASA by the end of next year.

Series A Round is Just the Start

To bring the Maeve 01 electric airliner to market, Dieben is under no illusion about the amount of capital needed. Currently, the company is in the midst of a Series A capital raise and is targeting 40 million Euros (USD\$44.3 million). Half of that money has already been secured through the European Investment Fund.

Going forward, however, Dieben expects the financial investment required to swell to the range of 1.5 to 2 billion Euros at minimum (USD\$1.6 billion to USD\$2.2 billion). "And that does not include any of the production capacity that you need to build up. If you add that to the mix, you have to extend it by a few billion," he said.

The big question looming over Maeve will be obtaining a staggering amount of money. When questioned about this, Dieben admitted that it seems like a huge mountain to overcome. He conceded that it will need to be broken down, whereby capital comes flowing in from different streams, such as various governments, suppliers, partnerships, and, at a later stage, an IPO.

"It's an extreme amount of money that you need. Those are investments that we cannot get ourselves, we cannot get through private routes," he said.

"Going forward, we'll see this is only achievable together with suppliers and partners. But also think about governments, it's a global project that we're doing and that means that we need to have investment from governments. Down the way, if we go into the production side of it, you might think about IPO, that final stage of capital investment."

The Pressure is On

Given the increasingly vociferous demands from governments and the public to tackle the growing environmental endemic, Dieben feels now is the perfect time to be developing the Maeve 01 as it will provide a solution to a problem that has been lingering for far too long.

"The timing is perfect, we couldn't have started Maeve 10 years ago, we would have failed.

“ “ *The timing is perfect because the technology is there, it's advancing at a sufficient speed, but also the public pressure is on.”*

He said while addressing mounting calls from the public for cleaner modes of transport.

Addressing potential increases in transportation demand in the future, Maeve wants its electric aircraft to evolve over time and increase the number of passengers it can carry from 44 to 52 by 2032. It may seem very ambitious for a young start-up, but Dieben brushed aside potential concerns.

Whether the uptick in passenger numbers happens remains to be seen as there are two hurdles standing in the way.

"We're talking about 10 years odd from now. So, is it going to be 2032? Our guess is yes, but it's based on what we see and the discussion we have with our partners and their roadmaps that they are sharing with us," Dieben said. "From an aircraft point of view, it's developed for that (increase in passengers), it's just the battery technology that needs to make it viable."

The conditions are perfect for Maeve to enjoy great success. All that's needed is for the company's electric airliner to take off and embark on its mission of bringing a whole new concept of travel to communities all over the world.

maeve.aero/home





Honeywell's New Opening Space in Electric Propulsion

An interview with Honeywell

By Mia Yao



Jia Xu
CTO
Honeywell UAM & UAS

The transition of energy from one to another makes for some of the most watershed moments in human history. From steamed-powered trains to high-speed railways, the power for land transportation has evolved from boiling water to a greener alternative: electricity. It was not until 100 years later that the first airplane was invented, but the shift of energy up above the sky has only just begun.

Honeywell Aerospace is one of the key players spearheading the transition. The U.S. based aviation company is developing the world's first generation of electric vertical take-off and landing (eVTOL) aircraft motors. Once its vision of electric air taxis flying around the city becomes a reality, the electric propulsion technology for urban air mobility (UAM) or advanced air mobility (AAM) will transform the way we think of aviation, once again rewriting the history of human transportation.

The Democratization of Aviation

Anticipating the tremendous opportunities behind this “new opening space” for aviation, Honeywell Aerospace embarked on its UAM journey three years ago. As an already established engine manufacturer in the aviation industry, Honeywell envisions electric

motors as a new way to reshape people's everyday lives.

Unlike helicopters or fixed-wing aircraft, eVTOLs will be closely connected to urban areas in some of the world's highly-populated cities and are designed to be accessible to a wider community while introducing a more efficient and sustainable means of travel.

“This is kind of a new opening space for aviation, a new way to democratize aviation, to make it pervasive and a different way to enter all of our lives.”

It's a great sandbox for building technologies like electric propulsion," said Xu Jia, Chief Technology Officer, Honeywell UAM and UAS, in an interview with Global Sky Media, adding that Honeywell envisions a future of air taxis carrying people around the city and making a 100-mile commute in under 45 minutes.

To unleash the economic and connectivity potential of advanced air mobility, Honeywell has a product line of electric motors as well as avionics and fly-by-wire systems. With both being an indispensable part for the integration of the operation system, electric propulsion is key to air taxis taking flight and an integral part of the whole new concept of eVTOLs.

"Without distributed electric propulsion, eVTOLs wouldn't really exist as a concept. It's really at this technology inflection and the potential market demand that drove the development of this key technology," Xu said.

