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第十届国际电动航空论坛 -10th
e-flight-forum - 10 anniversary edition



Whisper AEROs EDF Swift
The quiet Revolution E-Propulsion?
Whisper Aero 电涵道 Swift 验证机
安静的电驱革命？

Oshkosh - 2026



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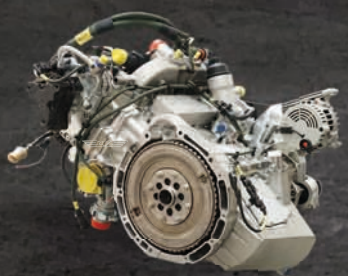
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威力·泰克（Willi Tacke）
《自由飞翔与通航》和《自由之翼》出版人之一，资深运动航空类爱好者，还出版有德文杂志 Flügel 和 WDFF 目录刊。拥有轻型运动飞机私照及教员证。



苟昕（Gou Xin）
固定翼私照飞行员，具有特技飞行资质和后三点式机型签注。喜爱休闲娱乐飞行，长期关注套材自制飞机、各类轻型飞机和特技飞机，对航空运动和私人飞行领域的发展有深刻认识。



贝提娜（Bettina Cosima Larrarte）
资深航空记者，Flügel 杂志创刊人之一，超过 27 年的航空杂志撰稿经验。1987 年至今取得私人飞行私照、悬挂滑翔机执照、滑翔伞执照。



马里奥·博瑞克（Marino Boric）
毕业于航空工程专业，持有 PPL 和 CPL/IFR 执照，曾是军机飞行员。非常热爱家庭自制超轻型飞机。是 Flügel 和 Vol Moteur 杂志的资深记者，喜欢驾驶飞机到处旅游。



罗比·贝尔（Robby Bayerl）
1992 年开始飞滑翔伞，接下来 10 年从事超轻型飞机飞行和教学。2002 年考取滑翔机执照，之后先后考取美国 LSA 执照、PPL 执照。德国 Flying Pages 公司特约记者，三轴类超轻型飞机试飞员。

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十年征程再出发

Restart at the 10th anniversary

今年 10 月，第十届由德国飞页公司发起并与中方合作伙伴联合主办的“国际电动航空论坛”(e-flight-forum）将在昆山举办。今年 10 月，也是优步 (Uber）公司发布那篇 eVTOL 和城市空中交通（UAM）白皮书十周年的日子。这两件事同时发生是时间上的巧合，也是行业发展的必然。这十年，是电动航空在国内外蓬勃发展的激荡十年。作为行业最重要活动之一的发起者和组织者，我们有幸参与并见证了这个行业的风云际会。

从 2017 年 4 月在慕尼黑的安联球场会议室里与中方代表团的一次思想碰撞，到 2017 年 11 月与中关村蓝创通航产业联盟合作在北京举办首届国际电动航空论坛。到本届，论坛已经连续举办十届，即使在疫情期间也克服重重困难没有间断，成为国内乃至全球最有影响力的行业活动之一。这十届论坛促进了中外行业交流。包括 EASA 官员、Joby 创始人、GAMA 主席、空客 UAM 代表等等一众行业有影响力的人物曾经到场，这个论坛是其中有些嘉宾首次也是唯一参加的在国内举办的活动。这十届论坛鼓舞了国内的行业发展。多家国内龙头企业的创始人是从参加论坛开始迈出创业步伐，有些创始人从首届开始连续每年参加。看到行业的发展和论坛的这些成绩，我们倍感欣慰，备受鼓舞，也备受鞭策。

十年，对于其他行业来说很长。论坛创立和优步白皮书发布时，电车新势力蔚小理都还刚成立，距离它仨中最早交付的蔚来的首批交付还有整整一年，华为和小米那时可能还压根没想过造车。spaceX 的猎鹰火箭的首次成功回收刚过去一年。现在如日中天的几家 AI 公司的创始人，当时还在工位打工或者读书。

十年，对于航空业来说很短。一个整机型号从设计到原型机试飞，再到适航审定，再到量产交付，十年是起步。2016 年，Joby、小鹰、Volocopter 等几家 eVTOL 先驱都已经成立六七年。时至今日，距离最早创立的 Joby 和小鹰成立已经十七年过去了，全球范围内只有亿航 EH216-S 一个载人 eVTOL 型号取得了型号合格证（TC）。十年间，这个行业人来人往，如同这个论坛。有的曾经如日中天的龙头企业，已经消失在发展的发展中。作为这个风口始作俑者的优步已经在 2020 年退出了这个赛道，而后发先至的低空经济正在蓬勃发展。

在我看来，十年，对于电动航空和 eVTOL 而言并不长，其实只是一个开始。这十年，只是它从个人爱好和科研研究起步，逐渐产业化的一个过程，其中的起伏，都是必然阶段，是从个人爱好者的畅想、到投资人的狂想，逐渐校正回归航空产品客观规律的一个过程罢了。优步发布的这份白皮书和掀起的这场风口，也许最大的意义和启发就是把硅谷的互联网产品思维和风投的资本运作带到了航空业，影响深远，必有回响。

下一个十年，调整整合也许会是行业的主题词。大浪淘沙，金子一定会出现。如果说过去十年是大开大合、荡气回肠，那么下一个十年可能就是细水长流，于无声处听惊雷。我们的这个论坛，将继续陪伴大家在这个充满梦想和情怀的行业奋斗。再次欢迎大家来到第十届国际电动航空论坛，我们下一个十年再会。

中文版主编

Xin Gou

苟昕



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《自由飞翔与通航》杂志是目前国内唯一一本专注于超轻机、轻型运动飞机、轻型直升机、自转旋翼机等运动航空器以及单发和双发轻型飞机的专业出版物，内容涵盖：

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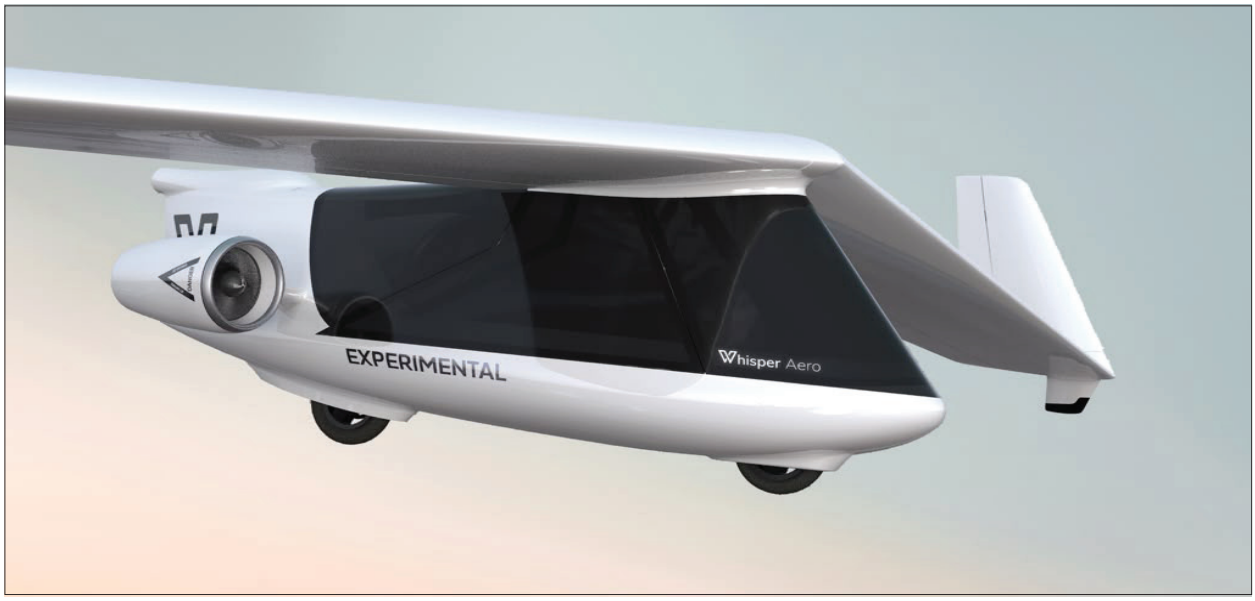
INTERVIEW: MARK MOORE
马克·摩尔：MARK MOORE

采用模块化设计的 19 座短途飞机

在 NASA 担任研究人员 32 年后，马克·摩尔（Mark Moore）出任 Uber Elevate 项目的技术总监。Uber Elevate 在运营四年后被电动垂直起降飞行器（eVTOL）制造商 Joby 收购，随后 Moore 创立了自己的初创公司 Whisper Aero。正如约翰·克里斯所说："名字已经说明了一切。" Whisper Aero 表示，公司正在开发超静音、高速且高效的电力推进技术。其核心是电动涵道风扇（EDF），这种涵道风扇具有一项独特特性：尺寸缩放时，推进性能基本不变。首批军用无人机型号正在试飞；采访刊载时，采用该涵道风扇的基于 Aeriane Swift 的有人驾驶超轻型动力滑翔机也已经首飞。Willi Tacke 就电动航空的历史与未来，以及 MOSAIC 新规的作用采访了 Mark Moore。

PLEASE FIND THE ENGLISH TEXT IN THE LAST EFLIGHT JOURNAL EDITION.

四十多年来，Mark Moore 一直追寻一个核心理念：电力推进能够改变航空器的飞行方式，并让飞行变得更加安静。从在 NASA 工作 32 年，到共同创立 Uber Elevate，再到如今领导 Whisper Aero，Moore 几乎参与了现代电动航空与先进空中交通（AAM）发展的每一个重要转折点。



首款搭载 Whisper EDF（涵道风扇）的载人飞行器是一款基于 Swift 3 飞翼的超轻型动力滑翔机，2026 年 8 月首飞。



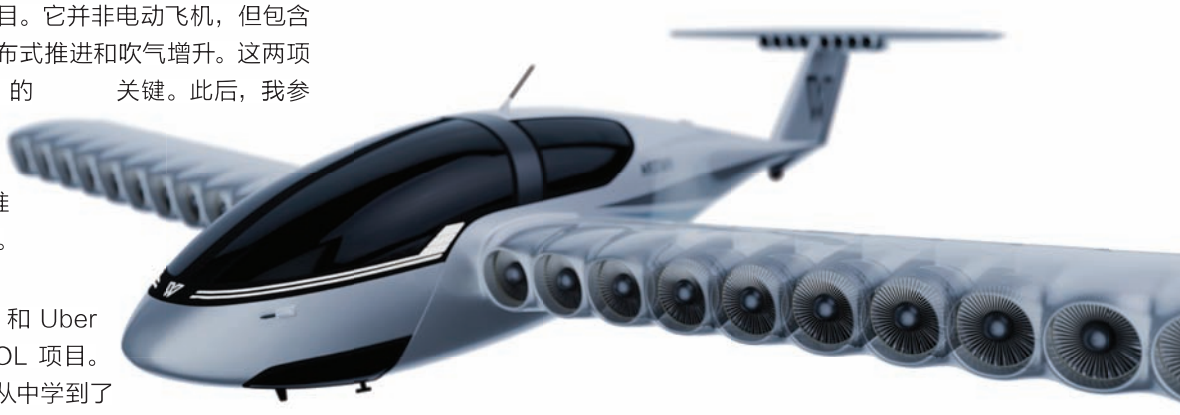
马克·摩尔职业生涯早期曾参与 NASA QSAR 项目的研发；这是一款 30 吨级的军用运输机，采用分布式推进系统，通过两台向机翼表面喷射气流的涡轮发动机产生“吹气升力”，从而实现短距起降。

Willi Tacke：在 NASA 工作 32 年多后，你转到 Uber Elevate；Uber Elevate 被 Joby 收购后，你又创办了 Whisper。你在 NASA 和 Uber Elevate 期间最重要的成果是什么? 你何时形成了 Whisper 的核心构想? 它究竟是什么?

Mark Moore : 在 NASA 期间，我参与过很多项目，其中包括 2010 年的 Puffin 单人尾座式 eVTOL 概念机、采用分布式推进的 GL-10 倾转机翼 eVTOL 无人机、采用分布式推进和吹气增升技术的全尺寸机翼，以及 X-57 Maxwell 电动飞机。X-57 以 Tecnam 2006 为基础，采用电池系统和分布式推进；我离开 NASA 后，该项目被 NASA 取消。在 Uber，重点是基于 eVTOL 技术界定空中出租车和配送无人机的市场。

Willi Tacke：你是什么时候想到 Whisper 这一构想的?

Mark Moore : 这个构想很大一部分可以追溯到 1982 年。当时我开始参与 QSRA 项目。它并非电动飞机，但包含另外两个重要组成部分：分布式推进和吹气增升。这两项技术后来都成为 Whisper 的关键。此后，我参与的工作无论以何种方式，几乎都与电力推进有关，也让我逐渐认识到分布式推进和吹气增升所带来的潜力。



Willi Tacke：你在 NASA 和 Uber 都参与过电动飞机与 eVTOL 项目。两者最大的区别是什么? 你从中学到了什么?

Mark Moore : NASA 是开展航空研究的优秀机构，甚至可以说是最好的机构；他们非常了解航空技术，但并不一



一项针对传统双发飞机的研究，该设计将涵道风扇（EDF）集成在机翼内，旨在提升飞机效率并显著降低噪音。



“低语”（Whispers）电驱技术的核心在于涵道风扇（EDF）。据 Moore 介绍，这种涵道风扇易于扩展，且不会造成显著的性能损耗。“其奥秘在于，众多叶片的叶尖通过一个圆环连接，因此不存在叶尖间隙，”Moore 解释道。



在 NASA 任职期间，摩尔（Moore）与 Joby 公司合作开发了一种采用分布式电推进系统的机翼，该机翼原计划用于替换 Tecnam 2006 飞机的机翼。

定知道如何针对特定市场开发产品。通过分析 Uber 数百万次出行数据，我们能够展示空中出租车的商业模式，吸引汽车企业、大型飞机制造商和风险投资机构投入大量资金。相关开发工作仍在继续。

Willi Tacke：Joby 接手 Uber Elevate 后，是他们不再需要你，还是你自己想离开?

Mark Moore：我与 Joby 创始人兼首席执行官 JoeBen Bevirt 保持着很好的关系，我们在我还在 NASA 工作时就已经合作过。但我希望创办自己的初创公司，围绕电动飞行和 eVTOL 的一项关键解决方案开展工作。

Willi Tacke：Whisper 的基本理念是什么? 它何时成为一个创业项目?

Mark Moore：我们在 Uber 做过多项大型研究，很清楚潜在客户并不喜欢大型、裸露的螺旋桨。在 Uber 工作的最后几年，我越来越确信，电动航空中许多问题的解决方案已经逐渐清晰。我对团队说：“你们知道，这样不对。采用开放式螺旋桨的 eVTOL 并不是未来的答案。”团队成员问我：“你说得这么肯定，那技术方案到底是什么?”我告诉他们一些线索，让他们自己推导。Ian Villa 是唯一把这些线索串联起来的人。他说：“我想我知道这项新技术是什么了。”我让他先不要告诉别人，并表示我们需要一起推进。Ian 是一位非常出色的合作伙伴和联合创始人，如今担任 Whisper Aero 的首席运营官（COO）。第一年里，我们验证了这个构想和技术确实可行，现在已经开始试飞。

Willi Tacke：Whisper 的技术秘诀是什么?

Mark Moore：我们并不打算成为机体制造商。Whisper Aero 开发的是超静音、高速、高效的电动涵道风扇（EDF），其独特之处在于具有尺寸缩放不变性。也就是说，无论风



分布式推进与吹气增升概念图；该方案也可能实现近乎垂直的着陆。

扇直径是 4 英寸还是 4 英尺，其推进效率和推重比都基本相同。这些 EDF 结构也非常简单：没有齿轮箱，不需要液体冷却，唯一的运动部件是电机轴承，因此十分简 单、坚固可靠。这样的特性使飞机能够采用高度分布式的推进系统，并将推进装置紧密集成到机翼内部。结果不仅是起飞性能出色，还能在高速巡航时保持较高效率；通过增加冗余、消除单一关键部件失效的风险，也能显著提升安全性。这种推进集成方式称为“上表面吹气”（Upper Surface Blowing）。它能够使机翼具有抗失速特性，并将起飞速度降至仅 20 节，起飞或着陆滑跑距离缩短至约 50 英尺。

Willi Tacke：此前也 有涵道风扇，为什么过去并未真正取得成功?

