

Electric Aviation, VTOLS, Multicopter, Rotor wings, Fixed Wing, Hybrid Technology, Rule making news, Test Reports * Electric Aviation, VTOLS, Multicopter, Rotorwings, Hybrid Technology, Rule making,

eFlight Journal

Quarterly Vol. 1-2019

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eVTOL rules - which way is best?

Since late last year the Chinese regulator CAAC has been pumping out a series of new rules and policymaking proposals which may change the landscape of electric aviation in China and even in the world. These new rules include:

1. Much simplified new non-Part 23 light airplane certification;
2. Tentative UAV including manned autonomous aircraft certification rule for up to 5700kg;
3. Tentative specific operational risk assessment (SORA)-based UAV operation rule to allow commercial operation of large cargo UAV in the first stage and manned autonomous aircraft to follow;
4. LSA MTOW increase to 700kg and inclusion of electric motor in the definition of LSA;
5. Primary category airplanes allowed for commercial operation and IFR;
6. Much simplified sport pilot training requirement.

CAAC set a very ambitious goal especially the timetable for these rulemaking. CAAC targets to complete the UAV certification system by the end of 2019. By the end of September this year, CAAC hopes to complete the certification standard for high-risk large cargo UAV, the general requirement for UAV detect and avoid system, and the general requirement for eVTOL. When all these new rules are in place in the end, it means that electric LSA and autonomous eVTOL would be much more practical to certify and to operate in China. In fact CAAC has selected five UAV companies including eHang, the maker of the manned autonomous eVTOL, to carry out unmanned trial operation regularly in several test areas in China. However, when and how can CAAC actually work out the technical specification requirement and implement these rules remain to be seen, but one thing is clear: CAAC is determined to propel the certification and operation of large UAV and down the road, manned autonomous eVTOL.

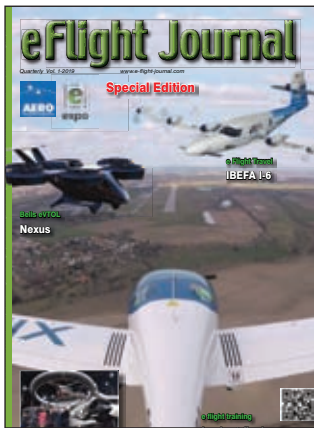
And what is the old world US and Europe doing to keep up this speed? As we told in our last issue EASA has now discussed SC-VTOL (special conditions) and will eventually issue a CS-VTOL based on these experiences. Some

think this is good as the manufacturers now know what to expect, but others object that the standard selected is very high like CS-29 for large rotorcraft - which will make the certification and operation very expensive and lengthy. Other see this even worse, the CS-29 like approach is not only costly but potentially impossible, there are no highly automated CS-29 aircraft today and the SC is a bar even above that.

But the EASA approach has another problem: by not putting the new vehicles to an existing class like fixed-wing CS-23 or small rotorcraft CS-27 the Cologne based authority is creating a new class - this causes the problem that before operating the aircraft in this new class EASA also has to create new operation rules. But EASA only can create the rules for which it is entitled by the EU and these are, at the moment, only fixedwing and rotorcraft so the basic EASA rules would need to be changed again, so the critics say, and this is a very long process. One may argue that the national bodies like the German LBA could issue rules for each European country in between - but this is definitely not the appropriate answer for a rising global development.

FAA the 3rd large authority is thinking to take a more pragmatic approach, in the middle of CAAC and EASA, if the eVTOL vehicle has wings it will be certified in the fixed wing class and if the lift is created by rotors (or propellers) only, also in forward flight, - than it's a rotorcraft. All operational rules for this class apply and only there where the vehicle is differing FAA will use special conditions. Then after a period of around 5 years the experience will be used for creating the new rules. Time will tell which is the best way to safe rules and fast but safe air vehicle development. But one thing is clear, those countries, or region, which can offer the dynamic new companies the rules under which they can operate faster and safe will be the region in which this new key technology of autonomous eVTOL flight will be developed and built and here the future workspace will be created. So authorities, companies and pilots should watch closely to see what the others are doing.

**Willi Tacke
Xin Gou**



We the **eFlight Journal (eFJ)** founders are a team of aviation journalists and enthusiasts who created Flying-Pages. Publishing several aviation publications around the world. It started with the interest in electric flying in 2009. We co-founded the e-Flight-Expo in Friedrichshafen/Germany as part of the AERO, and established it as the largest show for electric aviation worldwide.

The eFJ is supported by the GAMA EPIC committee, Siemens, Rotax and many others.

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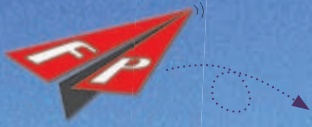
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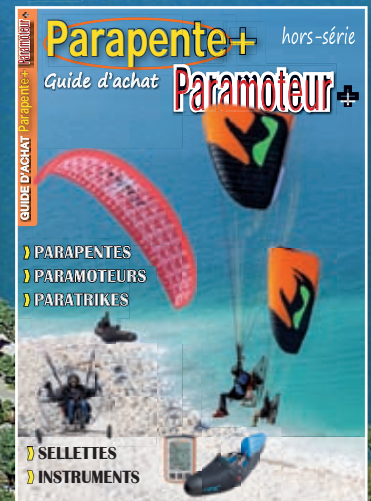
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Pipistrel Alpha Electro to fly in UAE

UAE is expected to approve Pipistrel Alpha Electro for flying training and private leasing by October 2019 after receiving training as per the Academy of Technical Training, ATT, standards. When approved, UAE will be the first country in the Middle East to fly Pipistrel Alpha Electro which have already obtained approval or permit to fly in multiple European countries, the US, Canada, Australia and New Zealand.

UTC Launched Dash-8 Hybrid project

United Technologies Corp. (UTC) is modifying a Bombardier Dash 8 Q100 regional aircraft into a hybrid-electric flight demonstrator which is expected to fly in 2022. The project is code named as Project 804 and will be led by United Technologies Advanced Projects – the group's new rapid prototyping and development unit, UTC subsidiaries Collins Aerospace and Pratt & Whitney will participate. The demonstrator will use a 1 mw turbine generator and 1 mw electric motor to replace the existing turbine engine on one side. UTC says that the arrangement allows the use of a smaller-than-usual gas turbine engine, optimized for cruise efficiency. The overall system could deliver fuel savings of at least 30% during a one-hour flight.



e.GO founder developing eVTOL

Prof. Günther Schuh, Germany's electric car pioneer and founder of e.GO Mobile announced at Geneva Motor Show that he is working on an urban air mobility aircraft. Details will be announced at the end of May at a press conference in Aachen, but Prof. Schuh disclosed that the eVTOL will have four electric motors and will have a hybrid electric power system. The project is being jointly developed with the Institute of Aerospace at RWTH Aachen University. A new company called e.SAT GmbH, which stands for Silent Air Taxi, has been established.



BRS and Transcend partnered to develop whole airframe parachute system

BRS Aerospace (BRS), a whole aircraft rescue parachute system manufacturer, and Transcend Air Corporation (Transcend Air) announced a partnership to develop a whole-aircraft parachute for the Vy400 six-seat eVTOL developed by Transcend Air. Transcend Air and BRS ex-

pect to go beyond the occupant protection requirements of the current Part 23, Part 25 and Part 27 aircraft certification regulations by providing the integrated use of frangible aircraft structure, safely deforming seat supports, and airbags.

US Congress held hearing on Urban Air Mobility

On 12 March the US House of Representatives Transportation & Infrastructure Committee’s Aviation subcommittee held a hearing on “Looking Forward: Aviation 2050” that included testimony on Urban Air Mobility (UAM) by Eric Allison, Head of Uber Elevate. The hearing lasted about two and half hours. The hearing witnesses include Dr. Eric Allison, Head of Elevate, Uber Technologies, Inc, Ms. Diana Cooper, Senior Vice President, Policy & Strategy, PrecisionHawk, Inc., Captain Joe DePete, President, Air Line Pilots Association, International, Dr. Eli Dourado, Head of Global Policy and communications, Boom, Mr. David McBride, Director, Armstrong Flight Research Center, National Aeronautics and Space Administration.



Zunum Aero won New Energy Pioneers by Bloomberg NEF

Seattle-based hybrid commuter airplane company Zunum Aero is one of the ten winners at the Bloomberg New Energy Foundation summit. The winners this year range from EV charging to new manufacturing processes. Bloomberg NEF established the New Energy pioneer prize in 2010 to identify game-changing companies globally in the field of clean energy, advanced transport, digital industry, oil and gas, and advanced materials technology and innovation.

Equator amphibian made first flight

On 30 March P2 Xcursion hybrid electric flying boat amphibian developed by Equator Aircraft in Norway had the maiden flight. P2 has two seats, uses one 97kw water-cooled ENGIRO M97 Electric motor on the tail, a 60kw ENGIRO and one 57kw WST KKM 352 Wankel multi fuel engine as the generator. P2 prototype was unveiled for the first time at AERO e-flight-expo in 2017.

www.equatoraircraft.com



SoftBank and AeroVironment Developing solar powered large UAV

The two companies plan to launch the solar-powered drone to deliver 5G wireless connectivity. The drone, named Hawk 30, will have a curved “flying wing” design similar to a series of high-altitude solar drones that AeroVironment made for NASA twenty years ago. The drone will have 10 electric engines and an operational altitude of over 20 kilometers. According to SEC filing, this project has a budget of \$76.5 million USD to design, build, and test the Hawk 30, including high altitude and long duration flights.



Japanese Insurer to provide coverage for eVTOL test flight

One of the largest Japanese insurer, Tokio Marine & Nichido Fire Insurance, plans to provide insurance coverage for urban air mobility aircraft test flight in April. The insurer will provide payouts if the eVTOL would cause damage or injuries during test flight. The coverage will apply to vehicles that are both manned and unmanned.