However, achieving the monumental technological breakthrough during the new journey calls for more than one player. Honeywell is working closely with companies including Lilium, DENSO, Archer and Supernal in developing electric motors and achieving specific goals like safety and noise, as well as optimizing the entire propulsion system.

Honeywell formed a joint research program with vehicle engine manufacturer DENSO in 2019 and signed an alliance agreement to develop an electric propulsion system for eVTOLs in 2021. The engineers are working together on a daily basis to develop e-motors for the Lilium Jet.

To meet the requirements of each OEM, Xu said cooperation is always about communication and tradeoffs and finding the right optimization between the aircraft and the motor systems. For example, the unique configuration of the Lilium Jet needs as many as 36 small motors to achieve the aerodynamic performance required. While for more conventional lift plus crews and tilting rotor configurations, architects are working on bigger motors.

Every Pound Matters: The Snowball Effect

While working with the right partner helps, Honeywell's most important task is to generate enough electric power to lift an aircraft

vertically in a safe, efficient, and coherent manner.

"It's one thing to build an electric motor for small drones or drone application, but when you want to build safe and certifiable electric motors at the scale that's needed to enable human or even cargo transportation over populated area, you very quickly get into some complex engineering problems and certification problems," Xu explained.

"One of the key challenges of vertical takeoff aircraft is we have very limited control authority at low speed right at high speed. The air is washing over the aircraft. We have a lot of energy in the air that we can play with to maneuver the aircraft at high speed, but at low speed when you're taking off, that's been really challenging," Xu added, saying that Honeywell is building electric motors that have a smart level of redundancy on both the power electronic side, the control side as well as the active component of electric machines.

For Honeywell, the "secret sauce" for building electric motors to achieve a high level of reliability is to ensure that the propulsion system still recovers and completes the flight if one of the motors fail. To achieve the safety and reliability goal, the architects divide the motor into numerous units that operate separately with the same amount of power. That said, the design has to be simple and light weight.

The weight of eVTOLs is a fundamental factor to consider during aircraft construction, as it directly impacts the cost, with heavier models being more expensive. Studies show that each pound of empty weight costs around US\$700 for aircraft acquisition. From the aircraft building side, even a slight change in weight can have a cascading effect, altering every aspect of aircraft design.

"We understand the trade offs that equip the tail with aircraft level, you know every pound that we put on an airplane in the form of a system, we have to build five more pounds of the aircraft right for these EV total platforms just because you put on this motor, the motor gets a little bit bigger. Now the whole aircraft gets a little bit bigger because we need more batteries to fly the same mission. The wing has to get bigger because we now have to sustain that flight, that cruise phase as well," Xu said.



Beyond the technological challenges, the successful take-off of air taxis needs a high level of integration in the development stage.

The critical role of Honeywell being a system integrator is to pre-integrate every aspect of the system to optimize the performance, weight, and power consumption before an eVTOL gets ready for the unprecedented task of mass production and commercialization. "When you look at aerospace, that's something that we haven't really been doing historically," Xu commented, emphasizing that building the complex electric aircraft system must go beyond individual companies.

"Successful is to have suppliers and integrators like Honeywell that will take some of that burden off of the system development and integration and bringing established expertise and experience in building an integrated certified systems into the space."

Engaging the Industry

As the advancement of technologies outstrip the pace of the development of regulatory guidance, the challenge that comes along next is certification. The process takes several years to complete due to the complex and extensive testing and validation required.

To navigate this complex issue, Honeywell recently launched the industry's first certification reference guide. The document summarizing Federal Aviation Administration (FAA) and European

Union Aviation Safety Agency (EASA) rules across multiple AAM segments is constantly updated and shared among the industry.

"So there's been a lot of progress and what we've noticed is that to elevate the level of discussion in the industry about certification and the pathway to get there, as well as the gaps that still in the regulatory system. We've decided to write all of this down and produce this handy one pager guide to where certification is for different segments of that advanced aerial mobility," said Xu.

Reaffirming the progress that has been made among AAM companies and regulatory bodies in the U.S. and Europe, Xu hopes to engage the industry in a dialogue through the reference guide. By working closely with other companies, Honeywell is positive about introducing a whole new aircraft category, which will not only transform the way people travel but also other segments of aviation.

"It's going to change profoundly how we design other kind of aircraft." Xu added. "I think that's incredibly exciting in terms of reducing fuel burn and increasing the sustainability of the aircraft, because suddenly as a designer, you have all of these new options to put power and control anywhere on the aircraft that you think is important to have. So, it's going to open up totally new kinds of aircraft configurations and that's incredibly exciting."

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