Mark Moore : 并不是没有成功。每一台客机涡扇发动机本质上都是涵道风扇，而且非常成功。但传统涵道风扇难以按比例缩放，排出的气流湍流也很强，因此不容易用于机翼吹气增升。此外，由于旋转速度很高，它们还会产生较大噪声。

Willi Tacke：这项技术申请了专利吗?

Mark Moore : 是的，我们拥有 120 多项专利。

Willi Tacke：你过去大部分时间从事民用航空项目，但 Whisper 的首批收入却来自军方。原因是什么? 未来会开展民用项目吗?

Mark Moore : 当然会。随着 MOSAIC 即将启动，现在正是合适的时机。我们最先与军方合作，是因为军方一旦看到某项技术有效或可能有效，就愿意采用并进行飞行测试。而在民用领域，尤其是商业运营，需要适航认证，这意味着开发需要投入大量资金和时间，因此航空业难以



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跟上技术变化的速度。MOSAIC 将改变这一状况。我们也因此与 ASTM 和 FAA 开展了大量合作。在这一机制下，制造商和其他利益相关方依据基本规则制定符合性方法，再由 FAA 进行评估。因此，我们首个有人驾驶民用项目计划在当年夏季首飞。

Willi Tacke : 这个项目是什么?

Mark Moore : 这是一款超静音飞翼式电动滑翔机，以比利时 Swift 3 为基础，由两台 Whisper EDF 提供动力。它是一个概念验证项目；我们也正在与多家电动飞机制造商洽谈合作。

Willi Tacke : 你们网站上还有一款产品——吹叶机。你们会把它推向市场吗?

Mark Moore : 如果你看过 LinkedIn，就会发现不少人曾嘲笑我们开发吹叶机。但这是一个经过深思熟虑的战略决定。先将这项技术用于商业产品，而不是先用于军用领域，可以避开许多出口限制和《国际武器贸易条例》（ITAR）的限制。因此，这不应被视为一种军用技术。我们也可能向美国以外的企业销售。

Willi Tacke : 最后一个问题：电动航空中，eVTOL（电动垂直起降）和 eCTOL（电动常规起降）哪一种会率先发展?

Mark Moore : 我相信我们的技术会在 eCTOL 领域取得成功。通过分布式推进、机翼集成和吹气增升，可以实现低噪声、极短起降距离，同时保持较高的能源效率，这对区域空中交通非常有利。静音、快速的电动通勤航空器拥有巨大的市场，尤其是在田纳西州农村地区这类服务不足的区域。



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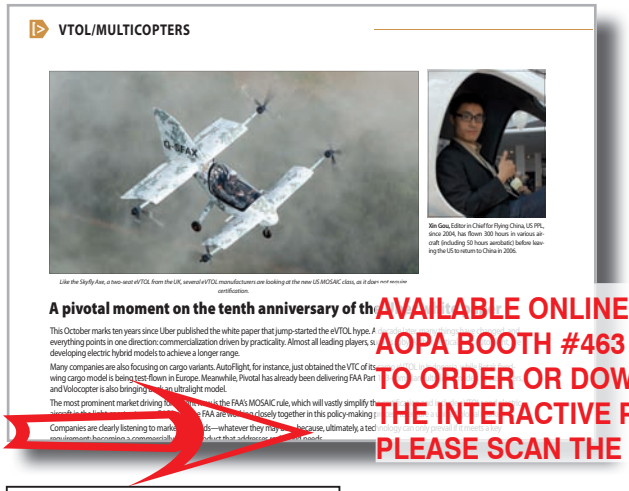
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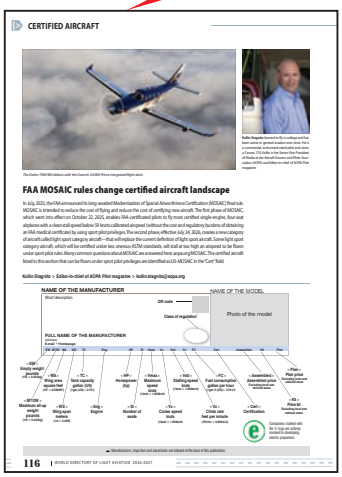


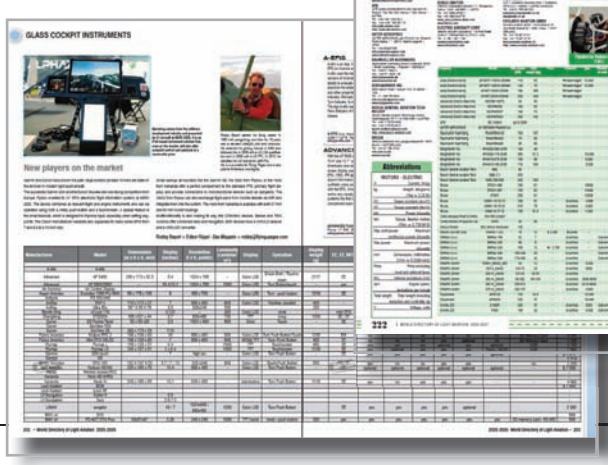
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10 years Uber Elevate (2016-2026)

When we wrote the Uber Elevate white paper in 2016, I had already been all-in on electric propulsion since 2006, when the Tesla Roadster inspired me that a new propulsion wave might be possible for aviation. While batteries still had poor specific energy, the characteristic of electric motors that excited me was scale independence, which doesn't exist with reciprocating or turbine engines. This ability of electric motors to maintain the same specific power and efficiency at any size enables distributed propulsion to finally make sense, which has never been true with other engine types. For 10 years, I had already been battling naysayers who couldn't get past the idea of battery weight ever making sense

With eVTOLs first emerging through my NASA Puffin concept and Joby's S2 concept, the initial path of using distributed electric propulsion to leapfrog helicopter inefficiencies, mechanical complexity, and low speeds was first established. But it took the Uber Elevate white paper to wrap a cohesive vision around the technologies, concepts, Urban Air Mobility concept of operations, and value proposition. Frankly, when we released this paper, I thought there was a good chance that I wouldn't have a job after six months. Fortunately, the reception was overwhelming, generating a combination of positive and negative energy that created a whirlwind of momentum in the aerospace community.



What Was Actually Accomplished with Uber Elevate (2026)

Uber Elevate gained great traction over the four years or so before COVID-19. We truly went from eVTOL being considered science fiction to having 10 developer partners turning it into science fact. The amazing thing was that Uber didn't provide any of them with funding; each was self-funded. The Uber team quickly grew to roughly 130 staff as we assisted with eVTOL design and built an incredible go-to-market simulation tool that ingested 15 billion Uber ground trips. This allowed us to understand travel patterns, willingness to pay, daily and seasonal variations, where vertiports could minimize ground distance between origins and destinations, and more. We built partnerships across cities, states, and countries that provided momentum for full transportation system needs. All this was possible because Uber was the 800-pound gorilla of on-demand mobility and has since proven itself capable of disruptively building a new scaled transportation flywheel—no matter how crazy it seemed as an initial idea.

We predicted certified eVTOLs by 2023, but we didn't foresee a two-year slowdown from COVID-19 and supply chain disruptions, nor the FAA changing the certification basis halfway through from Part 21.17(a) to 21.17(b) due to FAA Flight Standards not keeping pace with FAA Certification Services (which created a lot of chaos and extra work). Since Elevate was sold to Joby in 2020, there has been an operational vacuum in advancing the industry cohesively, transforming what used to be a fairly united effort into a fight among the handful of top eVTOL developers. Just like in the early automotive age, consolidation has begun as Lilium, OverAir, Volocopter, and Airbus have discontinued efforts. There will be much more consolidation as we approach the beginning of the eVTOL operational era—and many will not make it.

What Will Be Accomplished Over the Next Decade (2036)

Looking back over 20 years of being all-in on electric aircraft, I have two main disappointments. First, as in politics, most people have taken sides and lost their objectivity. As I've shared analysis of the eVTOL industry and its efforts, I've often critiqued what we're doing wrong (like adopting CCS charging instead of GEACS), while remaining a strong overall advocate for the industry (highlighting countries such as the UAE providing a forcing function for global regulators). There are good and bad things happening, but if you don't pick a side and stay in the middle, both sides disown you. Second, while I applaud this first generation of eVTOLs where leaders (Archer, Joby, and Wisk) are achieving amazing engineering breakthroughs, everyone must realize these are the Model T's of the electric age of flight. This first generation of aircraft has not accomplished a key objective that I laid out as a primary goal back in 2006: the removal of single-part criticality in VTOL aircraft to yield dramatically improved safety and lower operating costs. The intent of redundancy is to eliminate single-component criticality; however, eVTOLs still have many critical components, just like helicopters.

The thing I'm most excited about in the next decade is the eVTOL equivalent of SpaceX-style rocket simplification, where mechanical complexity and part criticality are removed through a combination of elegant system design, simplification, and new technologies (with no single-part criticality!). Joby and Vertical have already proven that a single component failure can result in a cascading failure. Tremendous breakthroughs are coming over the next decade across autonomy, batteries, hybrid turbogenerators, high-voltage bus management, motors and controllers, and even regulations (MOSAIC). But without the breakthrough of eliminating single-component criticality, we will not achieve the safety required to reach the Uber Elevate goal of scaled markets driven by the flywheel effect.

May the safest, quietest, and most cost-effective technologies prevail in this incredible new age of flying machines.

Mark Moore

CEO and Co-Founder of Whisper Aero. Prior to founding Whisper Aero, he served as Director of Aviation at Uber Elevate after spending over 30 years as an engineer and researcher at NASA, where his work on distributed electric propulsion helped lay the foundation for the modern eVTOL industry.

优步 Elevate 项目反思

2016 年我们撰写 Uber Elevate 白皮书时，我早在 2006 年就全身心投入到电推进技术中。当时，特斯拉的 Roadster 电动车让我意识到，航空领域或许会迎来一场新的推进方式浪潮。虽然电池的能量密度仍然很低，但真正让我兴奋的是电动机的特性——它不受尺寸限制，而内燃机或涡轮发动机则不具备这种特性。电动机能够在任何尺寸下都保持相同的功重比和转换效率，这使得分布式推进最终成为可能，而其他类型的发动机从未实现过这一点。十年来，我一直在与那些始终无法接受电池重量问题的反对者们就此争论不休。

随着我在 NASA 时的 Puffin 设计概念和 Joby 的 S2 设计概念的出现，电动垂直起降航空器（eVTOL）的雏形初现，利用分布式电推进技术克服直升机效率低下、机械结构复杂和速度慢等问题的路径也逐渐确立。但真正将技术、概念、城市空中交通运营模式和价值主张融会贯通的，是 Uber Elevate 白皮书的发布。坦白说，这份白皮书发布时，我曾担心自己六个月后可能就丢了饭碗。幸运的是，反响出乎意料地热烈，评论褒贬不一，但在航空航天界掀起了一股变革的浪潮。



Uber Elevate（2026）实际取得了哪些成果？

在新冠疫情爆发前的四年里，Uber Elevate 取得了巨大的发展。我们真正实现了从最初被视为科幻小说的 eVTOL 到拥有 10 家开发合作伙伴并将其变为现实的转变。更令人惊叹的是，Uber 并没有为任何合作伙伴提供资金，他们都是自筹资金。在我们协助进行 eVTOL 设计，并开发出一款强大的市场推广模拟工具（该工具模拟了 150 亿次 Uber 地面出行）的过程中，Uber 团队迅速发展到约 130 人。这让我们能够了解出行模式、支付意愿、每日和季节性变化，以及垂直起降场在哪些情况下能够最大限度地缩短起点和终点之间的地面距离等等。我们在城市、州和国家各个层级建立了合作关系，为满足整个交通系统的需求提供了动力。所有这一切都得益于 Uber 作为按需出行领域的巨头，并且已经证明自己有能力颠覆性地构建一个全新的、规模化的交通体系——无论最初的想法看起来多么疯狂。我们曾预测到 2023 年就能实现 eVTOL 认证，但却未曾预料到新冠疫情导致的两年经济放缓和供应链中断，也未曾预料到美国联邦航空管理局（FAA）会因为飞行标准未能跟上适航审定的步伐（这造成了诸多混乱和额外工作），而将认证标准从 21.17a 更改为 21.17b。自 2020 年 Elevate 被 Joby 收购以来，行业内一直缺乏能够统筹推动整个行业发展的运营商，曾经相对团结的努力也演变成少数几家龙头 eVTOL 开发商之间的竞争。正如汽车工业的早期阶段一样，随着 Lilium、OverAir、Volocopter 和空客等公司停止研发，行业整合已经出现。未来整合的趋势将会更加明显，因为我们才刚刚进入 eVTOL 运营时代——许多公司将无法生存下去。

未来十年（2036 年）将取得哪些成就？

回顾过去 20 年全身心投入电动飞行器领域，我主要有两点失望。首先，就像政治一样，大多数人都站队了，失去了客观性。在分享我对 eVTOL 行业及其相关努力的分析时，我经常批评我们做得不够好的地方（例如采用 CCS 充电口协议而非 GEACS），同时我仍然是该行业的坚定支持者（例如阿联酋等国家对全球监管机构起到的推动作用）。行业发展有好有坏，但如果你不选边站队，保持中立，就会被双方都抛弃。其次，虽然我赞赏第一代 eVTOL，尤其是 Archer、Joby 和 Wisk 等领军企业取得的惊人工程突破，但所有人都必须意识到，它们就像电动飞行时代的福特 T 型车。第一代 eVTOL 尚未实现我在 2006 年提出的一个关键目标——消除垂直起降飞行器中单部件关键性问题，从而显著提高安全性并降低运营成本。冗余设计的目的是消除单个部件的关键性，然而，就像直升机一样，eVTOL 仍然有很多关键部件。未来十年，我最期待的是 eVTOL 领域能像 SpaceX 火箭那样实现简化，通过巧妙的系统设计 / 简化和新技术（彻底消除单个部件的关键故障点！）来消除机械复杂性和部件关键性。Joby 和 Vertical 已经证明，单个部件的故障会导致连锁故障。未来十年，在自主飞行、电池、混合动力涡轮发电机、高压总线管理、电机 / 控制器，甚至法规（例如 MOSAIC）等领域都将取得巨大突破。但是，如果不能消除单个部件的关键故障点，我们就无法获得实现 Uber Elevate 目标所需的安全性，即通过飞轮效应扩大市场规模。愿最安全、最安静、最具成本效益的技术在这个飞行器新时代中占据主导地位。

Mark Moore

Whisper Aero 首席执行官兼联合创始人。在创立 Whisper Aero 之前，他曾担任 Uber Elevate 航空总监；在此之前，他在美国国家航空航天局（NASA）担任工程师和研究员长达 30 余年，其在分布式电动推进领域的研究工作为现代 eVTOL 行业奠定了基础。

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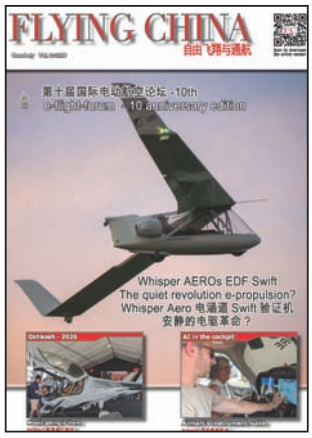
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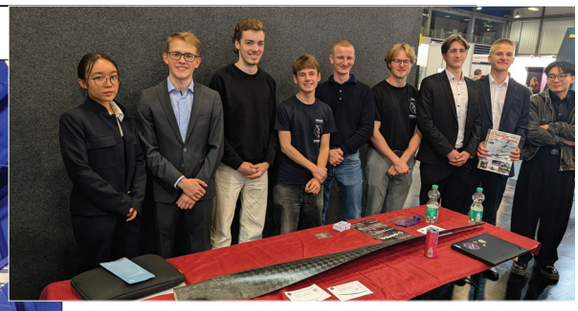
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www.flying-pages.com





The Odonata organisation has ambitious goals. with their their human powered aircraft (left) they want break the 1988 world record of Paul Mc Cready.

Odonata 组织制定了雄心勃勃的目标。他们希望其人力飞机（左图）能打破保罗·麦克克雷迪于 1988 年创下的世界纪录。

Airtec 2026 Augsburg

The Airtec a small Fair for Militryry and civil aviation supplies profited from the large investments of Germany and other EU Countries – Disappointing was that the numbers of eMobility and AAM Exhibitors is clearly going back. Exceptions was The Aviation battery startup V4smart a spin of of the Varta car battery company and Compact Dynamis a subsidiary of Schaefler one of the largest German car suppliers. They want to ofer Electric Motors and Hybrid drives for the AAM. The German Red Aircraft Engines did shoe their 12 Cylinder as a Hybrid solution with a Generator of the UK company Helix.