Heathrow Airport Initiated Sustainable Prize

On 28 March, Heathrow launched a prize worth £30,000 for an idea that will help the airport reduce its carbon emissions. This “Innovation Prize” was launched last year for the first time with £20,000 award and is part of the airport’s new “Centre of Excellence,” which is a hub of learning and exploration that will accelerate the arrival of sustainable air travel. The Prize for this year welcomes application in three subjects: 1. Sustainable surface transport: Enabling travel to and from the airport with low or zero emissions; 2. Preparing for sustainable flight: Expediting the arrival of a fossil-fuel free flight, including through the introduction of new hybrid and electric aircraft; 3. Delivering negative emissions: Finding new, practical ways to capture and use carbon at or near the airport. Applications will be accepted until May 22 online at:

<https://your.heathrow.com/centreofexcellence/2019sustainabilityinnovationprize/>



Rolls-Royce takes major step towards electrifying flight with successful hybrid aero propulsion tests

On 14 March Rolls Royce made the first ground tests of a hybrid system using its M250 gas turbine. The test used the hybrid version of the M250 gas turbine in a ground demonstration setting in three operating modes: Series Hybrid, Parallel Hybrid and Turbo-Electric. The M250 hybrid is planned to be used as a propulsion plant with power ranging from 500kW to 1MW. M250 is a mature turbine usually powering helicopters. The ground test paved

the way for the test flights on hybrid aircraft schedule for 2021. Rolls Royce, Airbus and Siemens have been jointly developing Efan-X hybrid airline aircraft, but the hybrid system has the potential to be used across a range of aircraft designs to enable distributed electric propulsion, including eVTOL, general aviation aircraft and hybrid helicopters

Harbour Air and MagniX Partnered to electrify De Havilland DHC-2 Beaver

One of the largest float planes operators in the world, Harbour Air Ltd. in British Columbia Canada plans to convert its De Havilland DHC-2 Beaver fleet to full electric with MagniX Technologies. The converted DHC-2 Beaver will use the 750 horsepower electric motor developed by MagniX, will have 60-minute duration and 160km range more than twice as long as Harbour's average flight, and will have the same gross weight as the DHC-2 powered by a Pratt & Whitney PT6 turbine to simplify the certification. The test flight is expected to begin in November. The goal of the partnership is to create the world's first full electric airline. Ultimately Harbour plans to convert its 15 Beavers and

22 DHC-3 Single Otter seaplanes to electric. Harbour Air operates 12 routes between Seattle and Vancouver and across Pacific Northwest, carries more than 500,000 passengers on 30,000 commercial flights each year.





Boeing GoFly prize announced Phase II teams

On 26 March Boeing-sponsored GoFly personal flying challenge announces the five teams which will be awarded \$50,000 USD each. The teams will go for Phase III in which they need to actually build and test fly the flying prototype for a final competition next year. More teams have received the certificate to go to Phase III, but the five teams are selected to be listed at GoFly website. The five teams include projects from Latvia and Russia, the

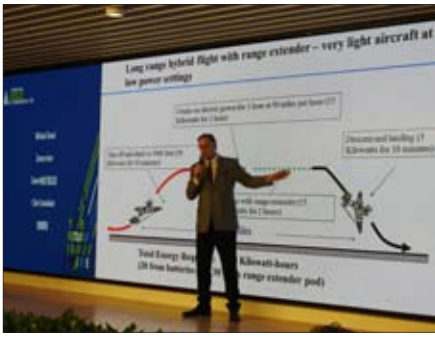
US and Netherlands. Following the Phase II announcement, GoFly and its Teams will be preparing for the Final Fly-Off in which the teams will put their personal flyers to the test, competing at a final event showcase or the remaining \$1.6 million USD in prizes. BRS and Transcend Air partnered to provide VY 400 with whole-aircraft parachute.

Sikorsky launched Urban Air Mobility Program

Sikorsky, the veteran helicopter manufacturer and a subsidiary of Lockheed Martin, recently launched its urban air mobility (UAM) program by setting up a website and releasing a video presenting its UAM vision. According to the program, Sikorsky wants to create an entire ecosystem of innovation and to make air taxis as safe and reliable as elevators. Foundational to Sikorsky entrance into UAM is its Matrix “optimally piloted” technology that integrated an autonomous co-pilot system into the cockpit. Matrix is a retrofit kit that introduces autonomy into existing aircraft to light-

en the workload on human crews. In 2008, Sikorsky developed Firefly™, an all-electric conventional helicopter demonstrator. Website: <https://lockheedmartin.com/en-us/products/sikorsky-urban-air-mobility.html>





The Event to bring your products and ideas to China & Electrify China's sky and your business

The third forum on electric aviation in China: VTOL-, Autonomous Flight-, LSA-, Hybrid-, Engine-, Battery-, Manufacturers-, Regulators-, Investors from around the World

Where: TBD - CHINA

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& the who is who in electric flight



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Air Race E

THE FIRST ELECTRIC AIRPLANE RACE EVENT

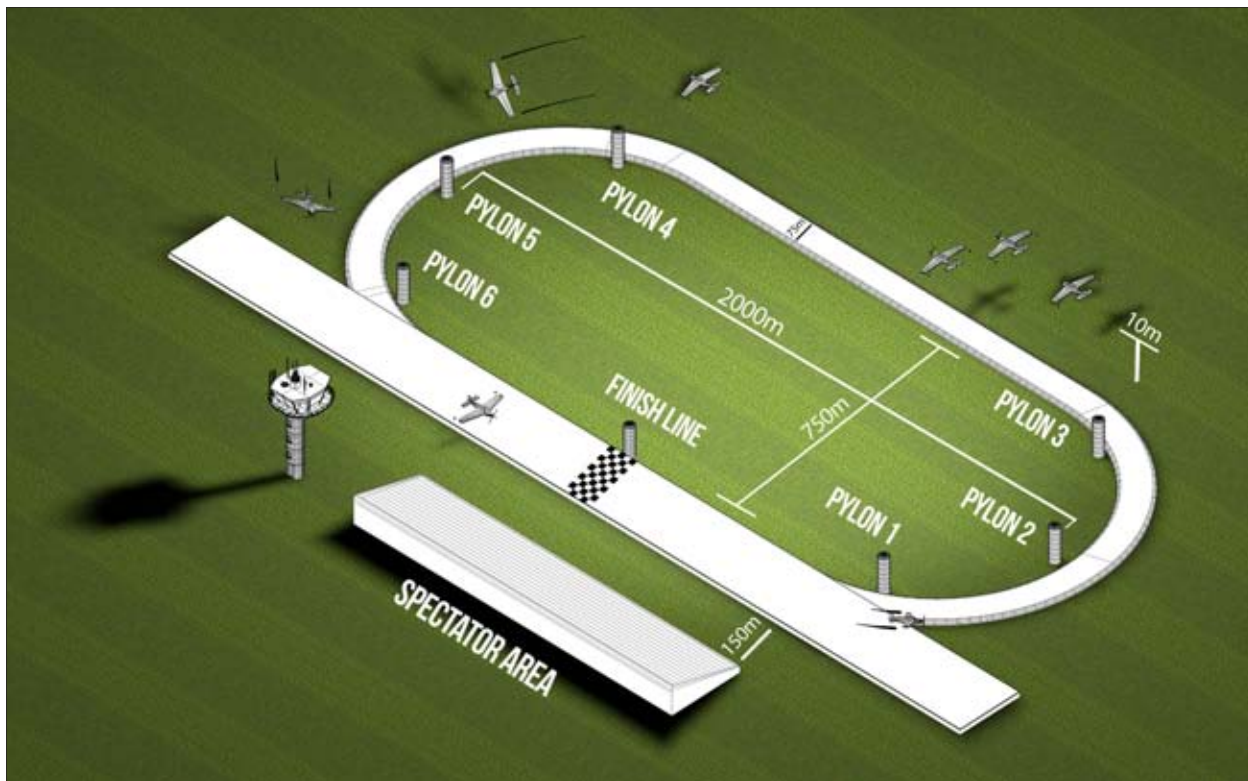
Many speculators go to air race events for the dazzling speed, cool airplanes and probably the engine noise and perhaps even the smell of exhaust gas. What about an air race without any exhaust gas and with the same fast but much more quite airplanes? If it were hard to imagine, there actually has been a race on the ground for electric cars called Formula E. Now there will be the Air Race E in the air planned for 2020 only with specially designed electric racing airplanes. Air Race E is the brain child of Jeff Zaltman. Here's our interview with Jeff.



Ready to go: Air Race E CEO Jeff Zaltman

eFlight Journal: What was your motivation for establishing Air Race E?

Jeff Zaltman: The idea was very much driven by the industry. A number of independent electric airplane manufacturers approached me having seen what we'd done with formula one air racing and the Air Race 1 series. They all wanted to showcase their products and use it as a test bed to trial their technology. But in each case the business model was tricky as they only wanted to use their own airplanes for all teams. What I realised was, it doesn't really test anything if they're all the same plane. The only real way is if it's wide open to all manufacturers. We're the only ones that were in a position to do an electric race series. I decided, now is the moment, we have all of the ingredients, let's do it.



This is the proposed track for the Air Race E.

What is your vision for Air Race E – how do you see it changing aviation history?

I see Air Race E as the focal point for engineering and the development of electric propulsion. I think some day when we're flying on an electric commercial passenger airliner, we'll be able to trace its roots back to Air Race E. That technology will get its start here. Air Race E will be a hub for that, demonstrating the various milestones throughout the entire life cycle of electric propulsion.

The development of electric aviation has been compared to the race to the moon. What do you think about that statement?

I think the race to the moon was a historic milestone and a statement about human possibility and accomplishment. Air Race E is helping to set us on a path to something as momentous as that, but with the added benefit of helping to better society. We're tackling world problems like carbon emissions and the sustainability of air transport and that's what's truly exciting.

Why does the world need electric airplanes?

It's really no different to other forms of transport that have led the way. Electric aviation is lagging behind those but for understandable technological reasons. We have some catching up to do, but the potential for this technology to benefit the planet is significant.

There's research to suggest that one round-trip flight between New York and California generates about 20 percent of the greenhouse gases that your car emits over an entire year. For those that travel by plane, air transport is probably the biggest portion of their carbon footprint. If you think there are around 20,000 planes in use around the world, serving 3 billion passengers annually, making those planes electric is probably one of the most important things we can do to save the planet.

How will electric race airplanes look, sound and race differently?

We will be starting with the formula one class of air race plane, so they will look very similar to those models in the first instance. But there is a wide scope for them to be developed in many different ways, looking at the fuselage design and the internal engineering.

We expect them to be faster than current formula one race airplanes which reach speeds of up to 450 km/h.

Unlike electric cars and motorcycles which have diminished sound, electric airplanes will make quite an exciting noise. The propeller makes most of the noise and that won't change so we expect electric air racing to have a similar sound.



Tell us about the commercial applications to come from Air Race E?

The technology used by Air Race E teams will be tested and adapted to help drive the development and adoption of cleaner, faster, and more technologically advanced electric engines.

How is Airbus involved?

Airbus is an essential partner in this endeavour. Together, we're working to create a mainstream platform in which innovation in electric propulsion can be developed, nurtured, and accelerated more rapidly. Airbus is supplying us with the industry expertise and insight to make this happen.

Can anybody race?

The Air Race E platform is meant to be open to all builders, inventors, engineers and pilots who wish to create a team. There is a set of rules and requirements, but it is designed to be open and accessible. We encourage anyone with the necessary flying qualifications to get in touch at airracee.com or search 'Air Race E' on Facebook and Twitter.

Tell us about when you flew solo for the very first time. What year was it, where did you fly and in what sort of airplane?