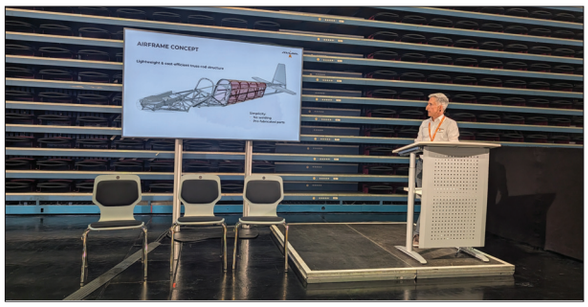
Airtec 是一场规模较小的军民航空产品展会，受益于德国及其他欧盟国家的大额投资——令人失望的是，电动出行（eMobility）和先进空中交通（AAM）展商的数量明显减少。例外的是航空电池初创企业 V4smart（瓦尔塔汽车电池公司的分拆公司）以及 Compact Dynamics（德国最大汽车供应商之一舍弗勒的子公司）。它们计划为 AAM 提供电动机和混合动力系统。德国 Red Aircraft Engines 公司则展示了其 12 缸发动机，该发动机作为混合动力解决方案，配备了英国 Helix 公司的发电机。



Compact Dynamis的电机项目雄心勃勃



Red Aircraft 的内燃发动机与 Helix 发电机



Martin Stierli from Milan Aircraft wants to develop a new 4 training aircraft with 2 hours endurance.
米兰飞机公司的马丁·施蒂尔利在研发一款续航2小时的新型四座教练机。



Mike Hirschberg (right) organized an exelent AAM conference at the Airtec 2026.
迈克·赫希伯格在Airtec 2026上组织了一场非常成功的AAM主题研讨会。



Software Upgrade for CubCrafters

CubCrafters is now offering a software upgrade for select models powered by the Rotax 916 iS. According to a press release from the US manufacturer, the revised FADEC software delivers faster acceleration on takeoff, improved climb performance, and higher cruise speeds. CubCrafters stated that the software was co-developed with RS Flight Systems and Polish STOL specialist and former Red Bull Air Race pilot Luke Czepiela. The modifications are achieved entirely through the engine control unit (ECU) software; according to the manufacturer, no physical changes to the engine or propeller are required. The company puts the price of the upgrade at around Euro 1,300. However, CubCrafters did not disclose specific figures in the release regarding the exact extent of the improvements to takeoff distance, climb rate, or cruise speed.
www.cubcrafters.com

CubCrafters 软件升级

CubCrafters 现已为部分选定的 Rotax 916 iS 机型提供软件升级服务。根据这家美国制造商发布的新闻稿，此次升级后的 FADEC 软件可带来多项改进，包括加速起飞速度更快、爬升性能更优以及巡航速度更高。据 CubCrafters 称，该软件系与波兰 STOL 领域专家、前 Red Bull Air Race 车手 Luke Czepiela 以及 RS Flight Systems 公司共同开发。相关调整仅通过发动机控制软件完成；制造商表示，无需对发动机或螺旋桨进行改动。该升级服务的费用据公司公布约为 1,300 欧元。不过，CubCrafters 在新闻稿中并未具体说明在起飞距离、爬升率及巡航速度方面的实际提升幅度。
www.cubcrafters.com

MTU and Airbus Plan Joint Venture

To develop and commercialize a fully electric hydrogen fuel cell propulsion system for aviation, Munich-based engine manufacturer MTU Aero Engines and European aerospace group Airbus have agreed to establish a joint venture dedicated to this objective. A memorandum of understanding to this effect had previously been signed at the Paris Air Show in June 2025. In a joint statement, both partners emphasized that the current agreement remains subject to regulatory approvals and the completion of a social partner dialogue at both European and national levels. Provided all outstanding matters are resolved, the new joint venture could launch as early as 2027.
www.mtu.de and www.airbus.com

MTU 与空客计划成立合资企业

为开发并推广适用于航空领域的全电氢燃料电池动力系统，总部位于慕尼黑的发动机制造商 MTU Aero Engines 与欧洲航空集团空中客车公司达成共识，共同成立一家以实现该目标为导向的合资企业。早在 2025 年 6 月，双方已在巴黎航展上签署了相应的原则性协议。然而，双方均在一份声明中强调，当前协议仍以获得相关政府审批以及在欧洲及国家层面开展社会伙伴关系对话为前提。若所有未决问题均已解决，这一新合资企业最早可在 2027 年启动运营。
www.mtu.de 及 www.airbus.com



Maiden Flight of the B-100C

The B-100C from Kaelin Aero—designed as a 600-kg ultralight and showcased as a world premiere at AERO 2026—has taken to the skies for the very first time. The successful maiden flight of the tandem-seater at Donaueschingen-Villingen Airfield in Baden-Württemberg lasted approximately 30 minutes. Among other things, the two-seat trainer is intended to set new standards in initial and recurrent pilot training. First deliveries of the all-metal low-wing aircraft are scheduled for next year. The B-100C is powered by a Rotax-based Edge-Performance engine producing 130 hp, which is designed to give the aircraft a top speed of 370 km/h (approx. 200 kts). www.kaelin.aero

B-100C 首飞

由来自奥伯恩多夫 – 阿姆内卡尔的 Kaelin Aero 公司研发的 B–100C 机型——其设计重量为 600 kg–UL——首次完成试飞，该机型此前已在 AERO 2026 航展上进行了全球首秀。这款双座教练机在巴登 – 符腾堡州的多瑙埃辛根 – 维林根机场完成了首次试飞，飞行时长约 30 分钟。这款双座教练机旨在为飞行员培训与进修制定新的标准。这款采用全金属结构的下单翼教练机首批交付预计将于明年启动 . B–100C 使用基于 Rotax 平台打造的 EdgePerformance 发动机，该发动机输出功率为 130 马力，该机可达到 370 km/h 的最大速度。网址：www.kaelin.aero

Investor Rescues Sonex Aircraft

As recently as March, it appeared that Sonex Aircraft, the American kit aircraft manufacturer, was about to disappear from the aviation scene. Sonex owner and president Maik Schaible had filed for bankruptcy and announced that business operations would cease. However, an investor has now emerged in the person of Darrel Osborne, who aims to revive the Oshkosh, Wisconsin-based company under the new name „Sonex Aviation“ with fresh capital and immense enthusiasm.

www.sonexaircraft.com

投资者挽救 Sonex Aircraft



就在今年三月，美国套材飞机制造商 Sonex Aircraft 似乎仍面临退出市场的风险。Sonex 的所有者兼总裁 Maik Schaible 曾申请破产，并宣布将停止商业运营。然而如今，Darrel Osborne 已成为新的投资者，他凭借新注入的资金与极大热情，致力于以全新名称 “Sonex Aviation” 重振这家总部位于威斯康星州奥什科什的企业。网址：www.sonexaircraft.com



Loganair Orders ALIA Air Taxis

Scottish regional airline Loganair has placed an order with American air taxi developer BETA Technologies for five electrically powered, conventional takeoff and landing ALIA-CX300 aircraft. In addition, Loganair plans to hold options for five further CX300s. Extensive real-world flight testing convinced Loganair decision-makers of the capabilities of the ALIA-CX300, which operates with conventional takeoff and landing (eCTOL) performance and is driven by an H500A electric motor. The aircraft features a payload capacity of 500 kg (1,100 lbs) and a range exceeding 600 km (approx. 325 NM). Loganair expects initial deliveries in 2029 and intends to deploy the CX300 for both cargo transport and passenger services. www.beta.team

Loganair 订购 ALIA-CX300 飞行出租车

苏格兰支线航空公司 Loganair 已向美国电动航空制造商 BETA Technologies 订购五架电力驱动、常规起降（CTOL）的 ALIA CX300 飞机。此外，Loganair 还计划为另外五架 CX300 机型申请采购选项。 Loganair 的相关负责人在真实环境条件下对 ALIA CX300 进行了全面测试，并对其留下了深刻印象——该机型采用常规起降模式，由 H500A 电动机驱动，载重能力为 500 公斤，航程超过 600 公里。Loganair 预计将于 2029 年接收该飞行设备，并计划将 CX300 用于航空货运及客运业务。 www.beta.team







Shark Defies Turbulence

The Austrian Aviation Authority (ACG) has granted approval for the integration of Turbulence Solutions' turbulence compensation technology into the Shark ultralight aircraft. With this certification, the Shark becomes the world's first and only aircraft equipped with this patented technology, which was designed to automatically stabilize aircraft when flying through turbulent air. The approval marks the culmination of several years of research, extensive flight testing, and close cooperation between the engineering teams at Turbulence Solutions and Slovakian UL manufacturer Shark Aero. www.shark.aero

湍流补偿技术在超轻机上应用

奥地利航空监管机构已批准将由 Turbulence Solutions 公司开发的湍流补偿技术集成至超轻型飞机 Shark 的认证申请。凭借此项认证，Shark 将成为全球首款且唯一搭载该专利技术的飞机。该技术旨在使飞机在穿越湍流气流时自动保持稳定。此次认证标志着历经多年研发工作、广泛飞行试验以及 Turbulence Solutions 与斯洛伐克 UL 飞机制造商 Shark Aero 之间紧密合作的最终成果。网址：www.shark.aero



首台 VL3 在火灾后交付

这场事故对该公司而言堪称重大打击——偏偏发生在 AERO 航展期间：在捷克维索克米托的总装车间发生火灾后，JMB Aircraft 公司现对此次事件作出了积极评估。所幸事故中无人受伤，但仍有数架飞机被火焰完全吞噬，另有若干架飞机因烟雾与灰烬而受损。由于四家生产基地中仅终装车间受灾，损失范围仍局限于局部区域。经过数周的修复工作，受影响区域现已重新投入运营。6 中旬，这一目标终于实现：火灾发生后首架完工的 VL3 飞机已成功交付至德国。为将客户面临的交付延迟降至最低，公司显著提升了生产速度。这一举措也有助于应对巨大的市场需求：尽管工厂传出不利消息，但在 AERO 展会上，公司仍从年初已售出的 18 台设备中，额外签署了 11 份对备受追捧的 VL3 机型采购合同。网址：www.jmbaircraft.com

Across the North Atlantic in a Carbon Cub UL

The first transatlantic crossing in a Carbon Cub UL powered by a Rotax 916 iS was recently completed by aircraft owner Zbigniew Dziubas and his pilot, Gabriel Batkiewicz. However, before heading across the “Big Pond,” the aircraft flew clear across the United States from west to east. The journey began in Idaho, where the Carbon Cub UL was handed over to its new owner. From there, the route led through Canada, Greenland, Iceland, the United Kingdom, the Netherlands, and the Czech Republic, finally ending in southern Poland. Over 94.5 flight hours, the aircraft covered approximately 6,900 nautical miles. To manage the longest overwater leg, the aircraft was fitted with an auxiliary tank holding an additional 95 liters of fuel, bringing the total fuel capacity to roughly 270 liters. This enabled a non-stop flight from Reykjavík, Iceland, to Wick, Scotland—the longest leg of the journey, covering nearly 700 nautical miles in just under seven hours while burning 158 liters of fuel. On average, the Rotax engine consumed around 22 liters per hour. www.cubcrafters.com



驾驶 CarbonCubUL 横跨北大西洋

由 Zbigniew Dziubas 拥有并由 Gabriel Batkiewicz 驾驶的这架 CarbonCubUL 飞机，现已成功完成首次横跨大西洋的飞行。但在跨越“浩瀚海域”之前，这架飞机曾先从西向东飞越美国。起飞地点位于爱达荷州——此处正是这架 CarbonCubUL 飞机交付给新主人的地方。随后，它依次飞越加拿大、格陵兰岛、冰岛、英国、荷兰及捷克，最终抵达波兰南部。在累计 94.5 飞行小时后，飞机在此期间航行了约 6,900 海里。为完成最长一段水上航段，该飞机配备了一个可额外容纳 95 升燃料的附加油箱，从而使总加油量达到约 270 升。由此，飞机得以从冰岛雷克雅未克直飞至苏格兰的维克。在最长航段中，飞机在近七小时内航行了近 700 海里，共消耗 158 升燃料。平均每小时航速约为 22 升。

www.cubcrafters.com



Yiduo Technology | Electric Propulsion Engineering

Yiduo Technology is a specialized engineering partner delivering end-to-end, integrated electric propulsion solutions for aerospace applications, including eVTOL aircraft and advanced UAVs. Our capabilities span electric motor design, inverter and motor control unit development, and transmission system engineering.

Key Capabilities:

Electric Machine Design

- Multiple Machine Topologies: Expertise in permanent-magnet synchronous machines (PMSMs), induction machines, and axial-flux machines.
- Multiphysics Simulation: Integrated electromagnetic, thermal, structural, and noise, vibration, and harshness (NVH) simulation and co-simulation.
- Multi-Objective Optimization: Simultaneous optimization of efficiency, power density, acoustic performance, and cost.
- Faster Development: Our proprietary AI-powered motor design agent reduces prototype iterations and shortens development cycles.

Contact: support@yiduo-tech.com

Arcline Acquires Continental

Founded in 1905, engine manufacturer Continental is—alongside Lycoming and Rotax—one of the „big three“ powerhouses in aviation piston engines. For 15 years, the company was part of China‘s AVIC group; now, with Arcline, a US-based investor is taking the helm once again. On June 8, private equity firm Arcline issued a press release announcing the acquisition of the aero-engine manufacturer‘s holding company in a transaction valued at $535 million. Continental is headquartered in Mobile, Alabama. The company is a leading designer and manufacturer of piston aircraft engines, as well as a provider of related aftermarket products and services for general aviation. Its portfolio includes both AvGas and Jet-A engines, which power a large global fleet of aircraft. Continental‘s jet-fuel engine division also ties it closely to Germany: this segment originated from the acquisition of Thielert Aircraft Engines GmbH, which was integrated into the company as Continental Aerospace Technologies GmbH. The facility in St. Egidien, Saxony, has been preserved; to this day, Continental diesels are developed and built there, alongside development services provided for the US parent company in Mobile.

www.continental.aero

Arcline 收购 Continental

成立于 1905 年的发动机制造商大陆公司（Continental），与 Lycoming 及 Rotax 并列为航空活塞发动机领域的三大领军企业。2010 年被中航工业收购，如今被美国投资者 Arcline 重新执掌。6 月 8 日，私募股权公司 Arcline 发布新闻稿，宣布收购这家航空发动机制造商的控股公司，交易金额达 5.35 亿美元。大陆公司总部位于美国阿拉巴马州莫比尔市，是航空活塞发动机研发与制造领域的领军企业，同时为通用航空领域提供相关售后市场产品及服务。其产品组合涵盖 AvGas 及 Jet-A 型发动机，这些发动机已广泛应用于全球众多飞机机型中。大陆集团在与德国市场的合作中，尤其在喷气燃料发动机领域建立了紧密联系：这一业务板块源于对 Thielert Aircraft Engines GmbH 的收购，后者以 Continental Aerospace Technologies GmbH 的名义并入大陆集团。该生产基地位于萨克森州的圣埃吉迪安（St. Egidien）工厂得以保留；至今，该工厂仍在为美国母公司开发并制造 Continental 柴油发动机，并提供相关研发服务。网址：www.continental.aero



Beringer USA Receives PMA Approval

French brake and wheel specialist Beringer Aero has received Parts Manufacturer Approval (PMA) from the Federal Aviation Administration (FAA) for its facility in Greenville, South Carolina. The FAA-PMA approval enables the company to manufacture approved replacement and modification parts for certified aircraft directly at its US location. With this certification in place, the Greenville team is better positioned to support Beringer Aero’s growing North American network, including original equipment manufacturers (OEMs) of certified and experimental aircraft, aircraft owners, homebuilders, and maintenance, repair, and overhaul (MRO) facilities. www.beringer-aero.com



Beringer USA 获得 PMA 批准

法国制动与轮式部件专业制造商 Beringer Aero 现已获得 FAA 对其位于南卡罗来纳州格林维尔市生产基地的零部件制造商认证（PMA）。该 FAA-PMA 认证使该公司能够在其美国本土直接生产经认证的航空器的合格替换件及改装件。凭借此项认证，格林维尔市的团队今后将具备更强能力，以支持 Beringer Aero 日益扩展的业务网络——该网络涵盖经认证及实验性航空器制造商、航空器所有者、自制航空器爱好者以及遍布北美的维修服务商。网址：www.beringer-aero.com