It was 1998 in Oregon, USA. I was flying a Cessna 152. At this airport there were two very different runways and all of my flying hours leading up to my first solo flight were based off one particular runway. When my instruc-

tor hopped out ready for me to take my solo assessment, I radioed the tower and they decided to change the runway at the last minute. I now had to fly in a totally different direction, on a different circuit, with different landmarks and visuals. Add to that it was a very busy Sunday. That kind of panicked me and my instructor was going to call me back in. But I was determined to do it and so I did. I managed to get through and passed. I was highly focused while I was up there and in a sense it didn't really hit me until I was down on the ground what I had achieved. I do remember being in the air at one point and looking around and thinking "Wow, this is flying! The real deal!".

What inspired you to learn how to fly?

I had always had a passion for flying and it had been something I'd wanted to do my whole life. I first experienced the passion in the Navy. I worked on an aircraft carrier as an avionics technician on the A-6B Intruder. But it wasn't for some years later that I decided to give it a go. I was in Las Vegas at the time and on a bit of a whim I just said, "ya know what, I should do that". It's one of those things that people put off for their entire lifetime until it's too late. I made a point the very next day when I got home to call the local flying club. I didn't know what I was asking for, whether I wanted to fly fixed wing or helicopter, so I just turned up. Fast forward to seven weeks later and I was a pilot. ✓

www.airracee.com

A4-001



Air Race E will be similar to the established Air Race1.

e-FLIGHT-FORUM IN CHINA 2018:

CERTIFICATION, EVTOL AND AUTONOMOUS



The flying wing-shaped gate of the duty-free zone in Changsha, the host city of the forum 2018, somehow evokes memories of the legendary Horten-wing

Not only metropolitan cities like Paris, Beijing and LA want eMobility in the air. For the second e-Flight forum in China, Flying Pages and the Chinese Z-Park Alliance had invited to Changsha, the capital of the Chinese province of Hunan, from 2 to 4 November. The guests, who had expected a small meeting in the province, were positively surprised: The 7.4 million city showed that the „big business“ in China is not limited on the cities like Beijing, Shanghai, Hong Kong or Shenzhen.

A lot has happened since the first e-Flight forum in Beijing last year. The themes of eVTOL and urban air mobility have become global phenomena, As evidenced by both the number of registered visitors and the difficulty of coordinating the speakers' schedules. But the e-Flight Forum is still the only top event in China. The Chinese aviation industry, the regulator and investors showed a strong interest in the development of electric aviation. And companies from around the world came as well as the leading manufacturer association Gama to discuss technical de-

velopment, Certification and regulation and public acceptance. Due to the global interest eVTOL and autonomous flight were the main topics of the forum. With the boundaries between unmanned large-capacity drones and manned eVTOL fading away as autonomous flight control is the core of both developments. After the success its clear that the E-Flight-Forum China will happen again in 2019 but due to the success there are now several scities competing for being the host city. E-Flight-Journal will keep u updated. Infos on www.e-flight-forum.com

Many eVTOL-projekts with flying prototypes in the panel! from left to right: Prof. Guo von BUAA, Willi Tacke e-flight-Journal (host), Derek Cheng/Airbus, Tian Yu / AutoflightX, Joeben Bevirt / Joby Aviation, Tassilo Wanner / Lilium, Fabien Nestmann / Volocopter, Mr. Zhang von CAAC.



INNOVATION BOOST AND WORLD PREMIERES FOR THE TENTH ANNIVERSARY

The ONIX from Pure-Flight will soon go into production. To create the infrastructure, the company plans to electrify more than 10 airfields in the Czech Republic.

e-flight-expo 2019



For the 10th anniversary, the e-flight-expo is once again offering tons of news to anyone interested in e-mobility in the third dimension. So you can not only continue to pursue the strategy of Siemens to equip more and more small aircraft with the in-house e-engines, but you can also meet new companies pushing into the electric flight market each year.

10 years ago the first e-flight expo took place. There had been a few small ULs with electric motors made by backyard mechanics, at whom “right” flyers just sneered. That was still the case when two years later Volocopter exhibited its “flying rubber ball” at the Flying Pages booth. Some Visitors took it as a yoke, when Volocopter talked about developing manned vertical-launching multicopters. Today ministers of transportation, heads of

governments and chief executives of the world's largest companies of many branches of industry from IT, automotive to Aviation talk about Urban Air Mobility and eVTOL... and invest billions of cash in Air e-mobility. The AERO Friedrichshafen has marked a trend here, which is drawing ever wider circles.

As e-mobility is growing rapidly, especially in the field of aviation, it is only logical that this year e-aircraft are not only in the Hall of innovative e-flight (Hall A7, in which you will also find the Flying Pages booth A7-101) but such machines can also be found throughout the fair. In almost all halls - no matter if row A or B - you will find e-exhibits. E-Propulsion has somehow become normal. Many gliders, which are primarily exhibited in Hall A1, have an electric drive,

The Skyleader SL 400 electric: a metal low-wing aircraft based on a standard UL / LSA. Since the Chinese industrial group Zall took over Skyleader, an electric Skyleader has been in the works because e-mobility is very popular in China.





After almost two years of testing, the C42 e will soon inspire students.

Above all, e-projects are piling up in the ultralight B-halls. The Flight Design F2 celebrates its world premiere, and will be unveiled on Wednesday morning in hall B2 at the traditional Flight Design location. At the Ikarus Comco Booze two further improved e C-42s are on display, which will go into production soon after the 600 kg class become legal reality. But that's not all: Pipistrel expects the EASA approval of its Virus Elektro at its stand during the fair. And the Czech competitor Skyleader has further developed the electric version of its training double-seater and wants to get into series production.

It is almost a matter of course that in the field of eVTOL at the AERO 2019 that there will also be world premieres: AutoflightX, based in the German Oberpfaffenhofen, is the new company of the electric flight and UAV pioneer Tian Yu. It will be in Hall A7 and reveal solemnly on Wednesday afternoon the V600. It is one of the best kept secrets of the scene, how this plane, which will launch vertically with rotors and then fly efficiently with wings, will look exactly. If all goes well, the plane should still make its maiden flight in the time between the copy deadline for this issue and the beginning of the fair. The V600 flies by the way as UL in the sphere of authority of the DULV.

Although other eVTOL manufacturers will not come to Friedrichshafen with their machines this year, nearly all of their decision-makers spend one to two days at this leading trade fair for air e-mobility. Some because of the GAMA Epic meeting, some for the assembly of the UAV Dach or for the discussions, but all because of the competence of the AERO Friedrichshafen

Sadly, Airbus unfortunately will not bring its CityAirbus, which was presented to the public for the first time in early March in Ingolstadt, to the AERO, but we will see at last the engines of these eVTOL at the Siemens booth in Hall A7.

On the other hand, the Urban Air Mobility team of the Franco-German aircraft and helicopter corporation will show up at the AERO 2019. Several leading executives will participate in various discussions in Forum Ost. A lot more developer and executives of other top companies involved in the eVTOL sector will meet at the discussions The Lindbergh Innovation Forum and the newly founded e-Connect Area complete the global e-flight experience at the AERO.. ✓

www.e-flight-expo.com

Hall A7

Not only three-axle planes want to be electrified: the eGo trike from the Czech Republic has long been flying with e-power.



Lindbergh Innovation Forum



After a several year absence, Erik Lindbergh returns to the AERO in 2019. This time he will not join with his LEAP foundation, but with the Lindbergh Innovation Foundation, which has been organizing innovation forums in various US locations for two years, most recently at the Airventure in Oshkosh. This year, fair leader Roland Bosch was able to persuade the grandson of transatlantic flight pioneer Charles Lindbergh to come to the event for the AERO / e-flight-expo.

“The AERO with its aeronautics-friendly audience and especially the e-flight-expo as the first and leading fair for the electric air mobility are the ideal platform for our forum,” said Arvind Iyer, the director of the foundation. As part of the AERO / e-flight-expo forum, the Lindbergh Innovation Forum wants to show new facets in the development of aviation that go beyond the pure electric-flight approach.

It offers visitors inspiring and provocative lectures by aviation pioneers on cutting-edge technological concepts and key breakthroughs that will shape the future of flying. Participate in the future of aviation and take the opportunity to discuss with the speakers after the event.

Like many other AERO lectures in the aviation language English, the forum takes place on Thursday, April 11th from 3 to 6 pm in the Foyer OST Forum under the motto “A radical transportation future”. ✓



Erik Lindbergh
at the Lindbergh
Innovation Forum
Oshkosh 2018.

speaker	topic
Andre Borschberg CEO, Co-Founder and Pilot, Solar Impulse	New technologies and innovation trends in aviation
Patrick Ky Executive Director EASA	Innovative certification approaches for novel aircraft concepts
Ilan Kroo Professor of Aeronautical and Aerospace Engineering - Stanford University	Advances in aeronautical design
Roland Gerhards CEO ZAL Center of Applied Aeronautical Research Podiums Diskussion mit Patrick Ky, Andre Borschberg, Ilan Kroo and Roland Gerhards Moderator: Erik Lindbergh	The potential of additive manufacturing in aviation A RADICAL TRANSPORTATION FUTURE
Jean Botti CEO VoltAero	Advances in hybrid propulsion technology
Dr. Frank Anton Head of eAircraft Siemens AG	Hybrid electric aviation and how its Digital Twin expedites development
Ulrich Wenger Head of Innovation and R&T Strategy Rolls Royce	Electric and hybrid technology
Gregor Grandl Senior Partner Porsche Consulting Joachim Kirsch Senior Partner Porsche Consulting	VTOL technologies and trends
Podiums Diskussion mit Jean Botti, Dr. Frank Anton, Ulrich Wenger, Gregor Grandl and Joachim Kirsch Moderator: Erik Lindbergh	REIMAGINING THE AIRCRAFT



The Future of Aviation

April, 10-13, 2019

Friedrichshafen - Germany



e-flight-expo

is part of the annual AERO in Friedrichshafen / Germany. You will find the most advanced electric, hybrid, fuel-cell and solar aircraft and propulsion systems.



eVTOLs flying



www.e-flight-expo.com

E-FLIGHT-FORUM

High-profile cast

The forum at the e-flight expo is once again top notch this year. One Example is the panel discussion "eVTOL - whats next" with representatives from Siemens, Bosch, Airbus, AutoflightX, GAMA and Bauhaus Luftfahrt, another is the presentation of the BEAM project Programm, which concerns a test airfield for electric autonomous flying in Oberpfaffenhofen near Munich. Also the individual project presentations for electrically powered aircraft - from the Alice in the passenger aircraft to the H3PS joint project by Tecnam, Siemens and Rotax for the development of a scalable hybrid drive for small aircraft, to the hybrid project of the IBEFA (means innovation alliance for the development of low-emission aircraft propulsion) of BBAA (Berlin-Brandenburg Aerospace Alliance). But that's not enough green topics: EASA presents "Greener Skies Ahead Electric and Hybrid Solutions for Sustainable Aviation". And exhibition manager Roland Bosch was able to convince the Lindbergh Foundation that it will hold its successful innovation after its premiere in Oshkosh last year now here during the AERO on Thursday.