Archer Acquires Wisk Aero from Boeing

American eVTOL developer Archer Aviation has acquired three highly innovative companies—Wisk Aero, Insitu, and SkyGrid—from aviation giant Boeing. In return, Boeing takes a strategic equity stake in Archer. Archer expects the transaction to close by the end of the year. Having previously focused on the development of its “Midnight” piloted air taxi, the company is now pressing ahead with a newly initiated diversification strategy. By adding unmanned aerial systems (UAS), aviation-specific AI, and comprehensive autonomous flight technologies to its portfolio, Archer aims to expand its footprint in the currently booming defense sector. A notable side note: just five years ago, eVTOL rivals Archer and Wisk Aero were locked in a bitter patent dispute. Now, UAS specialist Wisk Aero belongs to its former adversary, Archer Aviation.
www.archer.com

Massive Job Cuts at H55

H55, the Swiss manufacturer of aviation energy storage systems, is laying off half of its workforce. Originally, as many as 80 of the company’s 110 employees were set to lose their jobs. However, this deep cut was mitigated following consultations with staff. Nevertheless, 54 employees in Switzerland will still be made redundant. The primary driver behind the massive downsizing is a necessary strategic realignment: contrary to H55’s initial expectations, aircraft manufacturers are increasingly turning to hybrid-electric propulsion systems, whereas H55 had previously focused primarily on high-performance, certifiable battery systems for fully electric aircraft.

www.h55.ch/en/

Archer 从波音公司收购 Wisk Aero

美国 eVTOL 开发商 Archer Aviation 已从航空巨头波音公司收购三家极具创新性的企业——Wisk Aero、Insitu 及 SkyGrid。作为交换，波音公司则获得对 Archer 的战略股权投资。

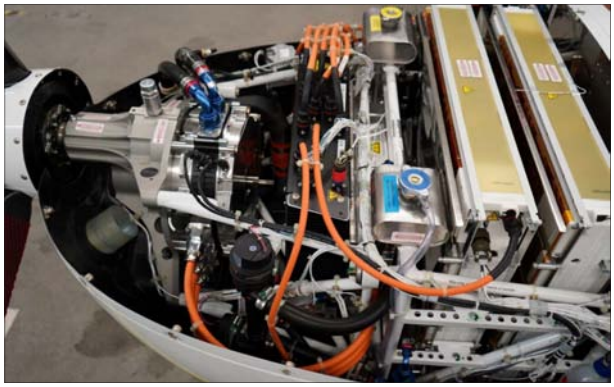
Archer 公司预计此次交易可在年底前完成。此前，该公司一直专注于其载人空中出租车“Midnight”的研发；如今，该公司将继续推进已启动的多元化战略，将其业务组合扩展至无人驾驶飞行系统（UAS）、专为航空领域开发的人工智能技术，以及完整的自主飞行技术体系，从而在当前蓬勃发展的军事领域加强布局。值得一提的是：就在五年前，eVTOL 领域的竞争对手 Archer 与 Wisk Aero 还曾陷入一场激烈的专利纠纷；而如今，这家 UAS 领域的专家 Wisk Aero 已归属于曾经的对手 Archer Aviation。

www.archer.com

H55 公司大规模裁员

瑞士航空储能系统制造商 H55 正在裁减其半数员工。最初，公司总共 110 名员工中有 80 人面临失业风险，但通过与员工充分沟通，这一裁员危机最终得以避免。尽管如此，仍有 54 名员工需从瑞士离职。此次大规模裁员源于公司必要的战略转型：此前，主机厂——与 H55 的预期相反——正日益转向采用混合电力驱动系统，而 H55 此前则主要专注于为纯电动飞机研发高性能且可通过认证的电池。

www.h55.ch/en



Wireless Charging for Electric Aircraft

All electrically powered aircraft share a common bottleneck: battery endurance. While wireless charging for smartphones is no longer a surprise to anyone, beaming power through the air to a moving aircraft undeniably presents a far greater technical challenge. Three years ago, researchers successfully used a laser to wirelessly charge a quadcopter drone, allowing it to remain airborne indefinitely. While that study proved the feasibility of the concept, the prototype suffered from significant limitations—particularly regarding energy efficiency.

Earlier this year, another research team took a major step toward practical application by optimizing the laser power transmission system. The scientists succeeded in overcoming several key hurdles, including long-range and high-altitude beam transmission, as well as precise tracking of a moving fixed-wing drone. Now, researchers at the Civil Aviation University of China (CAUC) have focused on one of the remaining weak points, significantly improving the efficiency of the onboard receiver: the receiver developed by the team converted nearly 40 percent of the incident laser energy into electricity—a remarkable result for this mode of power transfer. However, several obstacles must still be overcome before laser-based charging can be deployed in operational environments. It remains an exciting area to watch.
www.cauc.cn/en/

电动飞机的无线充电

所有电动航空器都有一个共同的短板：电池续航时间。尽管智能手机的无线充电已不再令人意外，但通过空气向飞行中的航空器传输能量，无疑是一项更为艰巨的技术挑战。早在三年前，研究人员就已成功利用激光对一架四旋翼无人机进行无线充电，使该无人机能够在空中无限期持续飞行。尽管这项研究证实了该概念的可行性，但其原型机在效率方面仍存在显著局限。今年年初，另一研究团队通过优化激光能量传输系统，在迈向实际应用方面迈出了重要一步。科学家们成功攻克了若干关键技术难题，其中包括将激光能量传输至远距离及高海拔环境，以及在运动中的刚性翼杆系统中实现精确跟踪。中国民用航空大学的科研团队近日聚焦于最后尚存的薄弱环节之一，显著提升了飞行器接收器的效率：其研发的接收器可将近 40% 的入射激光能量转化为电能——这一成果在该类能量传输技术中堪称亮眼表现。然而，要使基于激光的充电技术在实际应用中得以普及，仍需克服若干技术障碍。未来发展前景令人期待。

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EAA AIRVENTURE OSHKOSH 2026

文字: Willi Tacke; Photos: Flying Pages, EAA, AOPA, David Tulis, Emmanuel Davidson

OSHKOSH 2026

SMOKE, TORNADOS, MOSAIC AND A LOT OF NEWS

AirVenture 2026 was fortunate to land in a narrow window of clear skies. In the week before the show, smoke from wildfires in neighboring Canada made VFR approaches impossible on many days and, at times, even made breathing difficult. The Monday after the event brought severe thunderstorms to the region, with hailstones as large as baseballs, while a tornado destroyed several homes and cars in nearby Appleton. But between those extremes, Oshkosh enjoyed ideal, comfortably mild weather. From July 20 to 26, Wittman Regional Airport once again became the world capital of general aviation.

By near-unanimous acclaim, the United Kingdom's Red Arrows emerged as the standout airshow performers at AirVenture 2026.



烟雾、龙卷风、MOSAIC 新规和很多新闻

AirVenture 2026 航空展有幸在一段短暂的晴朗天气窗口期内顺利举行。展会前一周，邻近加拿大地区的野火产生的烟雾导致许多日子里无法进行目视进近，有时甚至令人呼吸困难。展会结束后的周一，该地区出现强雷暴天气，冰雹颗粒大如棒球，同时一场龙卷风摧毁了周边地区的数栋住宅及多辆汽车。但在这两个极端之间，奥什科什却享有理想且舒适的温和气候。从 7 月 20 日至 26 日，威彻曼区域机场再次成为了通用航空领域的世界之都。

凭借近乎一致的赞誉，英国“红箭”飞行表演队成为AIRVENTURE 2026 航空展上的瞩目亮点。



This year's AirVenture airshow theme was largely devoted to the 250th anniversary of American independence.

今年AIRVENTURE 航空展的主题主要聚焦于美国独立250 周年。

This year's AirVenture carried extra symbolic weight. As the United States prepared to mark 250 years of independence, Oshkosh drew a record 734,000 visitors and averaged 101 takeoffs and landings per hour throughout the week. Despite a tense global political climate, roughly 20,000 international visitors from 98 countries made the trip to Wisconsin. With more than 1,000 commercial exhibitors on site, the show once again underscored its role as one of the world's most important aviation marketplaces.

MOSAIC on the horizon

Yet the record numbers, anniversary celebrations and spectacular night airshow, impressive as they were, were not the true focus of this year's gathering. On the flight line, in the exhibition halls and throughout manufacturers' briefings, one word seemed to dominate nearly every conversation: MOSAIC, short for Modernization of Special Airworthiness Certificates. The initiative updates and expands the Light Sport Aircraft rules first introduced in 2004. Although the new regulatory package had been published last year, it officially took effect on July 24—right in the middle of the show—turning a long-awaited reform into a visible market reality.

The timing made clear how seriously the FAA regards Oshkosh. Senior agency officials repeatedly used the event to brief attendees on MOSAIC's rollout, and the U.S. secretary of transportation traveled to Wisconsin in person, as he did last year.

MOSAIC is a priority for the FAA

The current picture looks like this: after the core FAA rules took statutory effect last July, provisions governing sport pilot certificates, along with broader rules for operating and maintaining LSA aircraft, were published in October 2025. Then, on July 24, the framework was formally renamed and folded into the existing regulatory structure. What had previously been described within the LSA definition as



Andrew Pittman, CEO of South Africa's Sling Aircraft, with the company's first MOSAIC-ready airplane: the Sling Low Wing Whisper.

南非SLING AIRCRAFT 公司首席执行官安德鲁·皮特曼携该公司首款符合MOSAIC新规的飞机——SLING WHISPER 亮相。



在 TECNAM 全新旗舰单发活塞式飞机“RIVALE”的备受瞩目的亮相仪式上，仅展示了机身前部，以衬托驱动该飞机的 CONTINENTAL CD-300 航煤发动机。.

T今年的 AirVenture 展会承载着额外的象征意义。正值美国准备纪念独立 250 周年之际，奥什科什机场吸引了创纪录的 734,000 名访客，整周期间每小时平均起降架次达 101 次。尽管全球政治局势严峻，仍有来自 98 个国家的约 20,000 名国际访客到访威斯康星州。现场汇聚了逾 1,000 家商业参展商，此次展会再次彰显了其作为全球最重要的航空贸易市场之一的核心地位。

MOSAIC 法规深入推进

尽管创纪录的参展数量、周年庆典以及精彩的夜间空中表演令人印象深刻，但它们并非今年此次集会的真正焦点。在飞行线区、展览展厅以及制造商的简报会现场，几乎每场对话中都有一个关键词占据主导地位：即“MOSAIC”——这是“特殊适航证现代化改革”（Modernization of Special Airworthiness Certificates）的简称。这一倡议对 2004 年首次推出的轻型运动航空器法规进行了更新与扩展。尽管这套新监管方案已于去年公布，但它正式生效的日期却是 7 月 24 日——恰好在展会期间——将这项期待已久的改革转化为切实可见的市场成果。这一时机充分表明，美国联邦航空管理局（FAA）对奥什科什航空展的重视程度。该机构的高层官员多次借此次盛会向与会者介绍“MOSAIC”计划的实施进展，美国交通部长亦如去年一般亲自赴威斯康星州考察。



With the high wing Sonex also aims to the Mosaic aircraft class - sold ready to fly and it can be used for flight training.

凭借上单翼设计，SONEX 公司还致力于开发MOSAIC 机型——该机型可整机交付并可用于飞行训练。



No Aircraft at the eFlyer booth only the e-motor test vehicle the first conforming prototype is preparing for the maiden flight.

在 EFLYER 电动飞机展台现场并无飞机，仅有一辆电机测试车——首款符合标准的原型机——正在为首次试飞做准备。



The Jetson part103 UL-eVTOL flew at the UL -Area

JETSON PART103 UL-EVTOL 在UL 区域进行了飞行表演。



French gyroplane manufacturer DTA is now turning its attention to eVTOL development.

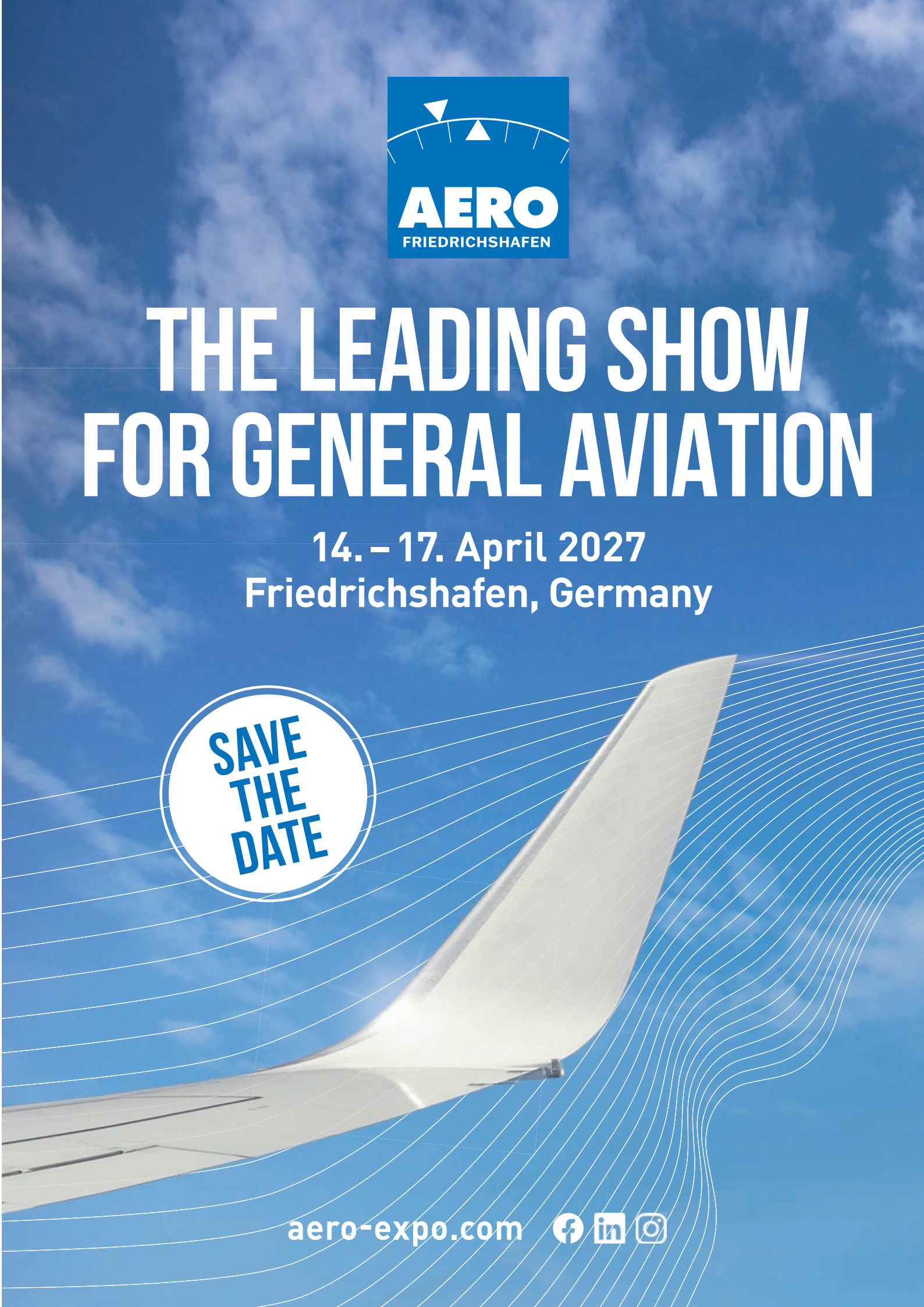
法国自转旋翼机制造商DTA 现已将注意力转向EVTOL 的研发。

"certification" is now administered under Part 22, specifically 14 CFR Part 22. This newly created rule set within MOSAIC defines the technical certification requirements for aircraft covered by the program. Still, the word "certification" should not be misunderstood. For MOSAIC-compliant aircraft, the FAA does not issue a type certificate after the sort of prior regulatory testing required under Part 23. Instead, the manufacturer must submit a Statement of Compliance confirming that the aircraft meets the applicable rules and Means of Compliance. If the FAA accepts that statement, it issues a certificate of airworthiness for the type. Before that happens, however, the agency inspects the manufacturer. For companies outside the United States, another condition applies: the manufacturer must be based in a country whose civil aviation authority has a bilateral agreement with the U.S., and the aircraft must also be legal to operate in its home country. For European manufacturers, one detail is especially important: where no equivalent domestic certification exists, EASA has agreed with the FAA to issue an expanded Permit to Fly.

U.K.-based Skyfly arrived with a new prototype featuring updated engines.

总部位于英国的SKYFLY 公司携一款配备了升级电机的全新原型机亮相。




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EVTOL物流无人机也在UL 区域运行。

Unmaned eVTOL were also operating at the UL-Area.

EASA intends to follow suit

Over the long term, EASA intends to create its own MOSAIC framework in the interest of reducing bureaucracy and harmonizing rules. The European system, including its certification provisions, is expected to hew as closely as possible to the U.S. model. That is why the American framework deserves close attention: its implications could reshape private aviation well beyond the United States.
For readers who want to dig deeper, we recorded the FAA experts' AirVenture briefing and posted it on our YouTube channel, Flying Willi.

At its core, MOSAIC removes the 1,320-pound limit—about 600 kilograms—that defined Light Sport Aircraft for two decades and replaces it with a more practical, performance-based framework. Under the new rules, aircraft may be heavier, faster and more technically sophisticated. Maximum weight is now tied to minimum speed. For LSAs that can still be flown with a Sport Pilot Certificate, the maximum stall speed is 59 knots with flaps retracted. A second stall-speed threshold, 61 knots in landing configuration with flaps extended, applies to aircraft that require a private pilot certificate. In other words, not every LSA can automatically be flown by a sport pilot. Fixed-wing aircraft may now have up to four seats, retractable landing gear and



Women power at AutoGyro: Aleksandra Witkowska, the German manufacturer's head of marketing, with Terry Rose, president of AutoGyro's distributor in the USA.

南非SLING AIRCRAFT 公司首席执行官安德鲁·皮特曼携该公司首款符合MOSAIC新规的飞机——SLING WHISPER亮相。



Israeli manufacturer AirEV, long active in unmanned drones, used Oshkosh to unveil a larger conforming prototype of its first MOSAIC eVTOL.

以色列制造商AIREV 长期深耕EVTOL领域，在航展上展示了其首款MOSAIC类别EVTOL 的更大尺寸合规原型机。

MOSAIC 新规是 FAA 的重点优先事项。

当前情况如下：自去年 7 月核心 FAA 法规正式生效以来，关于运动飞行员执照的规定，以及关于操作和维护 LSA 飞机的更广泛规则，已于 2025 年 10 月公布。随后，在 7 月 24 日，整个体系重新命名，以便纳入现有法规体系。此前 LSA 定义中使用的“审定”（Certification），现在改为按照 Part 22 进行“审定”，准确名称为“14 CFR Part 22”。这是 MOSAIC 计划中新设立的一套法规条款，重新定义了适用于 MOSAIC 飞机的技术适航要求。

然而，“认证”一词仍不应被误解。对于符合“MOSAIC”标准的飞机，FAA 在完成第 23 部分规定的相关监管测试后，不会颁发型号合格证。相反，制造商必须提交一份符合声明，确认该飞机符合适用法规及符合方式。若 FAA 接受该声明，则将为该型号颁发适航证书。但在颁发证书之前，该机构会对制造商进行审查。对于非美国境内的制造商，则需满足另一条件：制造商所在国民航当局须与美国签订双边协议，且该飞机在其本国境内合法运营。对于欧洲制造商而言，有一项细节尤为重要：在缺乏等效国内认证的情况下，EASA 已与 FAA 达成协议，颁发扩展版飞行许可。



The single-seater VeloX from U.S. has been flying for a year.

来自美国的单座EVTOL VELOX 已投入运营一年。



Korean company V-Space is bringing its eVTOL to the U.S. market.

韩国公司V-SPACE 正将其超轻型EVTOL推向美国市场。

MagniX CTO Ben Loxton outlined the electric-drive manufacturer's latest product, MagniAir, an air-cooled 175-kW electric motor rated at 130 kW for both peak and continuous power. The motor is expected to power the first Van's RV-10s and reach the sky no later than early 2027.

MAGNIX 首席技术官BEN LOXTON 介绍了这家电驱制造商的最新产品MAGNIAIR——一款风冷式175 KW电动机，其峰值功率与持续功率额定值均为130 KW。该电机预计将为VAN‘S RV-10套材飞机提供动力，并最迟于2027 年初首飞。.



At the Rotax booth, a lineup of potential MOSAIC light-sport aircraft was on display, including this Scalewings Mustang.

在ROTAX 展台，展出了一系列潜在的MOSAIC轻型运动飞机，包括这款SCALEWINGS MUSTANG复制飞机。



Lightspeed CEO Heider Lazzarini, left, and Rotax aircraft engines director Marc Becker collaborated on a distinctive Rotax sound signature for the Delta Zulu ANR headset.

LIGHTSPEED 首席执行官HEIDER LAZZARINI（左）与ROTAX 航发总监MARC BECKER 共同为DELTA ZULU ANR 耳机打造了一套独特的ROTAX 声 音特征。



Several years after completing certification in China(a sister model is marketed as the Avic AG100 by Cirrus's Chinese parent company)., Cirrus has launched the aircraft once known as the SR10 as the TRAC 10, a new trainer priced at nearly half a million dollars and powered by a Rotax 916 iS engine.

在 CAAC 完成认证数年后（其姊妹机型由 CIRRUS 的母公司以 AVIC AG100 销售），CIRRUS 推出了曾被称为 SR10、现以 TRAC 10 命名的教练机，该机型定价近 50 万美元，搭载 ROTAX 916 IS 发动机。

EASA 拟效仿此举。

从长远来看，EASA 旨在建立自己的综合框架（例如推行类似 Part 21 Light 的简化认证架构），以简化官僚程序并统一法规。欧洲体系，包括其认证条款，预计将尽可能贴近美国模式。正因如此，美国的框架值得密切关注：其影响可能重塑美国境外私人航空业的格局。 对于希望深入了解的读者，我们录制了 FAA 专家的采访，将其发布在我们的 YouTube 频道“Flying Willi”上。

从根本上说，“MOSAIC”规则取消了过去二十年来对轻型运动飞机设定的 1,320 磅（约 600 公斤）重量限制，取而代之的是一个更实用、以性能为导向的框架。根据新规则，飞机可以变得更重、更快，并且在技术上更为先进。最大重量现在与最低速度挂钩。对于仍可使用运动飞行员执照飞行的轻型运动飞机，其最大失速速度为 59 节（收襟翼时）。对于需要私人飞行员执照的飞机，则适用第二个失速速度阈值——在着陆配置且伸出襟翼时，最大失速速度为 61 节。换言之，并非所有 LSA 飞机都能由运动飞行员 directly 驾驶。固定翼飞机现在最多可配备四个座位、可收放起落架以及可变螺距螺旋桨。电动和涡轮推进系统可与活塞发动机并存。运动飞行员特权也有所扩展，包括经过额外培训后可进行夜间飞行，但搭载四人仍需要私人飞行员执照。体检要求基本保持不变。对于日间 VFR 飞行，有效的驾驶执照仍可替代体检证明；而夜间飞行则要求持有 BasicMed 或 FAA 三级体检证明。



The Cubcrafter ULT is now also powered by the Turbotech turbine and a French Duc propeller.

CUBCRAFTER ULT 现已同样搭载 TURBOTECH 涡轮发动机及法国 DUC 螺旋桨

variable-pitch propellers. Electric and turbine propulsion systems are permitted alongside piston engines. Sport pilot privileges have also expanded, including the possibility of night flying with additional training, though carrying four people still requires a private pilot certificate.

The medical requirements remain largely unchanged. For daytime VFR flights, a valid driver's license still stands in for a medical certificate, while night flights require either BasicMed or an FAA third-class medical.

When the new rules took effect, not every aircraft category theoretically eligible under Part 22 was immediately covered. For now, certification is available only for fixed-wing aircraft, gliders, powered paragliders and eVTOLs that generate the necessary lift with wings and propellers. Other categories still require additional Means of Compliance to be accepted by the FAA. The process remains ongoing and will continue to be negotiated in the months ahead between the FAA and ASTM, the standards organization formally known as the American Society for Testing and Materials.

LSA certification now Part 22

The practical implication is unmistakable: a new generation of aircraft is poised to enter the market with performance characteristics that previously sat well outside the light-aircraft category. That prospect poses an uncomfortable question for manufacturers whose established airframes have long relied on proven but, in some cases, aging designs—especially given the time and expense associated with developing newly certified aircraft under more burdensome rules. How much of the old order can survive when buyers are offered more performance, greater flexibility and modern systems such as advanced avionics or fly-by-wire remains to be seen.

Against that backdrop, it was no surprise that a slate of manufacturers showcased MOSAIC aircraft at Oshkosh. Fixed-wing models dominated the field, illustrating the breadth of what the new rules now allow. Kit-market leader Van's Aircraft was out in front, having already completed the Statement of Compliance paperwork and the FAA inspection. As a result, a Van's RV-12—the first MOSAIC-compliant aircraft to receive an FAA certificate of airworthiness—was delivered to a customer while AirVenture was still underway.

More new developments

ICON introduced ICON Sense, a safety system designed to prevent pilot errors when extending or retracting the landing gear on its A5 amphibian. The company, now under new ownership, is preparing for a planned restart of production in 2027.

Australia's Jabiru displayed its MOSAIC-compliant Twin J432, a four-seat aircraft powered by two Jabiru engines.

South Africa's Sling Aircraft has converted its entire kit-aircraft lineup to MOSAIC. In addition to the low-wing Sling TSi, the high-wing Sling HW is offered in both two-seat and four-seat MOSAIC versions.

U.S. manufacturer Vashon Aircraft presented the Ranger Grand Teton, a rugged model aimed at off-airport operations. It features flat-folding sleeper seats and was offered at a starting price of $241,000.

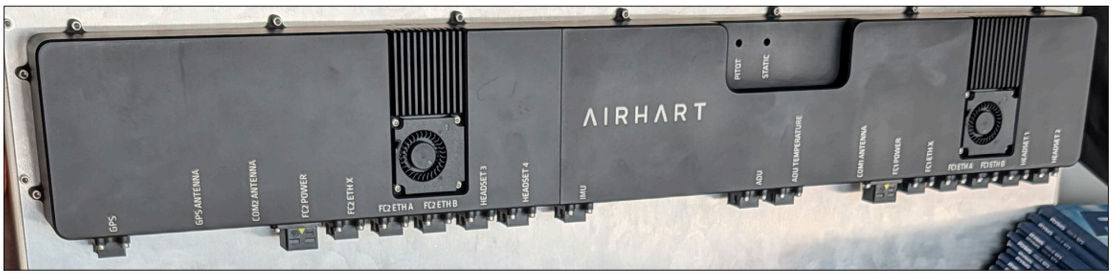
Among new accessories, Garmin's Axis Display stood out, appearing in a range of aircraft at launch.

Flight instruments with Nvidia p

German newcomer Alphafrog/Exentra showed its Nvidia-based instrument system in the Skyfly Axe eVTOL, while Airhart, another new avionics player, made its first major public appearance at Oshkosh. The Silicon Valley startup is developing an instru-



TL ULTRALIGHT 的 SIRIUS 机型于捷克制造，现已推出搭载 ROTAX 916 发动机的版本——该动力装置可提供卓越的起飞性能，尤其对于野外起降而言更为突出。



新法规生效后，并非所有根据第 22 部规定在理论上符合资质的飞机类别都能立即纳入该类别。目前，认证仅适用于采用机翼与螺旋桨产生必要升力的固定翼飞机、滑翔机、动力滑翔机及电动垂直起降飞行器（eVTOL）。其他类别仍需通过额外的合规途径方可获得美国联邦航空管理局（FAA）的认可。其他类别仍需 FAA 接受更多 MOC（Means of Compliance，认可的符合性验证方法）。整个过程仍在持续推进，未来几个月 FAA 与标准制定机构 ASTM（American Society for Testing and Materials，美国材料与试验协会）将继续协商。

LSA 认证现已纳入第 22 部

其实际意义已显而易见：新一代飞机即将进入市场，其性能特征此前完全不属于轻型飞机范畴。这一前景为制造商提出了一个棘手的问题——这些制造商长期采用的机型一直依赖于经过验证但已在某些情况下趋于过时的设计，尤其是考虑到按照更为严苛的法规开发新认证飞机所需投入的时间与成本。当买家能够获得更高性能、更大灵活性以及先进航电系统或电传操纵系统等现代化配置时，旧有格局能在多大程度上得以延续，仍有待观察。

在此背景下，多家制造商在奥什科什展会上展示符合 MOSAIC 标准的飞机，这并不令人意外。固定翼机型在展区内占据主导地位，充分展现了新规所允许的多样化机型范围。套件市场领导者 Van’s Aircraft 已率先完成符合性声明文件准备及 FAA 检验工作，因而其推出的 Van’s RV-12——首款符合 MOSAIC 标准并获得 FAA 适航证的飞机——在 AirVenture 航展期间成功交付给客户。

更多产品新闻

ICON 公司推出了 ICON Sense 安全系统，该系统旨在防止其 A5 水陆两栖飞机收放起落架时发生人为操作失误。ICON 正在新股东的领导下，按计划为 2027 年重启生产做准备。

澳大利亚的 Jabiru 公司推出了符合 MOSAIC 标准的 Twin J432 机型——一款由两台 Jabiru 发动机驱动的四座飞机。

南非的 Sling Aircraft 公司已将其全部套件式飞机产品线全面转换为 MOSAIC 标准。除下单翼型 Sling

(翻至第33页继续)



AIRHART 是硅谷一家新兴航空电子初创公司，由总裁 NATE THULI 领导——图中她正与公司的首位客户 LINDAR SOLARS 一同坐在驾驶舱内。她的 SLING HW 916IS 机型已在安装该系统后累计飞行数千公里。该硬件完全由公司内部研发，以两台冗余的 NVIDIA 计算机为核心构建（如插图所示）。下一步计划是将该飞机改造为采用 AIRHART 自主研发的伺服驱动器的线控飞行系统。



The “Smart Ass Fuel Mule” is an electric-powered fuel cart capable of carrying up to 250 liters of avgas, mogas or Jet A.

“SMART ASS FUEL MULE”是一款电动的燃油运输车，可装载最多 250 升航空汽油、柴油或 JET A 燃料。



The FAA put MOSAIC front and center, using several sessions to walk manufacturers and pilots through the new rule, its implications, and the key distinctions between what a MOSAIC light-sport aircraft may do and what license a pilot will need to fly it.

美国联邦航空管理局（FAA）将“MOSAIC”新规置于核心位置，通过多场专题讲解会，向制造商及飞行员系统介绍这项新规、其 具体影响，以及“MOSAIC”轻型运动飞机可执行的操作范围与飞行员驾驶此类飞机所需持有的执照之间的关键区别。



Australia’s Jabiru 432 is a MOSAIC-compatible, four-seat twin powered by a pair of engines built in-house.

澳大利亚的JABIRU 432 是一款符合MOSAIC新规的四座双发机型，配 备两台自主研发的发动机。



In a historic milestone at Oshkosh, the first RV-12 certified under MOSAIC regulations was formally delivered to its new owner.

在奥什科什举行的一场历史性里程碑活动中，首台根据MOSAIC法 规认证的RV-12 轻型运动 飞机 正式交付给机主。

ment suite built around two large, in-house touch displays that also use Nvidia processors and are intended to make flying safer through AI-supported functions. One early feature, also offered by Exentra, is voice recognition that transcribes radio calls from air traffic control and displays them on screen for the pilot.

France’s Turbotech has secured additional customers for its TP-R90 turbine. In addition to the certified Elixir, the engine is slated for use in CubCrafters’ Carbon Cub UL and in a Sling aircraft.

Beringer Aero received FAA approval for its South Carolina subsidiary, while DUC Hélices continues to supply propellers for several MOSAIC-linked programs.

Hartzell, which plans to increase its focus on propellers outside Part 23 certification, was joined by German competitor Helix, which exhibited its ARC propeller on several aircraft.

As in previous years, there was little new to report in the trike and powered-paraglider segments, where Air Creation and Evolution Trikes face little real competition.

MOSAIC helicopters, meanwhile, remain stuck on the runway because the Means of Compliance for Simplified Vehicle Operations have not yet been drafted or approved by the FAA.

It will also take time for eVTOLs in the new class to get airborne, although manufacturers around the world are placing considerable hopes in the category.