In addition to the public events there will also be the meetings of the EPIC commission of the Manufacturers' Association GAMA, of the standardization organization ASTM and of the drone association UAV Dach.

WEDNESDAY, APRIL 10

ELECTRIC PROPULSION STANDARD DEVELOPMENT

Speaker: Tom Gunnarson
09:00 - 10:30 am
Conference Center East, Room London

PANEL DISCUSSION „EVTOL- WHATS NEXT“

Frank Anton - Siemens, Tian Yu - AutoflightX, Mirko Hornung - Bauhaus Luftfahrt, Greg Bowls - GAMA, Erwin Weger - Bosch
10:30 - 11:45 am
Forum, Foyer Ost

PANEL DISCUSSION „THE BEAM PROJECT“ OBERPFAFFENHOFEN TESTFLUGGELÄNDE FÜR AUTONOME E-VTOL-FLUGGERÄTE

2:30 - 3:30 pm
Forum, Foyer Ost

SUNFLYER - E-AIRCRAFT,

Speaker: George Bye
4:10 - 4:30 pm
Forum, Foyer Ost

THURSDAY, APRIL 11

DAS ELEKTROFLUGZEUG ALICE DER FIRMA EVATION VOR DEM ERSTFLUG

Speaker: Omer Bar-Yohay
2:00 - 2:30 pm
Forum, Foyer Ost

ISCAD - EIN NEUER HOCHLEISTUNGSANTRIEB FÜR ELEKTRISCHE FLUGZEUGE

Speaker: Prof. Dr.-Ing. Dieter Gerling
2:00 - 3:00 pm
Konferenz-Zentrum Ost, Room Lissabon

PRÄSENTATION DES FLUGZEUGHERSTELLERS AMPAIRE

Speaker: Susanne X.Ying
2:30 - 3:00 pm
Forum, Foyer Ost

LINDBERGH INNOVATION FORUM

(Program see page 18)
3:00 - 6:00 pm
Forum, Foyer Ost

FRIDAY, APRIL 12

SMARTFLYER CH - HYBRID-ELEKTRISCH MIT SIEMENS SP260D

09:30 - 10:15 am
Forum, Foyer Ost

H3PS - DAS EUROPEAN HYBRID PROJECT VON TECNAM SIEMENS UND ROTAX

10:15 - 11:00 am
Forum, Foyer Ost

IBEFA - BBAA - DIE APUS FLUGPROJEKTE AUS BRANDENBURG

11:00 - 11:40 am
Forum, Foyer Ost

EASA - GREENER SKIES AHEAD

ELECTRIC AND HYBRID SOLUTIONS FOR SUSTAINABLE AVIATION
1:00 - 4:00 pm
Konferenz-Zentrum Ost, Room Berlin

FLIGHT DESIGN F2

4:30 - 4:50 pm
Forum, Foyer Ost

STEMME ELFIN

Speaker: Dr. Rainer Stemme
4:50 - 5:10 pm
Forum, Foyer Ost

CEREMONY OF THE E FLIGHT AWARD 2019

5:10 - 5:25 pm
Forum, Foyer Ost

SATURDAY, APRIL 13

ATB - ELECTRIC MOTORS

Speaker: Prof. Gao
09:30 - 10:00 am
Forum, Foyer Ost

FUEL CELLS IN SMALL AIRCRAFTS

Speaker: Peter Stadthaler
10:00 - 10:30 am
Forum, Foyer Ost

METRO HOP - A SHORT TAKE OFF ELECTRIC TAXI CONCEPT

Speaker: Bruno Mombirne
10:30 - 11:00 am
Forum, Foyer Ost

SAFETY MANAGEMENT OF BATTERY ELECTRIC PROPULSION

whole day
Konferenz-Zentrum Ost, Room Rom

E-FLIGHT TRAINING PIPISTREL

12:30 - 1:00 pm
Speaker: Mr. Marc B. Corpataux / Pipistrel CH
Forum, Foyer Ost

BARRIE ROGERS ELECTRICAL APPROACH IN FIVE AUSTRALIAN AIRPORTS

1:00-1:30 pm
Forum, Foyer Ost

AERO ELFIN 20E,

Speaker: Dr. Rainer Stemme
1:00 - 2:00 pm
Forum, Foyer Ost

RCC MÜNSTER-COSPAS-SARSAT SYSTEME / DER RICHTIGE UMGANG MIT DEM ELT

Speaker: Herr Hptm Stefan Hollands – RCC Münster
1:30 - 2:00 pm
Konferenz-Zentrum Ost, Room Paris

BRENNSTOFFZELLEN IN KLEINFLUGZEUGEN

2:00 - 2:30 pm
Konferenz-Zentrum Ost, Room Berlin

(Subject to change)

e Connect Area

The Flying Pages booth in Hall A7 - 101 has become an increasingly popular destination for electrical projects from around the world in recent years. The number of innovations has grown strongly with the boom in electric aviation mobility in recent years.

For this reason, the exhibition management team and the Flying Pages Team decided to help found a network and create the e-connect area on the AERO 2019 after a first and successful test in Changsha. In the field of e-flight technology - and in particular in eVTOL development - is a great need for employees' expertise. Unfortunately, the e-flight movement also competes with electric cars and autonomous mobility for the same specialist and create an even bigger bottleneck. Here the e-connect-area comes in and tries to help. Companies from the e-flight segment looking for employees will show their interests here and also universities who want to make contact to industry or help their student to find the was to the most fitting employer. For networking, the focus is therefore on four points:

1. To bring together the academic talent pool and the talent need.
2. Providing a platform for e-flight companies to present their designs and technologies to universities and other research institutions, and to look for technology and research partners.
3. To draw the attention of the professional public to the participating e-Flight start-ups by showing their employment opportunities.
4. Give academies the opportunity to get knowledge about the latest developments in electric / electronic aviation and to inspire new research.

THE E-CONNECT-AREA CONSISTS

OF THREE COMPONENTS:

1. There is a booth for information material and discussions about the respective activities for each company or university.
2. The e-Connect Stage, a small presentation stage in Hall A7, where participants can present their projects and job opportunities (information about the presentations currently on the Flying Pages stand, A7-101)
3. The e-Connect Lounge, where you can talk about future projects or job options.



Exciting discussions in the context of the e-flight-expo are also guaranteed in 2019 thanks to the top-class discussion partners on the stage in the Forum Ost. Our picture on the left shows a discussion from 2017 with representatives from Pipistrel, Uber, Siemens, Volocopter, EASA and Bauhaus Luftfahrt.



The information booths in the e-connect area (here at the e-flight forum 2018 in Changsha, China)



e-flight award ceremony 2017: Frank Anton (left), winner 2016, congratulates Marc B. Corpataux (right), winner 2017. Center of the picture: Pipistrel boss Ivo Boscarol.



TECNAM, SIEMENS & ROTAX

Scalable parallel power hybrid



P2010 Hybrid

Siemens and Rotax had already worked together with an aircraft manufacturer, in this case Pipistrel, on the serial hybrid in the Hypstair project. Now the two companies are developing a parallel hybrid drive for small aircraft in cooperation with the small aircraft specialist Tecnam. The development is getting funded from the EU H3PS program.

Tecnam has always been at the forefront when there was something new to develop in aviation. Thus, the company from near Naples, Italy was a leader in the use of Rotaxmotoren in certified aircraft. Tecnam also relied on Rotax engines for its twin-engined P2006 - as the first twin manufacturer ever. Thanks to impressive performance data, this machine has outperformed comparable models with much larger engines, not least because of the unbeatable low fuel consumption. In addition, the Italians

impressed in recent years by the fact that they mastered the approval of their machines at EASA in record time. And that's exactly what makes Tecnam an ideal partner for Rotax and Siemens for an engine concept that is to be developed as quickly as possible to market.

Unlike a classic hybrid in which an internal combustion engine drives a generator generating electricity, which in turn powers the electric motor for the propeller, both motors work together in a parallel hybrid. The electric motor is needed as a "booster", which boosts the performance of the burner at startup. This can be made smaller overall, which significantly reduces consumption. There are also advantages in terms of registration and safety: If one of the engines fails, the aircraft can continue to fly with the others to the next safe airport. ✓



Rotax 915 iS motor

www.siemens.com/eAircraft

A7-201

www.tecnam.com

A4-319

www.flyrotax.com

A3-301

FLIGHT DESIGN F2



One for all

The Flight Design CT is one of the most successful machines in the UL class. Now the manufacturer is about to develop a successor and of course the bar is high and the goals are ambitious. The new F2 will be - almost identical - with 600 kg in the UL and the LSA class and with 650 kg MTOW as Part 23 approved aircraft. But that's not all: The CT successor should be significantly more spacious and also it will be available direct from the start of the project not only with an internal combustion engine, but also with an electric drive from Siemens. Both versions will be on display at the AERO.

It is a long list of properties as well as specifications that the manufacturer wants to give to the new aircraft. Thanks to its high aerodynamic quality, the machine is expected to achieve a top speed of more than 250 km/h with a Rotax 912IS despite its "significantly larger dimensions" than the CT. She will be the first certified machine to have Amsafe airbags in the dashboard. In all versions, the seats are electrically adjustable. The equipment also includes three-point belts with retractors as they are known from cars. In addition, the machine should be spin proof (spin resistant).

The prototype has already completed its maiden flight before the AERO expo, the certification process is already well advanced and it is expected that the machines in the UL version are to be delivered already this summer to the first customers. The certified CS 23 version will follow at the end of the year. From 2020 there will be an IFR approved version. All these different certifications will make the machine an ideal school machine, in which you can train everything from the UL license to the IFR CPL. It is interesting that Flight Design with its international team not only developed the basic aircraft in record time,

but also an electric variant that is powered by the Siemens engine SP 65. While the burners variants are already in the certification process, the F2e is still a "proof of concept". However, it is clearly planned to bring the machine with electric motor to series. By the end of 2020, the E-variant will also be available as a CS 23 certified aircraft. Because of the allowed higher weight in that class, more batteries can be installed, so that the plane really is able to fly two hours and still will have some reserve.

The price of the F2 with internal combustion engine should be in the UL version in the range of an equivalent equipped CTLS, the certified CS23 variant is naturally more expensive. Another interesting aspect is that the F2 is not just a single aviator in many variants, but rather to be the backbone of a new aircraft family. Soon after the registration of the two-seater a four-seater variant - called F4 - and possibly later even follow an F5. Well, we don't know yet, when these will be seen at the AERO, but - you may be curious. ✓

Text: Xin Gou

photo: MGM Compro and ΦNIX

MGM COMPRO

A Versatile Electric Flight Developer

Companies from Czech Republic have been one of the driving force in electric flight development. Considering the dynamic activities of UL and LSA industry in Czech Republic, it is not a surprise to see their interest in electric flight with emphasis on efficiency and innovation. MGM Compro is a good example of such effort. Here is a glimpse of some of the new products that you may see at AERO 2019 from MGM Compro and the latest update from this pioneering company in electric aviation.

As the winner of the “e-flight-award” at AERO EXPO 2018, MGM COMPRO has been showing a strong and diversified innovative capability in electric flight. Their products, clients and projects cover a wide spectrum in electric mobility from electric cars, to electric surfboard and electric airplanes. In term of electric airplanes, their proj-

ects range from PPG and hang glider, to UL and eVTOL, all the way to Virgin Galactic’s spaceship. In the last year there is a huge rise of interest in MGM COMPRO concerning development projects for e-VTOL aircrafts, some of which are in the reference list at the company website, but the majority of them are under NDAs. The

ΦNIX electric airplane with MGM COMPRO electric system and 60 kw motor. The airplane offers 10.6, 15 and 17 meters wing extension options to meet customers needs. In the background is the charger.





Airbus E-Fan with four RET 60 (25 kW) engines and one REG 30 (7 kW) engine for the wheel gear. Flying time is around 40 minutes.



The SportStar EPOS was one of the first electric UL built in series production. It used a REB 90 Engine (80 kW), MGM COMPRO HBC 400400 Controller (photo below) and LiPo 80 Ah battery pack (360 V).

project partners of MGM Compro include some leading names including Bell, NASA, Airbus, Siemens, Virgin Galactic, and so on. MGM Compro delivers specialty controllers to Bell's Nexus eVTOL project. MGM COMPRO delivers industrial HBC Electronic Speed Controllers for NASA's electric airplane project. MGM Compro also participated on the deliveries of industrial speed controllers, batteries as well as chargers to Airbus E-fan project.



Projects of LSA aircrafts are also going forward quite fast. One of the most interesting project that the company has been working on is Φ NIX. We saw Φ NIX's electric airplane at AERO 2018 with two wing extension options. The company says that there are orders already on the table. On AERO EXPO 2019 Φ NIX will show modified version of electric airplane Φ NIX with 17 wing extensions. It means that Φ NIX can actually fly with 10.6, 15 and 17 meters wing span. Actual endurance of Φ NIX is 2.5 hours with 30 minutes reserve. Electric propulsion power is 60 kW. On selected airports already started installations of universal chargers allowing to recharge electric Φ NIX and electric cars. Φ NIX project website: <http://pure-flight.eu/>

MGM compro's new successor line of electronics is in the latest phase of development and testing which will make the power range of its electric propulsion systems even wider (2-300kW) with more advanced connectivity, even lighter and smaller and with more options of settings

There are a lot of other concrete news/improvements, namely battery safety systems, new types of electric motors, close partnerships with propeller producers, larger testing capacities etc. You can get more information about the products and the company at Hall A7 at AERO EXPO. ✓

www.mgm-compro.com

A7-301



Grisa and Martin Dvorsky manage the company MGM COMPRO.

ATB Group



A newcomer to the electric aviation scene

ATB Austria Antriebstechnik AG may sound unfamiliar to you even though it is a long established business with more than 90 years of history. That is perhaps because it's not been in the aviation business. **ATB is a leading global suppliers of electric drive systems for industrial applications and home appliances ranging from 25W to 25MW.**



a **WOLONG** *company*



Dr. George Gao,
CEO of ATB group.

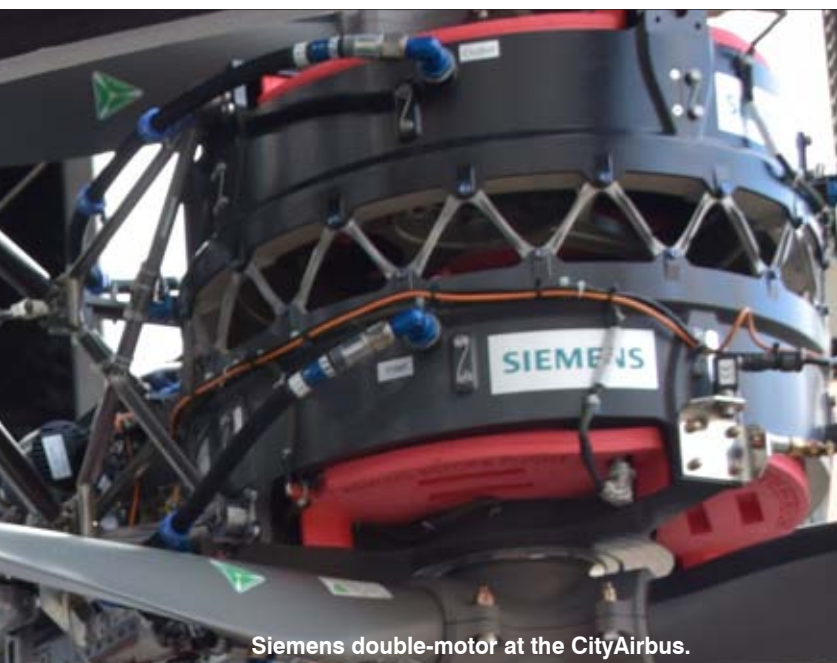
ATB was acquired by the Chinese Wolong Group in 2011 and has been expanding globally further since then. Now it wants to join the global effort of electric aviation proudly and swiftly. Early this year GE Aviation Czech and ATB have agreed to jointly explore turboprop propulsion solutions for the general aviation and urban air mobility market in the power range between 500 and 1000 SHP, leveraging GE's H Series turboprop aircraft engine technology and ATB electrical machines. Different configurations will be investigated and a first proof of concept test is aimed to take place later this year. With this lesser known but aggressive new player in the field of electric aviation, we believed many people would be as interested in them as we are, so we interviewed the CEO of ATB group, Dr. George Gao.



The I6 of the IBEFA /BBAA Berlin
 Brandenburg Aerospace Allianz

SIEMENS INSIDE

Intel has coined the slogan “Intel Inside”, which you see and hear all around the computer industry. Siemens seems to be planning the same for the e-Aviation Industry. So you will see a horde of planes at the AERO in Hall A7, which all will be powered by Siemens, the Power-House of E-Aviation.

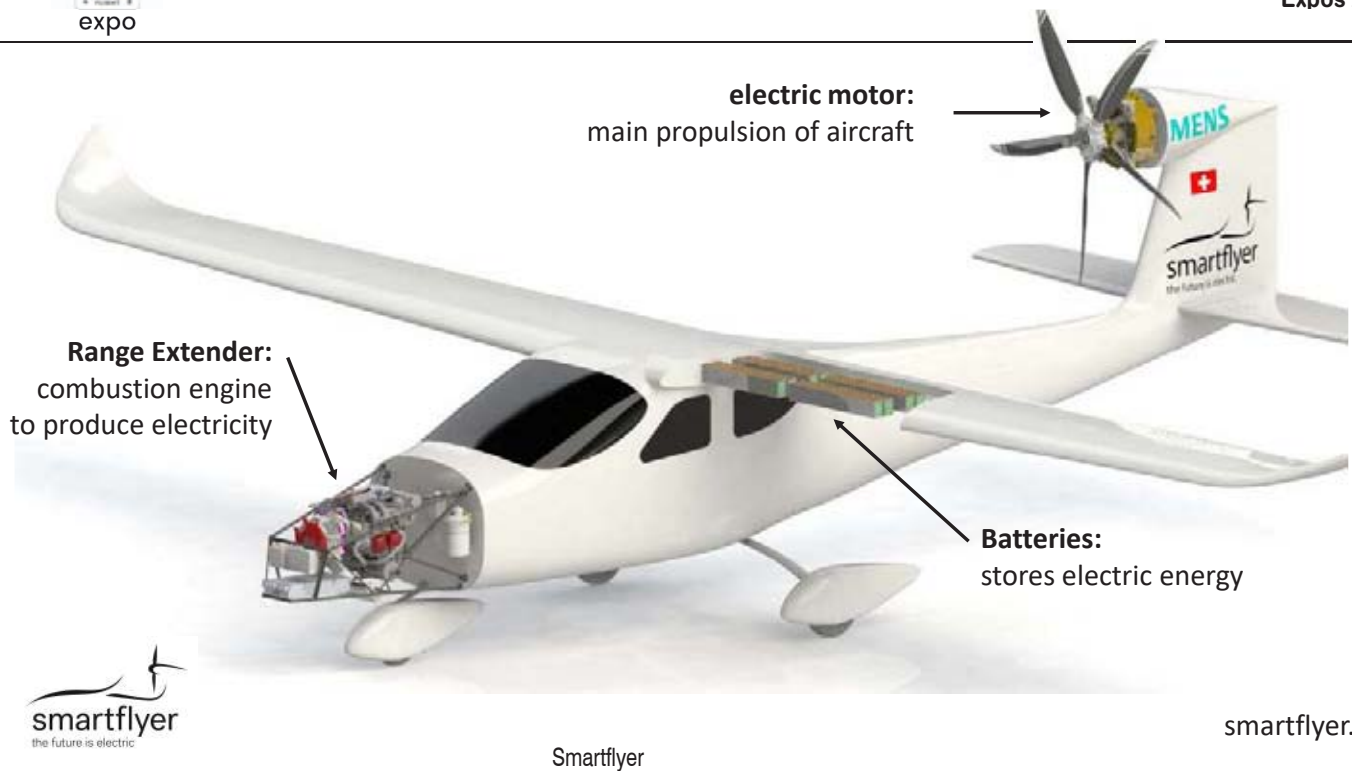


Siemens double-motor at the CityAirbus.

When the global corporation Siemens decided for approximately eight years to enter with their Brainpool e-Aircraft for the development and construction of electric drives for aircraft of all kinds, the comments were initially rather critical: “Time waste, the low energy density of batteries will force a decade of delay in development.” But the team led by Frank Anton followed the development path towards becoming a universal provider of electric propulsion systems more consistently than it first appeared.

SINCE 2011 A MAINSPRING OF DEVELOPMENT

After the first steps, better first flights, together with Diamond Aircraft and the Airbus producer EADS in 2011 and 2013, the first electric UL with Siemens engine, the WattUp, saw the sky in 2014. This plane is a forerunner of the Alpha Elektro, which is produced in series since last year but does not a Siemens engine anymore.



Twelve months after WattsUp was in the sky the SP 45D65 and the world record SP 260D engines were presented in two demonstrators planes the Magnus e-Fusion and the Extra 330LE. Planes of which a non-e version already existed. In 2017 and 2018 the e-Fusion and the Extra climbed the skies as a part of the worlds first e-flight show at the AERO Friedrichshafen.