Israel’s AirEV appears to be the furthest along, followed by the U.K.’s Skyfly. Both companies showed new aircraft prototypes, though neither had flown yet. A Jetson One, meanwhile, flew at the ultralight site during the Twilight Flight Show, and several Chinese manufacturers displayed copies of Italy’s

(continue page 34)

2026 国际电动航空（昆山）论坛议程

e-Flight-Forum Program

10月30日				
8:30-9:05	开幕式 opening ceremony	中方主持人：高远洋 北京航空航天大学通用航空产业研究中心主任 国际航空航天协会协调理事会AAM咨询组委员 Chinese host: Gao Yuanyang, Director of General Aviation Industry Research Center, Beijing University of Aeronautics and Astronautics; Member of the AAM Advisory Group of the IAA Coordination Council 外方主持人：Willi Tacke 德国飞页公司总裁 Foreign host: Willi Tacke, CEO, Flying Pages GmbH		
时间 time	环节 item	发言人 speaker	职务 job title	
8:30-8:35	致辞 welcome speech		昆山市人民政府	
8:35-8:40		陶智 Tao Zhi	中国科学院院士、中国航空学会电动航空分会主任委员 Academician of The Chinese Academy of Sciences,director of the Electric Aviation committee, Chinese Society of Aeronautics and Astronautics	
8:40-8:45		陈暘	中国航空学会秘书长	
8:45-8:50		孙卫国	原国家空管委办公室副局长	
8.50-8:56		Willi Tacke	德国飞页公司总裁 CEO, Flying Pages GmbH	
30.10.2026				
议题一：低空经济、人工智能政策制订与FAA轻型运动类新规 Low Altitude Economy, AI policymaking and the MOSAIC rule of FAA				
主持人 host：Willi Tacke				
上午 Morning				
9:10-9:25	慕尼黑工业大学 TUM	教授 Professor	Florian Holzapfel	欧洲AAM与低空经济现状与管理挑战 AAM/LAE in Europe and regulatory challenges
9:27-9:42	中国民航大学 Civil Aviation University of China	教授	王岩韬	《低空航行体系安全概念体系与技术方案》 Safety Concept System and Technical Solution for Low-Altitude Navigation
09:44-09:59	美国材料与试验协会（ASTM）	F37委员会主席 F37 Committee,Chairperson	Linda Sollars	MOSAIC类别航空器的符合性方法与运行规则 definition of MOCs and operational rules for MOSAIC class aircraft
10:01-10:16	中国航空学会适航分会中国民航科学技术研究院航空器适航研究所无人机审定室 CSAA	主任	郝志鹏	eVTOL审定方法与实践 eVTOL Certification Methods and Practices
10:18-10:33	美国Pivotal公司	产品总监 head of product	Greg Kerr（线上）	安全运行eVTOL的快捷方式：103部、MOSAIC类别和审定类 The fastest way to safely operate eVTOL: Part 103, MOSAIC, certified
10:35-10:50	奥地利钻石飞机公司 Diamond Aircraft Group / 德国Volocopter		待定	从超轻型类到审定类：中国与欧洲的eVTOL适航审定 from ultralight to certified:eVTOL certificaiton in Europe and in China

e-Flight-Forum Program

10:52-11:07	北京航空航天大学通用航空产业研究中心 GAI Research Center of BUAA	主任 director	高远洋 Gao Yuanyang	先进空中交通AAM—国际民航组织的相关工作及全球发展 AAM - ICAO’s Related Works and Global Development
11:09-11:30	问答交流 panel discussion			
11:30	集体照 group photo			
下午 afternoon				
议题二：电动垂直起降航空器（eVTOL）、近乎短距起降航空器（near-STOL）与固定翼机型（CTOL）				
主持人 host：Willi Tacke				
13:30-13:45	中国商用飞机有限责任公司北京民用飞机技术研究中心 COMAC Beijing Civil Aircraft tech Res.Center	预研总师 CTO	杨志刚 Yang Zhigang	eVTOL气动设计:挑战、实践与展望 eVTOL Aerodynamic Design: Challenges, Practices, and Outlook
13:47-14:02	本田统合研究中心 Honda R&D Center of Excellence (HGR)	中心长 Center Director	小川厚 Ogawa Atsushi	Making Air Mobility More Accessible — Honda’s Vision and Challenge for Next-Generation Air Mobility 让空中出行更加触手可及 —— Honda 对下一代空中交通的愿景与挑战
14:05-14:20	四川沃飞长空科技发展有限公司 Aerofugia	CEO兼首席科学家	郭亮 Guo Liang	创造可信赖、可持续的美好低空出行 Creating a reliable and sustainable low-altitude mobility
14:22-14:37	鸿羽航空科技 Light Tech Aviation	董事长 Chairman	András Voloscsuk	一款MOSAIC类别的四座常规电动飞机研发 developing a four-seat conventional electric aircraft under MOSAIC category
14:40-14:55	上海峰飞航空科技有限公司 Autoflight	创始人兼CEO founder and CEO	田瑜 Tian Yu	以安全为基石，共创电动航空新未来 Safety First, Shaping the Future of Electric Aviation
14:57-15:12	巴西航空工业 Embraer		许世勋	UAM在中国，大家携手实现共同梦想 UAM in China: Joining hands to realize a shared dream.
15:15-15:35	问答交流 panel discussion			
议题三：市场准入与基础设施建设的全球实践 Global market access and infrastructure				
主持人 host：Willi Tacke				
15:37-15:52	马尔代夫驻中国大使馆 Embassy of the Maldives in China	大使Ambassador	H.E. Dr. Fazeel Najeeb	latest Developements in the Maledives
15:55-16:10	粤港澳大湾区数字经济研究院(IDEA)	院长 President	李世鹏 Li Shipeng	《低空经济：下一步该怎么走》 The Low-Altitude Economy: What’s Next?
16:12-16:27	美国SMG咨询公司 SMG Consulting	CEO	Sergio Cecutta	eVTOL运行准备：美国市场现状概览 Ramp up for eVTOL operations : overview of the US market situation
16:30-16:45	法国AOPA协会 AOPA France	主席 Chairman	Emmanuel Davidson	eVTOL及其他电动航空器商业模式的演化 Evolution of eVTOL and other electric aircraft business models
16:47-17:02	壹飞（四川）低空出行有限公司 Yifei Low-Altitude Mobility	总经理 general manager	王超 Wang Chao	《从高空到低空- 华龙/壹飞的低空出行商业化实践》 From High Altitude to Low Altitude: Hualong/Yifei’s Commercialization of Low-Altitude Mobility
17:05-17:20	奥地利Villinger公司 Villinger	商务总监 Director of Marketing	Ira Villinger	如何为电动航空器在欧洲提供适航服务 how to support certification for electric aircraft in Europe
17:22-17:42	问答交流 panel discussion（多加一位天津大学国家低空技术工程产教融合创新平台）			
19:00	电动航空之夜 reception dinner			

2026 国际电动航空（昆山）论坛议程

31.10.2026				
上午 Morning				
议题四：电驱动系统 electric propulsion system				
主持人 host：Willi Tacke				
9:00-9:15	Whisper Aero	产品总监 Director of Product	Andrew Terajewicz	电动涵道：电驱动的安静革命 EDF: quiet revolution in e-propulsion
9:17-9:32	中国航发控制系统研究所电动力事业部 AVIC	总经理 general manager	张宇 Zhang Yu	航空电动发动机适航思考 Considerations on the Airworthiness of Electric Motors
9:35-9:50	德国RED-Aircraft航发公司	市场总监 Dir. Sales & Market Development	Christian Mundiggler	eVTOL及通航航空器的混动电驱解决方案 Hybrid ee-solution for eVTOL & GA aircraft
9:52-10:07	浙江龙飞电驱科技有限公司 Longfei e	市场总监 marketing director	郑黎强 Zhen Liqiang	面向eVTOL产品研制和适航取证实践 eVTOL product development & airworthiness certif.
10:09-10:34	Compact Dynamics a Schaeffler Company	Program Manager	Bacem Kacem	电动机与混合动力解决方案的开发 Developement of eMotor & Hybrid Solutions
10:36-10:46	问答交流 panel discussion （Rotax航发总监Marc Becker参加）			
议题五：battery and power source 电池与电源				
主持人 host：Willi Tacke				
10:50-11:05	清华 Tsinghua University	教授 professor	张扬军 Zhang Yangjun	低空动力发展路径探索与实践 Low-Altitude Power: Development Pathways, Exploration and Practice
11:07-11:22	瑞士苏黎世联邦理工学院 ETH Zurich	项目主管 project manager	Julian Hofman	H2 Sling氢能飞机项目：从概念到试飞 update of H2 Sling project: from concept to test flights
11：24-11:39	安徽盟维新能源科技有限公司 Montavista	创始人、CEO founder	周莉莎 Zhou Lisha	高能航空动力电池技术演进及应用实践 High-Energy Aviation Power Battery Technology Evolution and Application Practice
11:41-11:56	北京航空航天大学 BUAA	教授 Professor	李海旺 Li Haiwang	混合电推进大型飞行平台关键技术及发展趋势 Key Technologies and Development Trends of Large-Scale Hybrid-Electric Propulsion Flight Platforms
11:58-12:08	问答交流 panel discussion			
下午 afternoon				
议题六：供应链、人工智能应用与电传飞控 supply chain, AI application and fly-by-wire				
主持人 host：Willi Tacke				
13:30-13:45	美国Airhart &Aeronautics公司	董事长 president/	Nate Thuli /Linda Sollars	适航新规下与电传飞控结合的人工智能机载应用的前景展望 Prospective of AI use in cockpit combined with FBW under new certification rules
13:47-14:02	上海柘飞航空科技有限公司 Shanghai Zephry Aerospace Tech	董事长 president	陈开鸣 Chen Kaiming	回归底座：针对EVTOL的可适航的飞行控制律 Back to Basics: Certifiable Fligth Control Law for EVTOLs;
14:05-14:20	慕尼黑工业大学 TUM	教授 Professor	Florian Holzapfel	虚拟现实深度辅助的先进飞控的研发、适航与培训 Extended Reality Simulation to support Developement,certification and Training of advanced Flight systems
14:22-14:37	庆伟航空	董事长 president	郭庆 Rock Guo	新一代飞控与飞行器管理计算（平台）解决方案 NEXT-GENRATION FLIGHT CONTROL & VEHICLE MANAGEMENT
	圆桌讨论 roundtable discussion 展望电动航空的下一个十年 prospective of the next 10 years of the electric aviation			
14:40-15:40	Willi Tacke,Mark Moore,Florian Holzapfel,Sergio Cecutta,Frank Anton(online)			

e-Flight-Forum Program

2026/10/31 31 Oct.

上午 Morning				
分论坛一：低空经济创新实践与协同发展 Practices and Collaborative Development of Low-Altitude Economy				
时间 time	单位名称 company	职务 job title	姓名 speaker	演讲题目 topic
9:00-9:05	低空头部	创始人	林海 Lin Hai	主持人开场 welcome speech
9:05-9:15	民航空管局 ATC Management Bureau of CAAC	原局长 former director general	车进军 Che Jinjun	致辞 keynote speech
9:15-9:40	中国商飞 COMAC	澳大利亚工程师院院士、俄罗斯工程院外籍院士 Fellow of Engineers Australia; Foreign Member	任和 Re He	《低空飞行器全生命周期综合健康管理（IVHM）体系研究探索》（拟） Research on Integrated Health Management (IVHM) System for Low-Altitude Aircraft Lifecycle
9:40-10:20	议题1：低空经济产业链协同与生态构建 Topic 1: Collaboration and Ecosystem in the LAE Industry Chain			
	同济大学 Tongji University	教授 Professor	郑百林 Zhen Bailin	主持“产业协同圆桌” Host, roundtable discussion of industry collaboration
	通易航天	董事长	张欣戎	
	狮尾智能	董事长	施维	
	锐天科技	总裁	薛桢一	
	沃飞长空	销售总监	王世鹏	
	啸翔航空	董事长	庄啸地	
10：20-11：00	Topic 议题2：制造革命——eVTOL从“样机”到“量产”的跨越思考 Manufacturing Revolution – Reflections - eVTOL -‘Prototype’ to ‘Series Production’			
	中国商飞 COMAC	澳大利亚工程师院院士、俄罗斯工程院外籍院士 Fellow of Engineers Australia; Foreign Member RAI	任和 Re He	主持“董事长圆桌” host, roundtable discussion of the chairmans
	蓝色向量	董事长	吴穹	
	御风未来	董事长	刘十一	
	追梦空天	董事长	蔡文宽	
	览翌航空	董事长	党铁红	
	天翎科航空	董事长	蒋彬	
	维新宇航	董事长	何威	
11：00-11：30	议题3：中国低空经济制度创新与商业闭环 Topic 3: Innovation in China's Low-Altitude Economy System and Business Cycle			
	低空头部	创始人	林海 Lin Hai	主持“总裁圆桌” host, roundtable discussion of the CEO
	武汉市汉阳区	区长	张健	
	沃兰特	CTO	张宝柱	
	中科星图	副总裁	何阿奇	
	祥源通航	总经理	王鸿霄	
	零重力	CEO	石红	
	元禾厚望	合伙人	佘立斌	
交流问答 Q & A	主持人:林海 Host: Lin Hai			

TSi 外，上单翼型 Sling HW 亦提供双座与四座两种 MOSAIC 版本。

美国制造商 Vashon Aircraft 推出了 Ranger Grand Teton 机型，这是一款专为野外起降设计的坚固机型。该机配备可折叠座椅，起售价为 241,000 美元。

在新增配件中，Garmin 的 Axis Display 尤为突出，在产品上市之初便已应用于多款飞机上。

搭载 Nvidia 处理器的航电

德国新晋厂商 Alphafrog/Exentra 在 Skyfly Axe eVTOL 上展示了基于英伟达技术的仪表系统；而另一家新兴航电设备制造商 Airhart 则在 Oshkosh 航展上首次亮相重大公开活动。这家来自硅谷的初创公司正在开发一套航电，其核心是两块大型自主研发的触控显示屏——这两块显示屏均采用英伟达处理器，旨在通过人工智能支持的功能提升飞行安全性。其中一项早期功能同样由 Exentra 提供，即语音识别技术：可将空中交通管制部门的无线电通话转写并显示于驾驶舱屏幕，供飞行员参考。

法国的 Turbotech 公司已为其 TP-R90 涡轮发动机赢得更多客户订单。除已获认证的 Elixir 型号外，该发动机还计划应用于 CubCrafters 的 Carbon Cub UL 机型以及一款 Sling 型飞机。

Beringer Aero 已获得美国联邦航空管理局对其南卡罗来纳州子公司的批准，而 DUC H é lices 仍持续为多个 MOSAIC 关联项目供应螺旋桨。

Hartzell 公司计划加强对 Part 23 认证范围之外螺旋桨的研发投入，其德国竞争对手 Helix 公司也加入其中，后者已在多款飞机上展示了其 ARC 型螺旋桨。

与往年相同，在动力三角翼和动力滑翔机领域，可报道的新动态寥寥无几，因为 Air Cr é ation 与 Evolution Trikes 品牌在这些细分市场中几乎面临无实质性的竞争。

与此同时，MOSAIC 新规直升机仍止步不前，因为相应的 MOSAIC 规定尚未由 FAA 起草或批准。

尽管全球制造商对 MOSAIC 的 eVTOL 寄予厚望，但此类新型飞行器仍需时间才能实现首飞。



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21st Electric Aircraft Symposium

July 24-25, 2027

Oshkosh, Wisconsin

University of Wisconsin-Oshkosh Campus

The annual Electric Aircraft Symposium (EAS) in Oshkosh is the world's first and longest running electric aviation and advanced air mobility conference.

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www.eas2027.org info@eas2026.org

Vertical Flight Society
Federal City Chapter





Although Joby did not fly at the airshow, the California eVTOL manufacturer now occupies a booth directly opposite Textron on Oshkosh's Celebration Way, above, and used the show to recruit new staff, below.



尽管JOBY 公司并未参加此次航展的飞行表演，这家来自加利福尼亚州的EVTOL 制造商出现在OSHKOSH 的CELEBRATION WAY 上，与TEXTRON 公司直接相对的展位上设立展台，并利用此次展会招募新员工（如下图所示）。



Pipistrel's first new aircraft since its acquisition by Textron, the Voyager, was developed around the MOSAIC rule and related means of compliance.

PIPISTREL 公司自被 TEXTRON 收购以来推出的首款新飞机——VOYAGER，是围绕“MOSAIC 规则”而开发的。

Part 103 eVTOL-UL. Korea's V-Space returned for a second year with a multicopter, now also being produced in the United States. France's DTA plans to follow a similar path. The former trike and gyroplane manufacturer is developing a multicopter eVTOL based on its gyro cockpit and also intends to produce it in the U.S.