Many aircraft manufacturers then showed interest, and there has been a lot of talks with various manufacturers to power other aircrafts by Siemens, but you neither see these concept of planes in the sky nor at the fairs. - That

will change dramatically in 2019. At the Siemens booth in Hall A7, nine projects with their collaboration partners are to be evaluated.

In addition to the 200 KW strong units for the CityAirbus, the Sun Flyer from Bye Aerospace, the Flight Design F2-e, the i2 from APUS, the eViation Alice, the Hybrid H3PS Testplane from Tecnam, the Elfin of RS AERO, Diamond Aircrafts DA 40 eTwin, the Smartflyer and I6 of the IBEFA consortium of the BBAA will receive their e-powerdrive from Siemens. Some of the planes like the Sunflyer and the DA40 are already flying, others like the Flight De-

Frank Anton (right) in conversation with the then Bavarian Minister of Economic Affairs Franz Josef Pschierer (center). Bavarian Prime Minister Markus Söder (left) is examining the model of the Dornier 228: A Dornier 228 will be converted to fly with Siemens elector motors.



sign F2-e are coming as a prototype for the e-flight-expo (This plane is at the booth of Flight Design Hall B1-Booth101) and are supposed climb the sky in the weeks after the AERO. eViation/Israel will only show a model and one of its motors and Chief Executive Omer Bar-Yohay assured us, that the prototype is supposed to take off two months later and take part in the Le Bourget Airshow in Paris.

These visible activities are far from everything that Frank Anton and his highly motivated team have in their pocket. Siemens is working together with Airbus for eVTOL (vertical takeoff and landing air taxis and transport automatic aerial vehicle), especially the CityAirbus. It is planned to supply several other manufacturers with the drive technology, developed here to become the driving force behind the scene.

BESIDE EVTOL: ESTOL

Frank Anton is convinced that for reasons of energy efficiency, in addition to conventional aircraft and eVTOLS, a completely different species will make a name for themselves in the next: The eSTOL aircraft. In this case, “e” in eSTOL stands for both “electric” and “extreme”. It means extremely short startable aircraft with an electric motor. The advantage of these new “species”: they do not have the technically very difficult complexity with which drive units have to endure the vertical flight. There is no extremely difficult transition vertical to horizontal flight. On the other hand, the eSTOL devices require an infrastructure of runways, but these can be quite short.



i2 from APUS



Sun Flyer from Bye Aerospace

eViation Alice



Now eVTOL inside !!!

Certified Aircraft » Trikes » Gyroplanes » Helicopters » Motorgliders...
WINGS-WORLD
World Directory of LIGHT AVIATION
 Special issue of **Flügel**
 2018-19 Flügel - das Magazin
 EAA sport flying

Buyer's Guide
 1000 aircraft...
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 + INSTRUMENTS
 + PROPELLERS
 + RADIO
 + AVIONICS
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2017-18 > Australia \$15.90 • USA \$16.99 • UK £6.99
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 + 旋翼机
 + 直升机
 + 滑翔机
 + 发动机
 + 航空设备
 + 装备组件
 + 发动机
 + 更多资讯
 + 更多精彩

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World Directory of Light Aviation 2018/19

* The **World Directory of Light Aviation 2018/19** lists with images, descriptions and technical data over 1000 aircraft: ultralights, microlights, LSA, gyrocopter, ul-helicopters, certified aircraft, kitplanes, trikes, ultralight and certified gliders & motor-gliders, VTOLs and multicopters, instruments, engines, propellers and accessories.

* The **World Directory of Light Aviation 2018/19** is available in four languages: English, French, German and Chinese.

* The **World Directory of Light Aviation 2018/19** is also available online www.flying-pages.com.





Elfin from
RS AERO.

THE HYBRID WAY

Although Siemens is involved in purely electric projects as the Flight Design F2 or the eViation Alice, the German Big Player is more likely to opt for hybrid solutions, at least for a decade. This a company planning for Decades, if you look at the "short term" concept of Siemens, short term is until 2030. Siemens believes, that this time they could deliver engines in the megawatt range for hybrid electric commuter planes with 30 and more seats, which then transport line-passengers on short- and medium ranges.

BIGGER IN MIND

In addition to the drive units for the CityAirbus and larger machines, this concept fits to a further development that is being planned together with RUAG - the manufacturer of the Dornier 228. This 19-seater is normally equipped

with two turboprops, in a first step one turboprop shall be removed and replaced by a equally powerful e-motor. This shall draw it power from a turbine generator installed in the fuselage of the engine. The advantage of this arrangement is, that you could otherwise leave the machine largely original. In addition, the remaining turbine serves as a backup, which makes the approval of such a test vehicle much easier than the approval of an equal-sized transport machine that has been completely converted to e-drive. If the hybrid string has proven its reliability, then in a second step, the other Turboprop could be replaced by an electric motor.

Although the megawatt engines are currently in development, at moment ultra-light, LSA and VLA benefit the most from Siemens developments. This will revolutionize flight-training in the next few years. ✓

www.siemens.com/eAircraft

A7-201



DA 40
eTwin from
Diamond
Aircraft



a WOLONG company



www.atb-motors.com

About ATB

The history of ATB Austria Antriebstechnik AG dates back more than 90 years. Today, the Group ranks among the leading global suppliers of electric drive systems for industrial applications and home appliances.

The Company, which includes famous brands such as Schorch, Morley, Laurence Scott and Brook Crompton, currently has twelve manufacturing bases – in Spielberg, Welzheim, Moenchengladbach, Nordenham, Leeds, Norwich, Cradley Heath, Tarnow, Subotica and Bor – and employs more than 3,500 people.



ATB is committed to providing green electric driving solutions







GE Aviation Czech and ATB to explore turboprop solutions for urban mobility market

Prague – GE Aviation Czech and ATB announced today they have agreed to jointly explore turboprop propulsion solutions for the general aviation and urban mobility market in the power range between 500 and 1000 kW, leveraging GE's in-series turboprop aircraft engine technology and ATB electrical machines. Detailed configurations will be investigated and a test program concept test is aimed to take place later this year.

"We're excited to contribute into the development of more sustainable transportation systems and greener flight" said Petruch U'Brady, President and managing executive of GE Aviation Czech, Business and General Aviation Turboprops.

GE Aviation Czech will also provide system integration supported by leading European research centers for electric propulsion and other key partners for battery systems.

"We are extremely proud to join our efforts with GE to investigate new turboprop solutions combined with our system electrical technology" said George Gao, ATB Chief Executive Officer.

"The solution aims to combine simplicity and power density for a unit tailored for the turboprop general aviation market" said Francesco Pizzi, ATB-GE's Chief VP Global Sales & Marketing.



ATB Aviation drivetrain products portfolios:

$P_{max} \leq 1000 \text{ kW}$ $N_{max} \leq 40000 \text{ RPM}$ SiC-inverter

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- Lucas Ye
- +49 1739280420
- yechao@wolong.com



AIRBUS: EVTOL CITYAIRBUS



The multi whisk from Bavaria/Germany

On 11 March 2019 Airbus presented to the public its CityAirbus proof-of-concept electric vertical takeoff and landing (eVTOL) aircraft at the Rathausplaza in the Audi town of Ingolstadt. The maiden flight is planned at the airport in Manching – about 60 km away from the development site at Airbus Helicopters in Donauwörth. Despite severe weather, several hundreds of speculators witnessed the ceremony with great interest. Federal officials attending the event included Digital State Minister Dorothee Bär and Federal Minister of Transport Andreas Scheuer.



The upper rotor is outside the duct and inclined towards the front of the vehicle



Details of the coaxial electric motor structure. Note: the Bavaria color decoration in the inner ring of the duct.

There are a dozen partners in the urban air mobility (UAM) program of Ingolstadt (main photo, left side)



CityAirbus has eight electric rotors specially designed by its partner Siemens. It will be able to transport four passengers. The 2.2-ton demonstrator has 650 kilos batteries, is expected to fly with a maximum of 80 kilometers per hour up to 15 kilometers at 150 meters altitude. Later model CityAirbus can fly at 300 meters at about 120 kilometers per hour airspeed for 50 kilometers.

The CityAirbus program is part of the EU Urban Air Mobility initiative, which is to conduct practical studies on the use of innovative electric aircraft for urban mobility. As of today a total of 14 continental European cities are participating including Ingolstadt, Hamburg, Toulouse, Antwerp, Brussels and Geneva. Ingolstadt has recently

made a lot of efforts to be at the forefront of technology in the field of digital and autonomous mobility. The city signed a MOU on 19 June 2018 with the Free State of Bavaria and various partners from industry and research to develop and explore innovative mobility concepts for the airspace in the Ingolstadt region. Urban air mobility aircraft will be utilized in various applications: medical emergency rescue, transport of blood and organs, public safety or passenger transport (so called "air taxi"). ✓

www.airbus.com/newsroom/stories/

Infos at Siemens-booth

A7-201



The first all-weather eVTOL aircraft? Despite the severe weather there were crowds of several hundreds of people at the ceremony.

Officials and Airbus helicopter CEO announced the reveal of CityAirbus.



Photos: Bell

BELL: NEXUS EVTOL



The urban air mobility scenario envisioned by Bell.

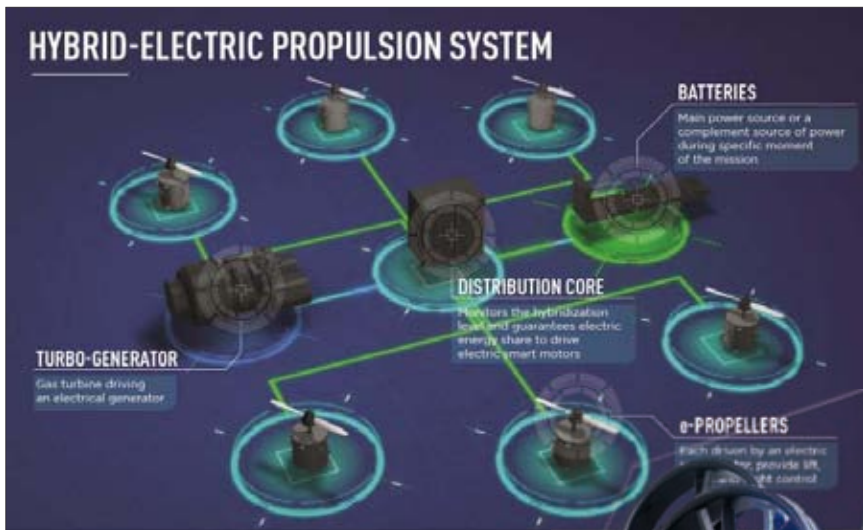
New player in the eVTOL arena

Bell officially unveiled its Nexus eVTOL full scale mockup at the Consumer Electronics Show (CES) in Las Vegas in January. Presenting Nexus to be innovative new eVTOL aircraft of transport and technology and of comfort and convenience, Bell will certainly be a very competent player in the crowded eVTOL arena.



The cabin experience is a key element in Nexus development. The four passengers should enjoy a very comfortable and luxurious cabin environment.

Nexus is the first eVTOL project of Bell after its rebrand last year. As the manufacturers of both V-22 Osprey and the forthcoming V-280 Valor, Bell certainly has lots of credibility and experiences under its belt in tilting rotor design, so it is not a surprise that Nexus shares some familiarities with its conventional siblings. Nexus has six large tilting ducted fans. The middle set of rotors are installed on a relatively short 2.4 m wings. The fans pitch from vertical to horizontal allowing vectored thrust. Nexus has a “4+1” configuration for a pilot and four passengers. Top speed will be 155 kt (288 km/h) with a range of 130 nm (241 km). It has a gross weight of 6,000 lb (2,720 kg), the largest and heaviest eVTOL of its type. Bell announced that a full scale demonstrator is expected early in the next decade with widespread service in the mid-2020s.



Safran's HEPS hybrid system has been put into ground test since last June up to 100kw power output (photo credit: Safran)

Safran's 600kw hybrid-Electric Propulsion System (HEPS) specifically developed for Bell Nexus (photo credit: Safran)



Bell is one of the first five manufacturer partners of Uber's Elevate urban air mobility initiative back in 2017. Bell announced in April 2017 at the Uber Elevate Summit that the two companies will be working together "to accelerate the eventual large-scale deployment of electric vertical take-off and landing vehicles (VTOLs) in order to fulfill its mission of providing a safe, reliable transportation service to everyone, everywhere."

Bell has put an eye-catching partnership including Safran (hybrid propulsion and drive systems), Electric Power Systems, EPS (energy storage systems), Thales (Flight Control Computer (FCC) hardware and software), Moog (flight control actuation systems) and Garmin (integration of avionics and the vehicle management computer). The propulsion solution developed by Safran for Nexus is capable of producing more than 600 kW power. During ground tests last June, the system produced 100 kW. ✓



Bell Nexus full scale mockup at CES

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SYMPOSIUM E2FLIGHT

Interesting concepts
presented from selected researchers.

Professionalism on the rise

In its fifth edition the e2Flight Symposium in Stuttgart / Germany presented many interesting presentations of universities, research institutes like DLR and Fraunhofer, as well as leading industry players like Rolls-Royce, Siemens, and Diehl. The quality of the presentations is reflecting the professionalism which is more and more visible in the e-flight arena.

Remarkable already the Keynote from Kay Ploetner, the researcher from Bauhaus Luftfahrt (a research institute created by the aviation companies Airbus, IABG, Liebherr-Aerospace, MTU Aero Engines and the Bavarian Ministry of Economics). The Munich based Institute explores future options of air transportation as well as alternative energy options for aviation.

Ploetner elaborated in his presentation that some of the promises which are made by some companies when it comes to the eVTOL Air Taxis will not be kept by the coming reality. He explained this just by simple math. Saying that Taxis are only 1 percent of the car traffic at

the moment. Considering that there would be also ride shares there may be - some people say even up to 10 percent of the traffic.

Than he took the example of Munich for being able to execute 1 percent of the traffic would be about 87 000 trips per day. For this it would need 61 large, 136 medium or 213 small vertiports, considering at the same time that there are only 100 Metro stations in the city and it is unlikely that the public in a city would accept this. He also compared the energy consumption of different ways of traveling in a city, also here the Airtaxi is definitely not the best solution.



Keynote speaker: Kay Ploetner from Bauhaus Luftfahrt explained why eVTOL will come different than many may think.

The conclusion was very clear: eVTOL will not solve the traffic congestion on the ground and it probably will not come in the quantity that many people are anticipating now, but it will come! And it will be a part of a new traffic concept and solve some problems of some people. Also, what is very interesting was the presentation from Ulrich Wenger from Rolls-Royce Germany. He stated how committed the turbine manufacturer is to the electric development in aviation and confirmed that Rolls want to become a leading supplier in this field. There is much more than the test motor for the airbus e-FanX or the RR eVTOL project.

Another interesting aspect was the fact that was stated by Florian Hilpert from the German Fraunhofer Institute: Not only e-motors are losing weight dramatically, also are the power electronics and other components. Interesting to see that the German two stroke engine manufacturer Solo is now also moving to electric and is becoming a specialist for cell packing and battery construction for aviation. Finally, also the aspect of fuel cell use in eAviation with liquid Hydrogene was pointed out by Pierre Crespi from Air Liquide.

RESUME

The three Organizers Josef Kallo (DLR), Len Schumann (University of Stuttgart) and Johannes Garbino-Anton from the Brandenburg IBEFA project have done a pretty good job in selecting competent speakers and subjects so that the discussion after the presentations was very fruitful.



Ulrich Wenger von Rolls-Royce explains the options of electrification for Aviation.



Rolls-Royce Vision of the electric future is more than just turbines for hybrid aircraft



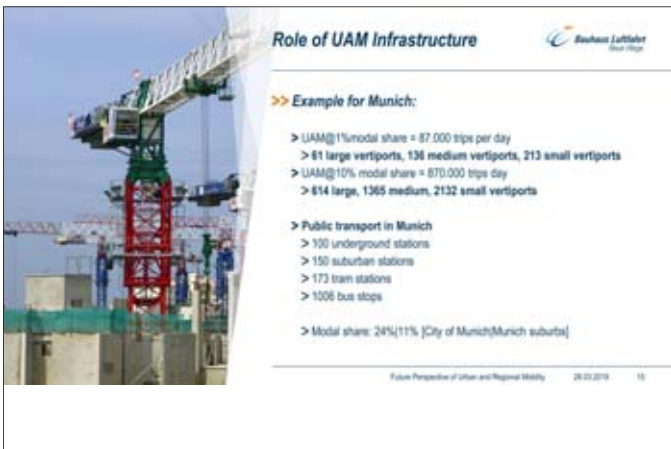
Protocol with a difference: A cartoonist draws the lectures on a large whiteboard.



The three organizers: Len Schuhmann, Johannes Garbino-Anton and Josef Kallo.



The BBAA from the Berlin metropol region develops different concepts for electrification.



Bauhaus Luftfahrt checked the option which scale Urban Airtaxis will really get.



The aircraft supplier Dhiel explained their motivation to get more and more involved.





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H3PS (acronym for “High Power High Scalability Aircraft Hybrid Powertrain”) is a project funded under the European Union Horizon 2020 research and innovation programme, Grant Agreement No. 769392.

GAMA (GENERAL AVIATION MANUFACTURERS ASSOCIATION)

GAMA EPIC

Electric Propulsion and Innovation Committee



A recent BluePaper by Morgan Stanley Research says On-Demand Air Mobility (ODAM) could create a \$1.5 trillion market by 2040. eAircraft are a critical component for the success of ODA. GAMA's Electric Propulsion and Innovation Committee (EPIC) has been working with global manufacturers and key regulators on policy, regulations and legislation over the last four years to support this anticipated new fleet. In 2015 when it formed, EPIC was comprised of 11 member companies from the U.S. and Europe. In only four years, the EPIC has expanded to over 75 members covering Asia, Europe, North and South America. The continued growth of participation attributes to the expansion of the solutions it has been able to develop as well as the opportunities to navigate new areas for integrating new technology.

BATTERIES

The EPIC's eVTOL and Electric Propulsion (ELC) Subcommittees have teamed up to explore alternate means to demonstrate equivalent levels of battery safety to the RTCA DO-311. While this key standard meets certain battery needs for the flight deck, it is not applicable for eAircraft propulsion batteries. This past March, industry gathered to discuss alternative ways to ensure battery safety and identify various testing methodologies to explore moving forward.

INFRASTRUCTURE

EPIC's newest Subcommittee on Infrastructure (INF) kicked off in January 2019. For civilians to maximize the benefits of ODA there needs to be a sufficient infrastructure in place to support it. Infrastructure in its truest definition will entail having sufficient landing sites (commonly referred to as vertiports). However, these landing sites will need to be designed and equipped to service both the aircraft as well as the passengers. INF's first priorities will be to address the safety of crew and passengers and the charging and maintenance of the aircraft.



Driving, flying and eVTOL: TF-X from Terrafugia.

Charging of the aircraft will need to consider the impact on the grid, the storage of energy including the speed at which aircraft can charge. Designing vertiports to safely accommodate the takeoff and landing, marshalling and maintenance of what is predicted to be hundreds of landings per day.

PATH FORWARD

Data communications is the most recent layer under EPIC's consideration. ODA will have certain operational characteristics that require ground-to-aircraft, aircraft-to-aircraft, aircraft-to-ATC and more. How and what information is shared needs to be determined not only for safety but also for customer (aka passenger) satisfaction. Setting forth the requirements for these communications from an options and security standpoint will also determine what equipment will be needed onboard and within the infrastructural support system.

The GAMA EPIC continues to work with authorities around the world on vehicle certification and operational requirements with a goal of maximized harmonization. A method for minimizing variances will be the usage of industry consensus standards developed by ASTM F44 and F39 committees.

If you would like to be a part of the GAMA EPIC, please contact Christine DeJong at GAMA (cdejong@gama.aero +1.202.393.1500). ✓

GAMA EPIC in Changsha

After several Meetings of the GAMA EPIC in Europe and US the electric arm united for the first time in China. To meet Chinese Manufacturers and to hear more of the opinion of the Chinese authorities from first hand.

On November 2 2018 general aviation manufactures association (GAMA) held the electric propulsion and innovation committee (EPIC) member meeting for the first time in China. The EPIC meeting was held in Changsha China one day before the e-flight-forum organized by Flying Pages GmbH and its Chinese partner Z-park General Aviation Innovation Alliance. GAMA President and CEO Pete Bunce and the vice President of Global Innovation and Policy Gregory Bowles attended the meeting along with over 40 participants representing over 20 GAMA global members from the US, Europe and China including Airbus, Rotax, Continental, AVIC, Joby Aviation, Lilium, Volocopter, Diamond Aircraft, Pipiestral, Terrafugia, and ICON Aircraft.