Innovation was not confined to MOSAIC.

Higher categories brought plenty of new developments as well.

Elixir Aircraft, Part 23 certified in Europe, in the USA for its initial model, arrived with three aircraft. The French manufacturer presented its Elixir+ family—the Essential, Expert and Elite models, the latter fitted with Turbotech turbine engines—and announced more than 300 orders.

Although several MOSAIC aircraft are now likely to move into the flight-school market, other manufacturers also used Oshkosh to showcase new trainers. Cirrus has finally launched its SR10—certified three years ago—as the three-seat TRAC 10. For the first time, Cirrus has chosen a Rotax engine, specifically the powerful 916 iS. The price is $499,900.

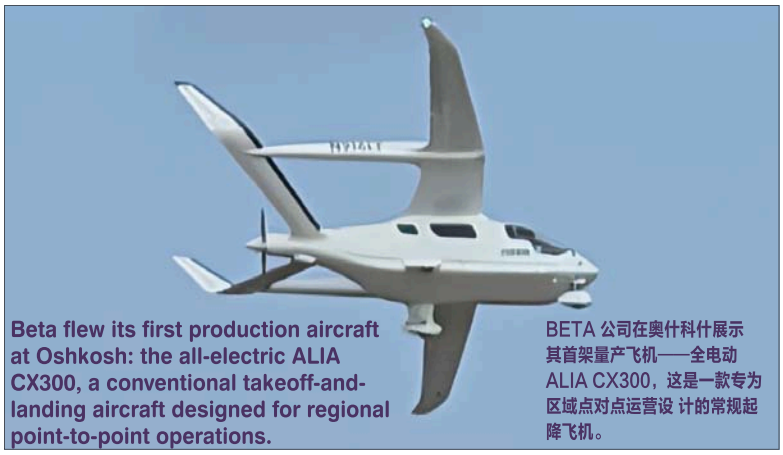
Textron unveiled a new Pipistrel model for the first time: the Voyager, priced at $275,000.

Tecnam's appearance this year unfolded with a touch of Commedia dell'arte, complete with theatrical concealment and a carefully staged reveal. The Italian manufacturer initially presented its new aircraft, the Rivale, under both a tarp and a black cloth. After rain showers passed at the start of the press conference, Giovanni Pascale unveiled the high-wing aircraft in brilliant sunshine. What appeared, however, was not a complete airplane but a cockpit-fuselage section paired with a large Rivale logo. Beyond its sleek design, the most striking feature is the Continental CD300 six-cylinder diesel engine, which is set to appear in a Tecnam aircraft for the first time. The company plans to release further details in stages from this fall through the next AERO.



For Élixir, the push into the American market is already paying off. Flight schools have embraced the French aircraft, underscoring their confidence with orders announced at the show. The first US deliveries are now underway, and the initial students bound for commercial pilot careers have begun training in the new fleet.

对于ELIXIR 公司而言，进军美国市场的举措已初见成效。多家航校订购这款法国制造的飞机，这彰显了他们在展会公布的订单中所展现的信心。首批美国交付订单现已启动，首批立志从事商业飞行职业的学员也已开始使用这款新机队接受培训。.



Beta flew its first production aircraft at Oshkosh: the all-electric ALIA CX300, a conventional takeoff-and-landing aircraft designed for regional point-to-point operations.

BETA 公司在奥什科什展示其首架量产飞机——全电动 ALIA CX300，这是一款专为区域点对点运营设 计的常规起降飞机。



MOBILE CLEARANCE 由 FOREFLIGHT 与美国联邦航空管理局（FAA）合作开发，将 IFR 起飞许可功能直接集成至 FOREFLIGHT 移动应用，使飞行员能够以数字化方式申请、接收并管理起飞许可，从而降低对拥挤无线电频道的依赖。

Developed by ForeFlight in collaboration with the Federal Aviation Administration, Mobile Clearance brings IFR departure clearances directly into the ForeFlight Mobile app, allowing pilots to request, receive, and manage clearances digitally while easing reliance on congested radio frequencies.



Turbines for everyone: France's Turbotech unit appeared on several MOSAIC LSA aircraft at Oshkosh, including this VL3 fitted with a DUC variable-pitch propeller, and Elixir, Bristell, Gogetair, and multiple US manufacturers are also planning a version for their trainer, backcountry or performance aircraft.

面向所有人的涡轮发动机：法国的TURBOTECH 部门出现在奥什科什展会的多款LSA 飞机上，其中包括这款配备DUC 可变桨距螺旋桨的VL3，此外，ELIXIR、BRISTELL、GOGETAIR 以及多家美国制造商也计划为其教练机、野外或高性能飞机推出相应版本。



Avionics took center stage as Dynon introduced its new SkyView HDX as an integrated IFR platform, while Garmin generated the biggest buzz with AXIS. The new system brings primary flight functions, navigation, radios, engine monitoring and intercom onto a single 11.6-inch screen, promising fewer units, fewer cables and less installation complexity for manufacturers and operators alike.

航空电子技术成为焦点，DYNON 推出了全新的SKYVIEW HDX，作为集成式IFR 平台，而GARMIN 则再次凭借AXIS 引发了广泛关注。这一新系统将主要飞行功能、导航、无线电通信、发动机监控及语音通信功能整合到一块11.6 英寸的显示屏上，为制造商和运营商提供了更少的设备数量、更少的线 缆以及更简单的安装流程



French propeller manufacturer DUC looking to MOSAIC as a catalyst for new growth.

法国螺旋桨制造商 DUC 已在美国市场深耕多年，如今正寻求将“MOSAIC”打造为新增长的催化剂。



Spirit SE-1: Brand-new MOSAIC LSA featuring an all-metal retro design, built ready to fly at the production facility in Grand Junction, CO.

SPIRIT SE-1 品牌全新MOSAIC LSA 飞机，采用全金属复古外观，现已从科罗拉多州的工厂下线，随时准备翱翔蓝天。

AOPAs View on AirVenture Oshkosh 2026

Flying into EAA AirVenture Oshkosh 2026 before the show opened was challenging because smoke from Canadian wildfires closed Wittman Regional Airport (OSH) to VFR arrivals for 2 of the 4 days leading up to the event. But once the smoke cleared more than 10,000 aircraft landed and a record crowd arrived to enjoy everything that makes AirVenture so unique: spectacular daily airshows; aircraft and drive-in camping (40,000 campers on 13,600 sites); 1,021 exhibitors; and more than 1,600 live presentations. It's simply not possible for an individual to experience everything AirVenture has to offer in one week.

Many announcements are typically made during AirVenture, and this year was no exception. Vans Aircraft, Jabiru Aircraft, Pipistrel, Zenith Aircraft, Blackshape Aircraft, Texas Aircraft, Sling Aircraft, and CubCrafters all announced, or debuted, aircraft that will qualify as light sport category aircraft under the FAA's Modernization of Special Airworthiness Certification (MOSAIC) rule that went into effect on July 24.

However, it was Lycoming Engine's announcement that it has extended time between overhauls (TBO) to 2,600 hours for a wide range of engines that received the most interest from AOPA members, as measured by how many members read our story.

One of AOPA's core missions is advocating for general aviation pilots and aircraft owners, and the status of a 100-octane unleaded avgas took center stage at AirVenture. FAA officials, fuel developers, and the aviation industry all discussed what the future may look like—with some suggesting that the transition may take longer than previously anticipated.

AOPA acting Co-President Katie Pribyl highlighted the need for one high-octane unleaded fuel and said that the goal of transitioning by 2030 may not happen.

"The transition plan assumes right now that the market is going to decide - which of the three fuels currently in development will be preferred, and that's probably not realistic," said Pribyl. "We want the FAA to have a role in that beyond just approving fuels. They're doing the testing. We believe that they're in the best position to help the industry come to that decision on what that fuel is going to be."

Kollin Stagnito,
AOPA Senior VP Media



In the opening days, smoke from Canadian wildfires dominated the skies, reducing visibility so sharply that many pilots were unable to fly under VFR conditions.

在最初几天，加拿大野火产生的浓烟笼罩了天空，导致能见度急剧下降，致使许多飞行员无法在目视飞行条件下执行飞行任务。

AOPA点评

AirVenture Oshkosh 2026

在 2026 年 EAA AirVenture Oshkosh 展会开幕前乘机前往是一项挑战，因为加拿大野火产生的烟雾导致维特曼区域机场（OSH）在活动前 4 天中的 2 天禁止目视飞行抵达。但一旦烟雾消散，超过 10,000 架飞机降落，众多观众也前来体验 AirVenture 的独特魅力：精彩的每日空中表演；飞机与自驾露营（13,600 个营地中共有 40,000 名露营者）；1,021 家参展商；以及超过 1,600 场现场展示活动。一个人要在短短一周内体验 AirVenture 提供的一切，简直是不可能的。

在 AirVenture 航展期间通常会发布众多公告，今年亦不例外。Van‘s Aircraft、Jabiru Aircraft、Pipistrel、Zenith Aircraft、Blackshape Aircraft、Texas Aircraft、Sling Aircraft 及 Cub-Crafters 均宣布或首次推出符合美国联邦航空管理局（FAA）《特殊适航性认证现代化》（MOSAIC）规则下“轻型运动类”飞机资质的机型，该规则已于 7 月 24 日正式生效。

Lycoming Engines 公司宣布，针对那些最受 AOPA 会员关注的多种发动机型号，已将大修间隔时间（TBO）延长至 2,600 小时——这一标准以阅读我们报道的会员人数来衡量。

AOPA 的核心使命之一是为通用航空飞行员和飞机所有者发声，而 100 号无铅航空燃油的地位在 AirVenture 上成为了焦点。美国联邦航空管理局的官员、燃油开发商以及航空业人士共同探讨了未来的发展方向——其中一些人认为，这一转型过程可能比此前预期的时间更长。



A Tornado forms up north of Oshkosh, bottom right, alongside the striking Piper Archer chosen as AOPA's AirVenture 2026 Sweepstakes aircraft.

龙卷风在奥什科什以北形成，右图是备受瞩目的 PIPER ARCHER 飞机，该机型已被选为 AOPA 公司“AIRVENTURE 2026”抽奖活动的参赛机型。

AOPA 代理联合主席凯蒂·普里比尔强调了需要一种高辛烷值无铅燃料的必要性，并表示到 2030 年实现转型的目标可能无法实现。

普里比尔表示：“该过渡计划目前假设市场将自行决定——当前正在开发的三种燃料中哪一种会成为首选，但这种假设可能并不符合现实。我们希望 FAA 能在此过程中发挥更重要的作用，而不仅仅是批准燃料。FAA 已开展相关测试工作，我们认为他们最具备优势，能够帮助行业就最终选用哪种燃料做出决策。”

科林·斯塔尼托
AOPA 媒体高级副总 裁
Kollin Stagnito,



During AirVenture, Google Maps displayed a tornado warning on Monday, shown in the photo left, before a tornado (photo right) struck a nearby town the day after the show, pictured at the bottom.





在 AIRVENTURE 活动期间，谷歌地图周一显示了一份龙卷风预警（如右侧小图所示），而就在活动结束次日，一场龙卷风袭击了附近的一座城镇（如上方图片所示）。

Text: Willi Tacke, Potos: Willi Tacke, Warren Liebermann

Battery, hybrid propulsion or fuel cell?

The 20th Electric Aircraft Symposium (EAS) drew an enthusiastic response in Oshkosh. After the Vertical Flight Society stepped away as the organizing association, Mike Hirschberg and Ken Swartz—who previously worked with the VFS on the event—took it on independently this year. With support from Industry sponsors and AERO Friedrichshafen's e-flight-expo, the symposium proved a clear success. More than 200 attendees filled the University of Wisconsin venue, joined by additional online participants, for a program of first-rate presentations—and many made clear they plan to return next year.



The 20th Electric Aircraft Symposium drew strong interest from presenters and attendees across the Americas, Europe, and Asia. Organized by Mike Hirschberg and Ken Swartz with support from AERO e-flight-expo and Flying Pages, the event attracted about 200 in-person participants and 50 online viewers, most of whom stayed through the final presentation on Sunday afternoon.

第 20 届电动航空研讨会吸引了来自美洲、欧洲及亚洲的演讲者与参会者的高度关注。本次会议由 Mike Hirschberg 与 Ken Swartz 共同主办，并获 AERO eflight-expo 及 Flying Pages 支持，共吸引约 200 名现场参会者及 50 名在线观众，其中绝大多数观众持续观看到周日下午的闭幕演讲环节。



电池、混动还是燃料电池?

第 20 届电动航空研讨会（EAS）在奥什科什取得了热烈反响。此前，实验飞机协会（EAA）作为主办方退出，Mike Hirschberg 与 Ken Swartz——他们此前曾与 VFS 共同参与该活动——今年则独立承办此次盛会。在行业赞助商及 AERO Friedrichshafen 电动航展的支持下，此次研讨会取得了显著成功。超过 200 名与会者挤满了威斯康星大学的会场，另有众多在线参与者加入，共同参与了精彩纷呈的演讲活动——许多人明确表示，他们计划明年再次参加。



H2Fly's Prof. Josef Kallo joined remotely after poor visibility left him stranded in Iceland on Saturday while traveling to the United States.

H2FLY 的约瑟夫·卡洛教授于周六在前往美国的途中，因能见度极低而滞留在冰岛，随后他以远程方式加入讨论



Ben Goldstein editor of Aviation Week as EAS host.

《航空周刊》编辑 BEN GOLDSTEIN 担任 EAS 主持人

After two decades, organizers Mike Hirschberg, Ken Swartz, Mark Moore of Whisper Aero, and Willi Tacke of Flying Pages offered a forward-looking view of what comes next.

二十年后，MIKEHIRSCHBERG、KENSWARTZ、WHISPERAERO的MARKMOORE和FLYINGPAGES的WILLITACKE对电动航空和先进空中交通的下一阶段进 行 了前瞻 性讨论

Marko Hirsch from Exenntra (right) in Germany discussing at the coffee break.

来自EXENNTRA 的MARKO HIRSCH（右）在讲解其使用英伟达芯片的自动飞控产品.







Although electric-aircraft development has taken longer than many expected two decades ago, interest in the EAS remains strong across the industry.

尽管电动飞机的研发进程比二十年前许多人预期的时间更为漫长，但整个行业对EAS 的关注度依然十分高涨.



Tobias Bretzel, project manager for AERO Friedrichshafen, supported this year's EAS through its partner event, e-flight-expo.

AERO FRIEDRICHSHAFEN 的项目经理TOBIAS BRETZEL 通过其合作伙伴活动E-FLIGHT-EXPO，为今年的EAS 提供了支持.



Peter Blume, founder of test-equipment company Bloomy, has been a longtime sponsor and exhibitor at EAS, where his company works with several electric-aircraft manufacturers.

测试设备公司BLOOMY 的创始人PETER BLUME 长期担任EAS 的赞助商及参展商，其公司亦与多家电动飞机制造商开展合作.





Nearly as important as the presentations and panel discussions are the B2B meetings that draw developers from around the world to EAS.

与主题演讲及专题讨论同样重要的，是吸引全球开发者参与EAS 的B2B 会议。

MagniX CTO Ben Loxton outlined the company's wide-ranging electric-propulsion strategy, from small drives for kitplanes to four-motor systems for larger electric commuter aircraft.

MAGNIX 首席技术官BEN LOXTON 阐述了公司全面的电动推进战略，涵盖从轻型固定翼飞机的小型电驱，到适用于大型电动通勤飞机的四电机系统。





Panel host Rex Alexander examined the challenges of bringing verti-ports to reality and financing their operations.

专题讨论会主持人REX ALEXANDER 探讨了将垂直起降场付诸实践所面临的挑战，以及为其运营提供资金支持的难题



And, of course, there was plenty of compelling reading material.

当然，当时也有大量引人入胜的阅读材料。



LAMA's Scott Severen moderated a high-profile MOSAIC eVTOL panel featuring representatives from AirEV, Skyfly, Lamvec and Pivotal.

LAMA 的SCOTT SEVEREN 主持了一场备受瞩目的EVTOL 专题讨论会，与会嘉宾包括来自AIREV、SKYFLY、LAMVEC 及PIVOTAL 的代表。

Text and Photos: Toni Ganzmann

VELIS ELECTRO:
On the Path to the Future



A whisper through the air—but how practical is electric aviation really? With the Velis Electro, Pipistrel has launched the world's first fully certified electric aircraft. A practical test in Leverkusen demonstrates how electric flight feels inside the cockpit, where the challenges lie—and why the journey toward a future free of emissions demands perseverance.