CAAC VERY INTERESTED

The deputy director in general Mr.Zhang Sen of the Airworthness Certification Department of the Chinese regulator CAAC attended the meeting with CAAC's policymaking think tank. As EASA just released eVTOL policy draft proposal days before the EPIC meeting, eVTOL rulemaking is naturally ranked high on the meet-



Mr.Zhang Sen deputy director Airworthness Certification of CAAC (left) discussing with GAMA President Pete Bunce.

ing agenda. GAMA executives and CAAC officials had extensive discussion with the industry about the certification policymaking prospect of electric aircraft especially eVTOL both in China and around the world. Mr. Zhang Sen made a detailed presentation of CAAC's certification workflow and stated that CAAC would set the regulatory framework for electric aircraft and eVTOL certification in the near future and would release a series of tentative rules expected in 2019. Carl Dietrich of Terrafugia showed the crash test video of the Transition hybrid-powered flying car. That was the first ever crash test of a flying car in order to meet the ground vehicle crash requirement. Airbus, Joby Aviation, Volocopter and Lilium also presented the latest development of their eVTOL projects. As the result of this first Chinese EPIC meeting was very positive both sides decided that it should be continued in the future



Great participation at the first GAMA EPIC meeting in Changsha (China) .

METRO HOP™ ESTOL



The initial design of Metro Hop extreme and electric short takeoff and landing airplane (ESTOL)

An alternative UAM solution

As eVTOL is the dominant subject of UAM, it may not be the only option for UAM solution. A start-up company called Metro Hop™ in California in the US has been developing an alternative type of fixed wing aircraft design for UAM application called ESTOL in which “E” stands for both extreme and electric.

Some background: The founder of the company and the designer of the aircraft Bruno Mombrinie is no stranger to electric flight and aviation innovation. When Bruno was a MIT student, he participated in the Chrysalis human powered airplane. He even flew the Chrysalis plane several times.

After graduating from MIT with a degree in mechanical engineering, he went on to found AVEC Scientific Design, a medical equipment manufacturing company. His passion for efficiency and human-powered vehicles drove him to design a very light bicycle crankset to help Lisa Vetterlein set the women’s human powered vehicle

land speed record of 107kph in 2005. Bruno has been a broad member of the long time non-profit organization “Comparative Aircraft Flight Efficiency” or CAFÉ Foundation for short to promote efficient aircraft designs. Bruno was the Event Manager for the NASA Green Flight Challenge Sponsored by Google in 2011, in which Pipistrel’s Taurus G4 electric airplane won the \$1.35million prize. Bruno founded Metro Hop company in 2018, but he has been thinking about the specific design for a long time. So when Mr. Mombrinie came up with a new airplane design, it’s worth listening. The following is the edited version of our conversation with Bruno.



Metro Hop ESTOL airplane on the ground. In this position the front landing gear is lowered for ground taxiing. The hub electric motor on the rear wheel provides propulsion on the ground.



Bruno Mombrinie is the founder of Metro Hop project. He is a veteran in the field of electric flight and aviation innovation.

eFlight Journal: First of all, could you explain what is Metro Hop™?

Bruno: Metro Hop™ is an electric, conventional fixed wing, all-weather aircraft designed to operate within the urban air mobility environment.

What are the projected specification and performance of the design?

Metro Hop would have two seats of totally 265kg payload. It would cruise at 400 kilometers per hour. Using current battery technology, it would have a 160 kilometer range, enough for inter-city hops as envisioned in UAM application. With the current battery technology, it will have 25 minutes cruise plus 20 minutes reserve energy. The flight would be very quiet against the normal urban background noise. It would use a unique, international patent pending landing gear system to make very short and smooth takeoffs and landings in 60 meters.

The landing gear system sounds innovative. Could you elaborate its design? How does it assist the extreme short takeoff?

The rear wheel has a hub motor to assist the takeoff roll. The main wheels in the front will rise to help set the airplane to takeoff angle of attack and will lower quickly after landing to ground taxiing attitude. The wings are also designed for STOL flight. So when all features combined together, this unique airplane could make takeoff and landing in very short distance to fit in the urban environment.

So the airplane could taxi on the ground by its hub motor instead of the propeller. Does it mean it is a “roadable airplane”?

No, the airplane is not designed to drive long distance on the ground. The motor is only for assisting the taxiing for quick passenger turnover.

Will the airplane use reversible propeller to shorten the landing roll?

No. The reversible propeller is too noisy for urban operation.

In order to reach the takeoff speed within 60 meters, the airplane must accelerate very fast. Would this cause a high G loading on passengers?

That’s a good question. We have already had this requirement in mind when designing the airplane. The answer is no. The fast acceleration at takeoff roll will not impose any large loading on passengers. The takeoff speed is 24 m/s and the airplane will reach 31 m/s at the

end of rotation within 60 meters. The takeoff roll will only last four or five seconds. The calculated acceleration at takeoff roll is only 1/3G per second maximum. In comparison, Fast elevators have 1/5G per second acceleration and roller coasters even have 2 and 1/3G acceleration. The racing car is even larger. So the airplane's fast takeoff roll is normal in acceleration G loading. All passengers should be able to withstand the acceleration comfortably because we must remember that this airplane is also intended for medical emergency transport in the city so the acceleration must be within tolerance of any person even patients.

What are the advantages of Metro Hop design compared with eVTOL?

Metro Hop has several clear advantages. First it's a fixed wing airplane with conventional takeoff and landing procedures instead of vertical takeoff and landing, which means to save a lot of electric energy which translates into longer flight distance and more efficiency. Second, it utilizes wheel-assisted takeoff roll for extreme short takeoff distance so that it is more quiet at takeoff and landing. Third, its powered wheel can drive directly and safely (without turning propeller) to loading area for very quick passenger turnover which is vital for profitable UAM operation for large number of passengers. We estimate the airplane could clear the runway in 10 seconds after landing. Two airplanes can come in and out end-to-end within 20 seconds if all goes smoothly. Fourth, the airplane uses time-proven conventional fixed wing airplane de-

sign features so the certification should be quicker than eVTOL aircraft. Fifth, the airplane's conventional design and high efficiency help keep the operational cost low. It could operate on \$39 fares and make itself a commonplace tool for any business, large or small. Sixth, since Metro Hop airplanes have wings, it could glide to land in the case of emergency. It has a 1:25 gliding ratio, high enough to make emergency landing possible. To make everyone feel safer, the airplane will also be equipped with whole airframe parachute system.

Where is Metro Hop going to fly out of? From rooftop strip or from the ground?

Metro Hop is designed to fly in and out of minimalist and efficient Skyport stations in city centers and other prime urban locations.

What's the current status of the design?

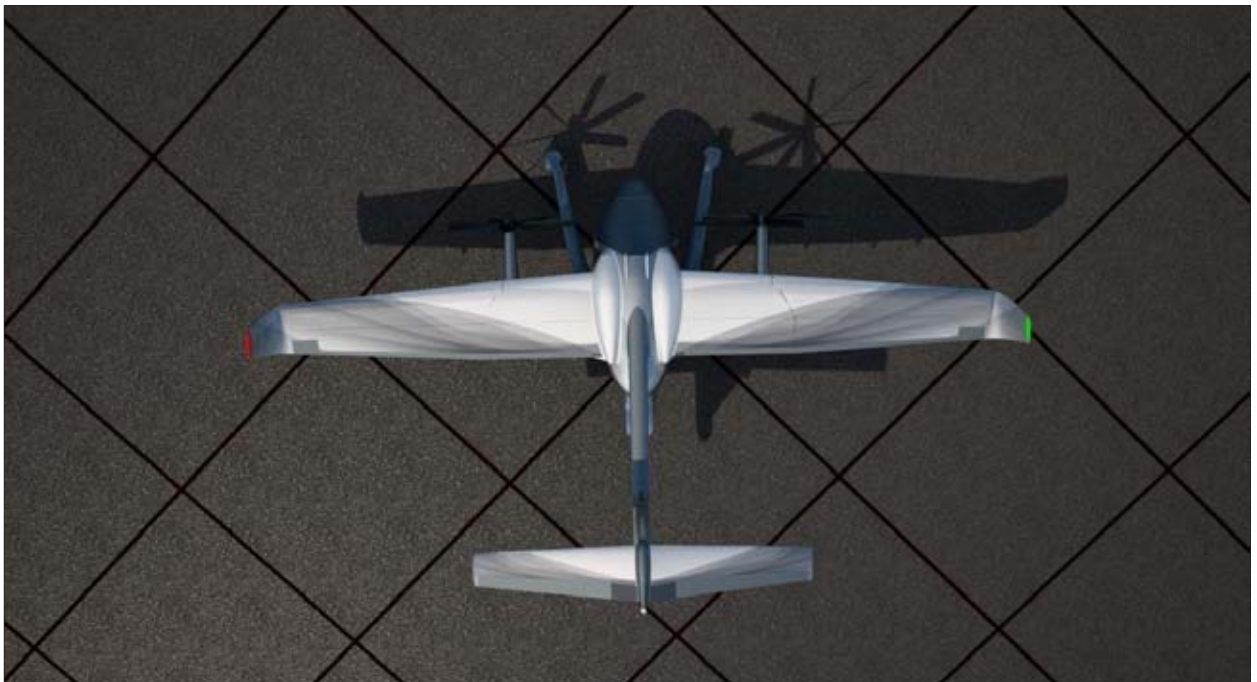
The overall design is half way done. The next step is to build two full size prototypes for test flight.

How soon do you expect to get the airplane certified?

Once the project is well funded, it's estimated to take 2.5 years to build the two demonstrator plane and then go for full certification. As mentioned earlier, Metro Hop uses mature technologies and techniques and follows a well-known flight envelope and a clear path to certification. ✓

<https://metrohop.aero>

Metro Hop ESTOL airplane top view. The airplane has efficient wing design for maximum flight duration powered by batteries and for gliding capability in the case of emergency.





一个联盟就是一个产业集群



Tim Archer, the Alliance's US representative and veteran general aviation expert, presented at the Alliance's forum in Beijing.



Host of the first Chinese electric aircraft forum with high participation.



The Alliance has set up booth at EAA Airventure for two consecutive years.



The Alliance's booth at Beijing Aviation Expo.



Mr. Jin Qiansheng, the Chairman of the Alliance, gave a speech at the Alliance forum

Z-Park Sky Innovations General Aviation Industrial Alliance is a nonprofit, non-government organization co-founded by numerous corporations and organizations representing the broad GA ecosystem in China including leading operators, research institutions as well as institutional investors. The Alliance is headquartered in Zhongguancun Science

hosting the first "China General Aviation Forum in Beijing", the 2017 China International General Aviation Innovation and Startup Competition, and planning and organizing the National Flying Car Design Competition together with Qinghua University General Aviation Technology Research Center.

Since the foundation, the Alliance has been active in membership services, coordination between commercial sector and relevant government agencies, and global cooperation, including setting up the Alliance booth at EAA Airventure for two consecutive years,

The Alliance is aggressively promoting the general aviation development in China through the integration of the industry and finance, aligning the unique strengths and values of individual members. The Alliance is also committed to support technological innovation and crossover development of technologies in Beijing as well as in over 200 industrial parks developed by Z-Park group. WWW.ZPARKGA.COM



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