Unlike aircraft powered by internal combustion engines, which can become extremely loud when fully loaded during takeoff, an electric motor produces only a pleasant whirring sound.

追寻未来的足迹

电动飞机在空中几乎悄无声息，但它在实际使用中究竟有多大可行性？斯洛文尼亚的Pipistrel（蝙蝠）飞机公司推出了首款获得EASA适航认证的电动飞机VelisElectro。本文在莱沃库森进行了一次实际飞行体验，展示电动飞行在驾驶舱中的真实感受、面临的障碍，以及为什么通往零排放未来的道路需要持之以恒的努力。



与全功率起飞时可能非常嘈杂的内燃机飞机相比，电动机发出的只有令人舒适的嗡鸣声

If we trust the publications of aviation suppliers and manufacturers, the sky should already be full of emission-free aircraft. But have you ever seen one of these fly past you – or even flown one yourself? You'd need a lot of luck, as there is currently only one fully certified electric aircraft: the Velis Electro from the Slovenian manufacturer Pipistrel. Around 140 units of this aircraft are in operation worldwide – and as many as six of them are in Germany

Battery Performance and Identification

Quick facts about this aircraft: In mid-2020, the Velis with purely electric propulsion entered the market. With an empty weight of approximately 428 kg and a maximum takeoff mass (MTOM) of 600 kg, it is classified as an LSA by EASA. Incidentally, this is the reason why these aircraft bear E-registrations in Germany – not because they fly electrically (just a joke, by the way). A key example of this development is the ultralight aircraft Pipistrel Virus SW 121, which is conventionally powered. Its cell, fuselage, and wing profiles are highly similar to those of conventional aircraft, yet are optimized for electric operation. In the engine compartment and behind the passenger seating row, two liquid-cooled lithium-ion batteries are installed; these batteries provide a total capacity of 22 kWh and weigh a remarkable 144 kg. The synchronous motor delivers 77 hp at 2,500 rpm for one and a half minutes, and maintains a continuous output of 66 hp at 2,350 rpm. A digital management system monitors the 2,304 individual cells and displays, among other information, the State of Charge (SOC) and the cell temperatures on a dashboard.

Prominent Visit to Leverkusen / Germany

So, enough with the facts – let's get to the story. At my home airfield in Leverkusen (EDKL), the bird made its appearance after the board of the aviation club had informally notified us that two rare birds had appeared. They would arrive. The birds are so rare that even the Minister of Environment, Nature Conservation, and Transport of North Rhine-Westphalia wished to pay a visit. And when the state's environmental minister makes a special trip, one can already expect something "green" to happen: after all, two pipistrells were spotted gliding through the air in their Velis Electro aircraft. For the birds to be able to take flight again, a proper power supply is required. This 85 kg electric power unit was already delivered on a trailer the previous day, and now the energy is pumped into the batteries via a 32-A CEE power socket. This process takes approximately one hour per aircraft. During this time, I receive technical instruction from Peter Müller, an employee of the Ministry of the Environment and also a flight instructor.





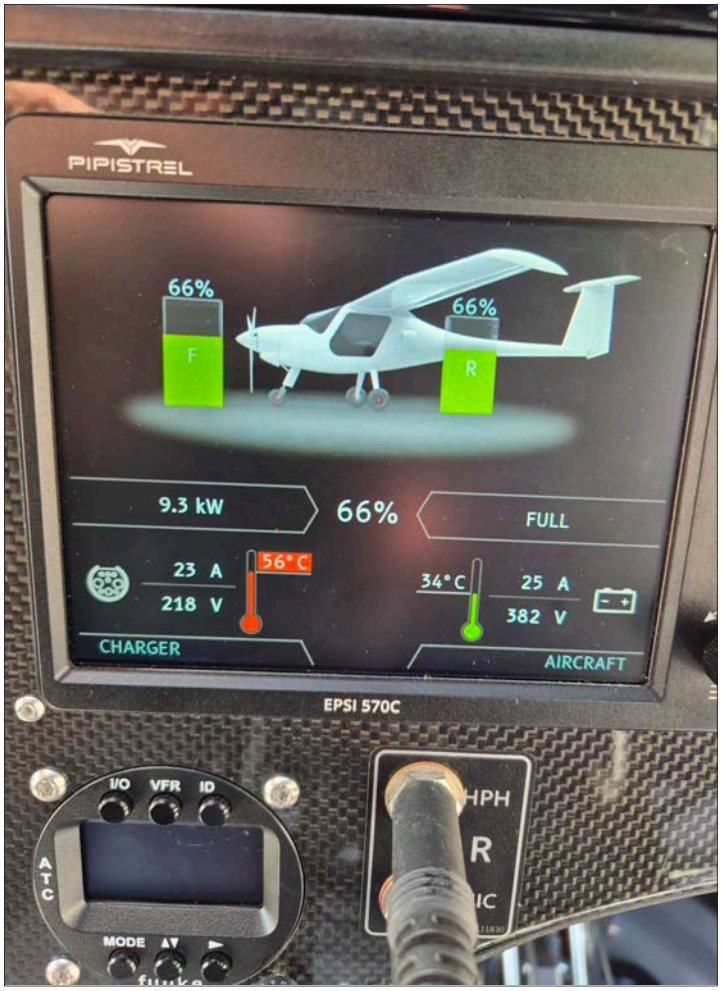
The cockpit is clearly organized. Characteristically, the charge status is also displayed. The status of both batteries and their temperatures is displayed. In the event of exceeding limit values, visual and acoustic warnings are triggered immediately.

驾驶舱布局清晰。与电动飞机的特点相符，显示屏还会显示两组电池各自的荷电状态和温度。一旦超过限值，系统便会立即发出视觉和声音警告。

如果相信航空供应商和制造商发布的宣传材料，天空早就应该布满零排放飞机了。但你是否曾见过这样一架飞机从身边飞过，甚至亲自驾驶过？这恐怕需要相当好的运气，因为目前全球只有一种获得EASA认证的电动飞机：斯洛文尼亚Pipistrel 的 Velis Electro。据称，全球约有 140 架在飞行，其中德国有 6 架。

电池性能与注册标识

先快速了解一下这架飞机的基本情况：Velis 于 2020 年年中以纯电动形式上市。其空重约为 428千克，最大起飞质量（MTOM）为 600 千克，因此欧洲航空安全局（EASA）将其归为轻型运动飞机（LSA）。顺便说一句，这也是这类飞机在德国使用以“E”开头的注册标识的原因——并不是因为它是电动。这款飞机的开发基础可以说是采用传统动力的 Pipistrel Virus SW 121超轻型飞机。两者的机身结构、机体和机翼剖面非常相似，但Velis针对电驱动进行了优化。发动机舱内和座椅后方安装了两组液冷锂离子电池，总共22度电，重量144千克。同步电机可在 2,500 转/分钟时提供 77 马力，持续约 1.5 分钟；在 2,350 转/分钟时可持续输出 66马力。数字化管理系统监控着 2304 个单体电芯，并在显示屏上显示电池荷电状态（SOC）和温度等信息。



Silent Start at 37°C

Then it gets serious, and I am to board. Easier said than done, given my height of 1.90 m, which makes it no simple task. However, once inside the cockpit, I find ample space, excellent visibility, and can easily reach all switches and control elements. The flap lever, however, immediately catches my eye: it is placed in an extremely inconvenient position and is also rather awkward to operate. Peter then explains the meaning of the electrical values displayed, and then we begin. To put it briefly: we roll toward the roll holding point. During this process, I find the high pedal pressure required for steering on the ground somewhat disruptive. After the start check – without the usual run-up – we stand on runway 33, ready to take off. At first, this feels unusual to me, as everything is quiet: the propeller is stationary, and all instruments read zero. However, the moment I push the small power lever between the two seats forward, the 80 electric horsepower come alive. Unlike piston engines, the current ambient temperature of 37 °C has no effect on them at all. However, they generate such a powerful wind that holding a conversation without a headset is hardly possible. Nevertheless, they lack the characteristic rumble of a combustion engine, and observers on the edge of the runway find the high-pitched noise level—measuring only 60 dB(A)—to be quite pleasant compared to other aircraft..

A Fine Touch on the Way

We quickly reached 50 knots, and the aircraft was ready to take off. So we first applied some pull, lifted off from the ground, and then began flying horizontally. Once we reached a true air speed of 75 knots, I reduced the power. I increased the power setting to 45 kW, ensuring that the engine, at 2,265 rpm, also operates within the “green arc “ of the instruments. This allowed us to climb from 450 ft/min to 2,000 ft above ground level, even though we were pushing against the upper weight limit. With the Airwork, I’ve noticed that the Velis, for “clean flying,” doesn’t only require significant rudder input in sharp turns. During slow flight, it doesn’t become “toxic”; instead, at 50 kts without flaps, it simply points its nose down to gain speed. At 45 kts with full flaps, it begins to whine, and the control column shakes, signaling the impending loss of lift. At that point, I apply more throttle again and quickly reach the cruising speed of 80 kts. Of course, it could go even faster, but then the engine operating time would noticeably decrease.

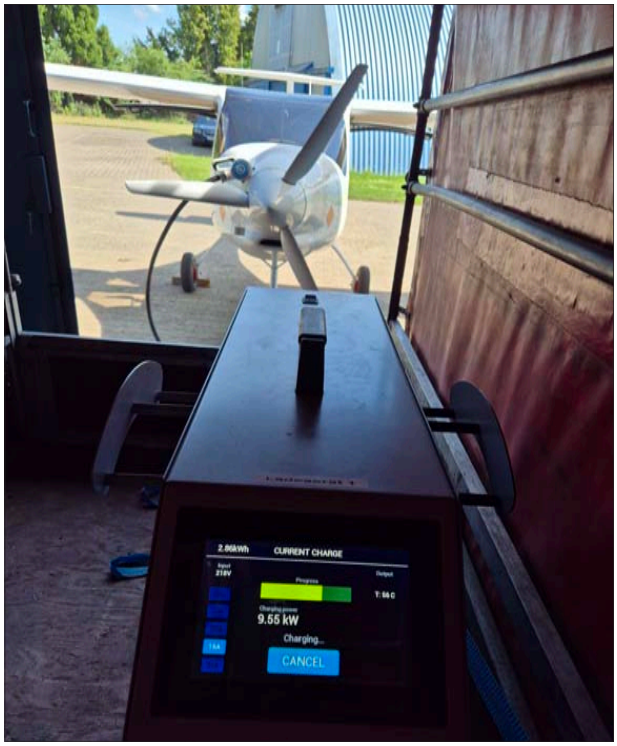
Adaptation-Required Land Approach

The approach to land required some acclimatization for me. Since the propeller simply spun in the wind in no-load conditions – generating no drag – only the twostage control vanes provided braking, albeit only modestly. To maintain a speed of just under 60 knots during the approach run while descending to 1,100 ft altitude, I needed to extend my approach distance – otherwise, I would have had to initiate the descent during the counter-approach phase. I therefore extend my cross-run to reach the centerline of the final at a lower altitude than usual. Nevertheless, I only take off shortly before the half-course marker. On my second attempt, I fly “normally” and simply trim the altitude with a slip. This also works perfectly.

The key-question: range

To get straight to the point: How far can the aircraft actually fly? With fully charged batteries and accounting for a 20-minute reserve flight time, a flight range of half an hour is realistic. This corresponds to an approximate range of 60 km in calm weather conditions. Given the current challenges facing Hase’s charging stations and charging infrastructure, policymakers aim to raise awareness among airfield operators, pilots, and aerobatic clubs about emissions-free flying. Accordingly, Oliver Krischer, the Minister of the Environment of North Rhine-Westphalia (Bündnis 90/Die Grünen), has assumed the stewardship of this funding project. It is clear: there is still much to be done, but we are, after all, only at the beginning of this new era of aviation. And let us recall: it took at least 15 years before the electric car could truly establish itself.

To “recharge,” a rather cumbersome charging device is required—one that must have access to a high-capacity mains power supply.



贵宾现身莱沃库森

好了，技术数据就介绍到这里，下面进入正题。我所在机场莱沃库森机场（EDKL）当天热闹非凡，因为当地航空运动俱乐部的负责人此前神秘地透露，将有两只罕见的“鸟”到访。它们稀有到连北莱茵-威斯特法伦州的环境、自然保护与交通部长都打算亲自前来看看。既然州环境部长专程赶来，想必这一定是件“绿色”的事：最终，飞抵现场的是两架 Pipistrel Velis Electro。要让这两只“鸟”再次飞上天空，就需要一台像样的充电设备。这台重达85千克的“电力补给站”前一天就已经用拖车运到现场。现在，电能通过一个32安培的 CEE 工业插座输入电池。每架飞机大约需要一小时充电。在这段时间里，环境部工作人员、同时也是飞行教员的 Peter Müller 为我讲解了飞机的技术特点。

37 摄氏度下的无声起飞

接下来要来真的了，我得登机。说起来容易做起来难——我身高 1.90 米，爬进机舱并不轻松。不过坐进驾驶舱后，空间足够，视野良好，各种开关和操纵装置也都触手可及。襟翼手柄却立刻引起了我的注意：它的位置很不合理，操作起来还有些卡滞。Peter 又向我解释了显示屏上各项电气参数的含义，随后我们准备出发。长话短说：我们滑行至跑道等待点。地面转向需要较大的脚蹬操纵力，这让我觉得有些不便。完成起飞前检查后——完全不需要传统飞机常见的发动机试车——我们在 33 号跑道上做好起飞准备。起初我很不习惯：周围一片安静，螺旋桨静止不动，所有仪表读数都为零。但当我把两座之间的小型功率杆向前推时，约 80 匹“电力马力”便苏醒了。与活塞发动机不同，37° C 的外界高温对电动机毫无影响。不过，螺旋桨的噪音还是不小，若不戴耳机几乎无法交谈。另一方面，飞机没有内燃机特有的轰鸣声；跑道边的观察者认为，与其他飞机相比，Velis约60分贝的高频噪声听起来舒服得多。

为飞机“加油”需要一台不算轻便的充电器，而且现场必须具备功率充足的供电系统。

进近时需要细腻操纵

很快，空速达到 50 节，飞机已经跃跃欲试，想要离地。于是我先轻轻拉杆，让飞机脱离地面，再逐渐加速进入平飞。达到最佳爬升速度 Vy——75 节——后，我将电机功率降至 45 kW，使电机转速保持在 2,265转/分钟，也处于仪表的“绿色范围”内。尽管飞机重量已接近上限，我们仍以每分钟450英尺的速度爬升至2000英尺。进行基本飞行动作时，我注意到，要让 Velis 飞得规范，不仅在大坡度转弯时需要明显使用方向舵，其他情况下也一样。在慢速飞行中，它并不会突然变得难以控制；当速度降至50节且襟翼未放下时，机头会自然下俯以恢复速度。当速度降至45节并放下全襟翼时，警报蜂鸣，操纵杆也开始抖动，提示即将发生失速。随后我重新增加功率，很快达到80节的巡航速度。当然还可以飞得更快，但续航时间也会明显缩短。

需要适应的着陆进近

着陆进近过程让我有些不习惯。因为电机处于怠速时，螺旋桨只是在气流作用下自由转动——并不会产生阻力——因此飞机主要依靠两档襟翼减速，而且效果并不明显。在机场起落航线中，要将速度维持在接近 60 节，同时下降 1,100 英尺，就需要拉长进近航线；或者我本应在下风边就开始下降。于是我延长了侧边航段，以便在进入最后进近时，飞行高度能够比平时更低。尽管如此，我还是直到接近跑道半程标志时才着陆。第二次尝试时，我按常规方式进近，直接用侧滑消除高度，效果同样很好。

航程：关键问题

电池充满电、并预留20分钟备用时间的情况下，实际飞行时间约为半小时。在无风条件下，这相当于约 60 千米的航程。目前的难点在于充电设备和充电基础设施。因此，政策制定者希望提高机场运营方、飞行员和航空运动俱乐部对零排放飞行的认识。北莱茵-威斯特法伦州环境部长 Oliver Krischer（绿党）也因此担任了这一资助项目的赞助人。有一点很明确：还有大量工作要做，但我们毕竟才刚刚进入这一航空新时代。回想一下，电动汽车真正普及也至少花了15年时间。







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